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Message from the Editor-in-Chief

Dear Readers,

I am very pleased to publish volume11 issue2 in 2012. As an editor in chief of The Online Journal of Educational Technology (TOJET), this issue is the success of the reviewers, editorial board and the researchers. This issue covers different research scopes and approaches by valuable researchers. I and The Online Journal of Educational Technology (TOJET) editorial team will be pleased to share various researches with this issue as it is the miracle of our journal.

Turkish Online Journal of Educational technology looks for research paper about using educational technology for teaching and learning activities. The research papers should discuss the perspectives of teachers, students, parents, school managers and the ministry of education about using technology to enhance learning and teaching environment.

The Turkish Online Journal of Educational Technology is online journal and published only through internet. In online system, accessing articles is available in one place are delivered to all over the world using internet. TOJET`s quality research papers on theory, applications and development of educational technology can be reached easily from Asia, America, Europe, Australia, and others through internet.

The Turkish Online Journal of Educational Technology is the center of research about educational technology used in instruction. The main goal of TOJET is to establish a bridge the gap between theory and practice. To help bridge the gap, TOJET provides readers with the new developments in educational technology world-wide and a main source for academics and professionals in the expanding fields of educational technology. Articles consist of all kinds of quality research on theory, applications and development of educational technology.

I am always honored to be the editor in chief of TOJET. I am always proud of TOJET for its valuable contributions to the field of educational technology.

TOJET is interested in academic articles on the issues of educational technology. The articles should talk about using educational technology in classroom, how educational technology impacts learning, and the perspectives of students, teachers, school administrators and communities on educational technology. These articles will help researchers to increase the quality of both theory and practice in the field of educational technology.

The guest editors of this issue were Prof. Dr. Collen Sexton from Governor State University, USA and Assoc. Prof. Dr. Eric Zhi-Feng Liu from National Central University, Taiwan. TOJET thanks and appreciate the guest editor and the editorial board who have acted as reviewers for one or more submissions of this issue for their valuable contributions. TOJET's reviewers are drawn quite widely from all over the world.

TOJET, Sakarya University-Turkey, Istanbul University-Turkey and National Central University-Taiwan will organize the 12th International Educational Technology Conference (IETC 2012) between July 11-13, 2012 in Taoyuan, Taiwan. The web page of IETC is "www.iet-c.net".

We are pleased to announce that TOJET has commissioned two special issues (October, 2012 and January, 2013) for the presented papers at the International Educational Technology Conference 2012.

Call for Papers

TOJET invites article contributions. Submitted articles should be about all aspects of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should also discuss the perspectives of students, teachers, school administrators and communities.

The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. All authors can submit their manuscripts to tojet.editor@gmail.com for the next issues.

April 01, 2012

Prof. Dr. Aytekin İŞMAN
Editor-in-Chief of TOJET

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The Review of TOJET

A COLLABORATIVE CROSS NUMBER PUZZLE GAME TO ENHANCE ELEMENTARY STUDENTS' ARITHMETIC SKILLS

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ABSTRACT
In traditional mathematics education, students have typically been asked to solve lots of tedious and uninteresting exercises for developing the arithmetic skills of addition and subtraction. The paper provides an account of learning arithmetic skills in a more interesting way through the collaborative playing of a puzzle game. 83 students in three classes in Grade 4 were asked to solve arithmetic problems with three different methods: via playing an adapted "cross number puzzle" game on Group Scribbles (GS) collaboratively, via playing the same game on GS individually, and via the traditional method of teaching and learning, i.e. with no games at all. Analysis of the pre and post learning achievement data reveals that the two classes who played the game performed better than the control class, with the collaborative class students achieving better than the individual class students. By playing the game, low-ability students, in particular, made the most significant progress in arithmetic capability and in building up their confidence in doing arithmetic calculations.

INTRODUCTION
Arithmetic skills in addition and subtraction are an important basic component in any mathematics curriculum for young children. We were interested in designing a simple yet fun digital game to enhance the learning of students. Our game takes the form of a cross number puzzle game to help young students learn and practice arithmetic skills in the formal mathematics curriculum in school. This adapted version of the "Cross Number Puzzle" runs on a technology platform called Group Scribbles. The game promotes the concept of addition and subtraction, and enhances children's capacity to build up their arithmetic skills progressively. We conducted a study with three classes of students, namely, traditional class learning serving as a control group, a class of students learning individually on GS, and a class of students learning collaboratively on GS, and analyzed the learning efficacies of these three groups. We also explored different collaborative learning patterns that involved students working together on solving arithmetic problems among those two classes doing collaboration.

Game playing is one learning strategy which is being actively researched. Research has shown that if games are embedded in education, it can motivate students and promote their willingness to learn (Coble, 1977). Aufshnaiter, Schwedes & Helankom, (1984) pointed out the "game-oriented pedagogy" can lead to amusing and fun activities to enhance teaching and learning. Effective learning performance can result from the projection of feeling and action into impersonal conceptual structures in the process of advancing skills of problem solving.

Many educators have classified operating addition and subtraction problems into four problem types: change, combine, compare and equalizer (Carpenter, Hiebrt & Moser, 1981; Fuson, 1992). English (1998) points out that change and combine are easier while take-away and compare are more difficult challenges for elementary school students. In an arithmetic equation, any of the three numbers could be the unknown number. We adopted this widely used method in our study. Fuson (1992) defines these three types of "change" (placeholder) as: Missing End, Missing Change, and Missing Start. Van de Walle (2001) also classifies the type of "change" into three types: result-unknown, change-unknown and initial-unknown. These three types of problems present different levels of difficulty to the students. In Thompson's study (1983), the initial unknown is most difficult. If the student applies the direct modeling strategy by using counters or tally marks to model directly the action or relationships described in the problem (Carpenter et al., 1993), he or she always does not know how many counters to be put down to begin with. Table 1 below illustrates the three levels of change types in story problems. Level I is when the result number is unknown, Level II is when the change number is unknown, and Level III is when the initial number is unknown (Carey 1991; Peterson et al., 1991).

Table 1: Three levels of "Change" types in problems

Change Types	Join	Separate
Result number unknown	Standard sentence: $A + B = \square$	Standard sentence: $A - B = \square$
Change number unknown	Standard sentence: $A + \square = B$	Standard sentence: $A - \square = B$
Initial number unknown	Standard sentence: $\square + A = B$	Standard sentence: $\square - A = B$

Design of game challenge level

Based on these three levels in Table 1, we designed our system in terms of five stages of problem posing to the students (Table 2):

In stage 1, the student is required to derive the answer of an arithmetic expression (result number unknown), inculcating the skills of basic addition and subtraction, for example: $3 \pm 2 = \square$.

In stage 2, the arithmetic operator is removed. Students were required to understand the concept of arithmetic operator, for example: $3 \square 2 = 5$.

In stage 3, the change amount is removed, for example: $3 \pm \square = 5$.

In stage 4, the initial amount is removed, for example: $\square \pm 3 = 5$.

In stage 5, both the initial and the change number are removed. It is more difficult with most changes, as here the sentence includes two variables: change amount and Initial amount unknown. For example: $\square \pm \square = 5$.

Table 2: Level of difficulty in the design

Level of difficulty	Description	Example
Level 1	Result number unknown － basic skill practice	$A \pm B = \square$
Level 2	Remove operator － between basic skill practice and comprehension application	$A \square B = C$
Level 3	Change number unknown add-to or subtraction － comprehension application	$A \pm \square = B$
Level 4	Initial number unknown add-to and subtraction － comprehension application	$\square \pm A = B$
Level 5	Change number unknown and Initial number unknown, addend or summand type － the most difficult level	$\square \pm \square = A$

The questions in cross number puzzle game are designed based on the national curriculum in Taiwan. Lewis et al.（1997）showed that most students could not find and understand the solution by backtracking or trial and error. Teachers should construct the connection between the mathematical concepts and the practical operations. In the light of the studies of Kieran (1992) and Lewis et al. (1997), we invited an experienced mathematics teacher to articulate a solution strategy using the unknown number mapping table (Table 3).

It lists the strategies in each difficulty level. Symbol "○" means this strategy can be applied at the level, while "×" means cannot. For example, in level 1, the student can use "counting number" with hers finger one by one or mental computing to get the right answer. Others strategies can not be applied at this level. At level 2, the student can obtain the answer by guess and estimation or "counting number". "Counting number" is the basic strategy which could be applied at all levels.

"Trial and error" means randomly select a number to replace the unknown number to seek the right answer. Strategies like "Undoing", "Shift item" work at level 3 and level 4. Problems at the most difficulty level (level 5) have two unknown numbers possibly with more than one solution. The student can use all strategies to solve problems spanning level 1 to level 4.

Table 3: Solution strategy of unknown number

Operation structure	Difficult Level	Strategy to get answer				
		Trial and error (guess and test)	Number counting	Undoing	Shift item	Balance
$5 \pm 4 = ?$	1	×	○	×	×	×
$5\ ?\ 4 = 9$	2	○	○	×	×	×
$5 \pm ? = 9$	3	○	○	○	○	○
$? \pm 5 = 9$	4	○	○	○	○	○
$? \pm ? = 9$	5	○	○	○	○	○

Note: ○: Working, ×: Not working. Difficult level is designed from table 2.

DESIGN OF THE FEEDBACK SYSTEM

A feedback mechanism was introduced to the game design in this study. Feedback is considered to have strong impact on the learning process and result (Kulhavy & Stock, 1989; Balacheff & Kaput, 1996). Appropriate feedback can lead the learners to focus on key elements of learning. The learner can always adjust their learning strategies to try to close the gap between their actual performance and the goal. They reflect on their learning by a self-monitoring feedback loop. Hence, they can change their learning strategies in the follow-up learning and seek a better way of learning (Alexander & Shin, 2000).

According to Roblyer (Roblyer, 2004), in repeating drill-and-practice activity, some elements should be considered: Control the speed of practicing-student need understand meaning of question and feedback timing. Feedback after correct answer-provide feedback message to student after student response the right answer and feedback should clearly understand and to motivate student learning. Reinforce the right answer- avoid counter effective to student, avoid student get more exciting from wrong answer's response message. Based on the 3 things: speed, feedback and reinforcement, should be considered in feedback designed in this study.

Schmidt (1991) proposes that feedback is the result of a series of actions. It represents the personal response or reaction to the information they received. The feedback itself is a problem solving process that checks the performance of action to improve a person or a group. In technology-enabled learning, feedback is typically provided as messages shown to students after their responses (Cohen, 1985). Siedentop (1991) points out that feedback can promote the interaction between the teacher and the learners. Teachers can give feedback to students in terms of their actions and performance, which enable them to know or to amend their understandings and may boost their enthusiasm for learning (Keh, 1992).

There are three forms of feedback: immediate feedback, summary feedback and compromise feedback (Schmidt & Wrisberg, 2000). Collins, Carnine, & Gersten (1987) point out three levels of feedback messages: little feedback- just show the answer is right or wrong; basic feedback- if answer is not correct then show right answer; and descriptive feedback- give some hints to learner, to drive right answer. Descriptive feedback can promote the motivation to challenge new tasks and new problem. The feedback mechanism provided by software systems mainly involves getting the right answer or the direction of goals as summarized by Sales (1998). These are: no feedback, knowledge of response, knowledge of correct response, answer until correct, and elaboration feedback. In our study, we rebuild feedback flow based on previous study. in the feedback flow. Feedback procedure is under different condition of property response different feedback message. The feedback mechanism flow is shown in Figure 1.
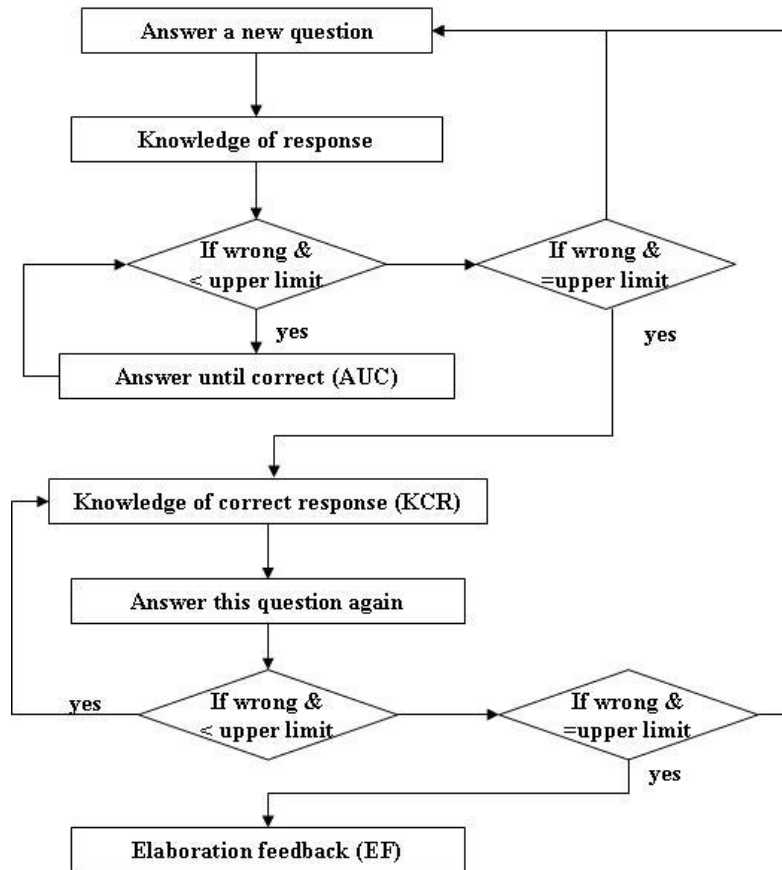
Figure 1. Flow of feedback mechanism

METHOD

A cross puzzle game was embedded in the Group Scribbles system which was used in our research for two classes of students. It was not offered to the third class of students which serve as the control class. This experiment includes pre-testing, teaching activity, post-testing, questionnaire and interview for four weeks. And we only study the learning outcome of addition and subtraction, others capabilities are not included. In this experiment learning performance and confidence will be tested by statistical examination.

Participators

Eighty three students in Grade 4 (ages 10 or 11) participated in our study. They learned some basic addition and subtraction since Grade 1 but they needed to connect them to the new concepts and skills required for Grade 4 mathematics. In this research, we explored the effects of "Cross number puzzle" game applied in learning, which was designed to provide the feedback mechanism. We had three experimental classes (shown in table 3): students in Class A played the "Cross number puzzle" game in small groups, and students in Class B played the game individually. Class C is the class doing traditional learning (a control class). Students in Class A and B were grouped according to their average scores of the previous three tests in the current term. Using percentile ranking, those students with the percentile rank of score over 73% were classified as high-math achievers; those with percentile rank of score between 27% and 72% were classified as medium-math achievers, and those with percentile below 26% were classified as low math achievement. Students in class A were divided into homogeneous groups with three per group. 6 students in the high-achiever group forming two groups. Three medium-achiever groups included 9 students and another three low-achiever- groups of 9 students separately.

Table 3: Experiment participators

Class	Type	Grouping Number	No. of students	Sum	Total
Traditional Learning (Class C)	Whole class teaching	No	31	31	31
Individual Learning (Class B)	High-achiever	No	8	8	28
	Medium-achiever		12	12	
	Low-achiever		8	8	

Collaborative Learning (Class A)	High-achiever	G1	3	6	24
		G2	3		
	Medium-achiever	G3	3	9	
		G4	3		
		G5	3		
	Low-achiever	G6	3	9	
		G7	3		
		G8	3		

Group Scribbles System

We utilized Group Scribbles (GS) as the platform for the game, and conducted analysis of the collaborative work within these groups. GS is a computer-supported collaborative learning system developed by SRI International to conduct small-group collaborative concept mapping activities (Chaudhury et al., 2006; Looi, Chen & Ng, 2010). Each student has a Tablet PC which the screen was divided into upper and lower frames (Figure 2). The lower frame is for individual cognition, that is, the student sketches or types his/her answer individually. The upper frame is a shared space (public board) in which the students show all of their individual answers, and work together as a group. They can even check the work from other groups by clicking the button on the top right corner (Figure 2). The teacher can monitor their process of learning and provide appropriate guidance.
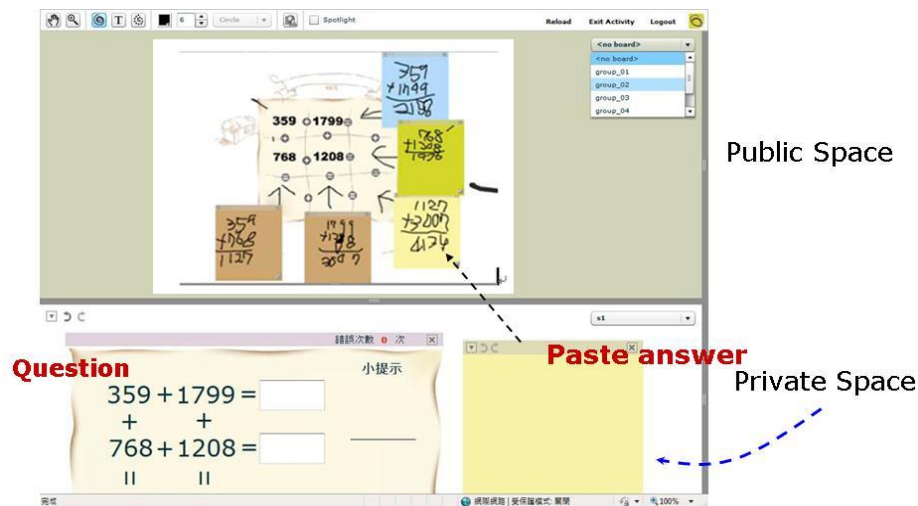
Figure 2. Spaces for individual and public cognition work

Figure 2 shows the interface of "Cross Number Puzzle" in GS. The questions are designed ranging from the easy to the difficult in terms of the five levels of difficulty. When the students complete the calculation, they can fill in the answer box and press OK button under the question area to submit. If the answer is correct, there will be a brief description of the key points. If the answer is wrong, the system will generate and display step-by-step hints based on the number of errors from the user inputs (Figure 7). The action repeats until the maximum number of errors reaches the upper limit. Then the system will show the correct answer and the methods of problem-solving. Four different types of questions were shown below (Figure 3 to Figure 6) in the "Cross Number Puzzle" and one case of an individual calculating process with wrong answers and hints.
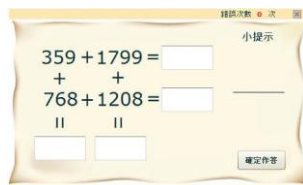
Figure 3. Question type 1
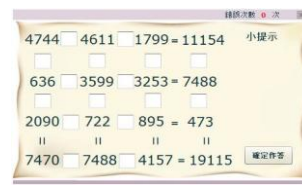
Figure 4. Question type 2
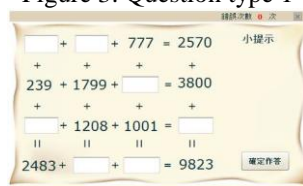
Figure 5. Question type 3
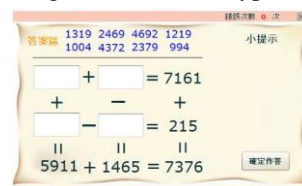
Figure 6. Question type 4

Figure 7. Hints
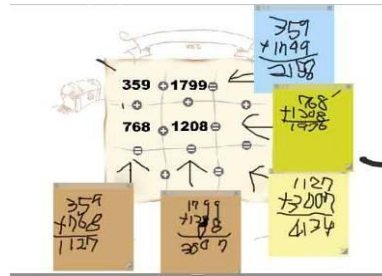
Figure 8. Calculating process

Figure 8 provides the screenshot of the calculation processes in a four-member group, in which each individual pasted his/her sketches in different color.

Procedure

The study for three classes lasted for four weeks. In the first week, a session for 30-minute pre-test and 20-minute training was administered. Students were asked to familiarize with GS system and the operation of the game by doing simple exercises. In the second week, the game was played in one lesson lasting for 60 minutes, followed by a 30- minute post-test and a 20-minute questionnaire in the third week. In the fourth week we did interviews to the teachers and students. A pre-activity and three formal learning activities were included in this study. The pre-test and post-test had the same questions but the questions are ordered differently.

In the game playing session, a pre-learning activity and three learning tasks were designed and implemented in Class A and Class B separately. Students were asked to fill in the operator in an arithmetic equitation in activity 1. Activity 2 is about filling in the unknown number while in activity 3 students were asked to estimate and trial-and-error methods to solve the problem. The only difference of these two classes was students in Class B played the game individually but students in Class A played it collaboratively. Figure 9 below gives an example of a game screenshot of a collaborative group with four members. Group members could use private board for sketches and confirmatory calculation. They could post their sketches or results to the public board.
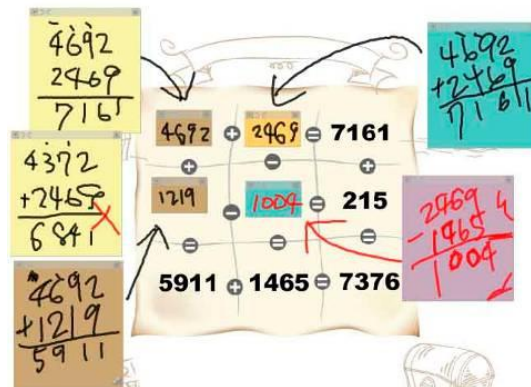
Figure 9. Example of Change number unknown and initial number unknown exercise

Findings

We analyzed students' scores in the pre and post-tests, collected questionnaires, video-taped their activities in classes, and tracked their screens during the process of game playing. Results were analyzed to look at the use of games to build arithmetic skills, collaborative patterns and how feedback was used in gaming.

Results of the assessment of arithmetic skill ability

We administered pre-tests and post-tests and performed independent sample t-test of three classes on their results. Table 4 shows the pre and post test results of Class A, B, and C. Students in Class A also have the highest average score in the post-test. Their average increased by 13.00, from 50.29 in pre-test to 63.29 in post-test (p=0.002<0.01). This indicates students in Class A progressed more than those students in Class B through playing the game collaboratively. Traditional class C made no significant improvement.

Table 4: Pair T-test of Pre and post tests

Tests		Pair t-test						
		Min.	Max.	Average	SD	Progress	t	p
Class C	Pre-test	28.34	86.68	58.35	9.73	0.01	0.049	0.961
	Post-test	25.01	93.35	58.36	11.184			
Class B	Pre-test	20.00	93.35	53.83	11.210	5.13	2.908	0.008*
	Post-test	13.34	100	58.94	11.399			
Class A	Pre-test	6.67	76.68	50.29	12.078	13.00	3.403	**0.002**
	Post-test	16.67	100	63.29	12.770			

*P<0.05, **P<0.01

Further observation of these collaborative groups implied that the low math-achiever students made the most significant progress, which can be easily gathered from the following table. Analysis of Table 5 and Table 6 showed that the low-achiever groups in Class A had the highest increase in post-test scores with high level of significance (P=0.001). This indicates that the low-achievers of these collaborative groups derived the most benefits in this study.

Table 5: T-test of pre and post tests in collaborative class

Number of Participants (N=24)		t-test of collaborative class						
Tests	Number of Participants	Min.	Max.	Average	SD	Progress	t	p
Pre-test of high-achievers	6	63.34	76.68	70.56	3.141	7.22	1.308	.248
Post-test of high-achievers		48.34	100	77.78	10.576			
Pre-test of medium achievers	9	45.01	66.68	56.48	5.182	6.47	.880	.404
Post-test of medium-achievers		40.01	98.35	62.96	14.454			
Pre-test of low-achievers	9	6.67	55.01	30.56	10.111	23.33	4.834	**.001**
Post-test of low-achievers		16.67	76.68	53.89	9.874			

Further analysis from Table 6 found that low-achievers and medium-achievers made more progress than high-achievers; there is obvious evidence that low-achievers made the most improvement in the individual class. It should be noted that two students' data were deleted from the data set of Individual Class, because one low-achieving and one medium-achieving student's scores were found to decrease dramatically on the post-test. Reviewing the interview and questionnaire data proved that these students did not like enjoy reading and did not pay attention to any feedback messages was given during game play.

Table 6: T-test of pre and post tests in individual class

Number of Participants (N=28)		t-test of individual class						
Tests	Number of Participant	Min.	Max.	Average	SD	Progress	t	p
Pre-test of high-achievers	8	53.34	93.35	71.06	8.070	1.04	.407	.696
Post-test of high-achievers		51.68	100	72.10	8.013			
Pre-test of medium achievers	11	21.67	80.02	48.16	9.502	5.55	.2.490	.032*
Post-test of medium-achievers		21.67	85.02	55.00	11.437			
Pre-test of low-achievers	7	20.00	60.01	43.08	9.245	5.21	2.657	**.046**
Post-test of low-achievers		26.66	75.02	48.03	11.112			

Table 7 shows further analyses conducted on three different types of test questions on "addition and subtraction" on low achievers in collaborative class. Students had better scores in all three types of questions in the post-test. But the low-achiever groups achieved significantly highest improvement in questions of "basic computing", "unknown constant" and "Cross Number Puzzle" with the increase of average score 9.63, 7.38 and 6.32 respectively. This suggests that these low-achievers benefited the most from the "Cross Number Puzzle" in improving their basic arithmetic skills.

Table 7: Low achieved students' progress in Pre and Post tests in collaborative class

Low achievers in Class A (N=9)		Pre -test	Post -test	Average increased scores	Ratio of progress in different questions
Basic computing skills	Score of question 1 to 5（33.33）	18.52	28.15	9.63	41.3%
Unknow constant	Score of question 6 to12（46.67）	8.90	16.28	7.38	31.7%
Cross number puzzle	Score of question 13 to 15（20.00）	3.14	9.46	6.32	27.0%

The average score of Class B (the individual group, shown in table 4) is 4.17 higher in the post-test (57.21) than in the pre-test (53.04) at a significant level of .026 (p<0.05). This indicates that learners also made progress through playing the game. To gain further insight into the differences between the improvement between the individual class and the collaborative class, regression analysis was performed to study the relationship between the scores of pretest (as the independent variable) and the score of post-test (as the dependent variable) within both classes. The results of F-test for pre-test (F = 2.487, p =. 121, p> .05) shows that the individual group (Class B) and the collaborative group (Class A) can be regarded homogeneous.

However, Table 8 below provides the result of F-test (F = 4.479, p =. 039, p <.05), which is significant at the p<.05 level. The striking result to emerge from the data is that the collaborative class had much greater improvement than the individual class in this study although they played the same game.

Table 8: ANOVA for individual class and collaborative class

Analysis of variance for Class A and Class B					
Item	Sum of squares	DF	Mean Square	F value	Sig.
Inter-group	313.995	1	313.995	4.479	.039*
In-group	3434.814	48	70.098		

Feedback usage in Class A and Class B

As we mentioned before, students in Class A played the game collaboratively in groups while students in Class B completed the game individually. We can easily conclude from Table 9 below that feedbacks in the form of "Hints" were much more frequently used in Class B than in Class A. It suggests that when students encounter problems and difficulties but without other people's help, he or she would search help from the "feedback" system. On the other hand, students in Class A would discuss their strategies to solve the problem within a group first, allocating cooperative work among group members. They only referred to the "feedback" system when all students in the group were uncertain or in a dilemma. They used the "Hints" less often then students in Class B. However either in Class A or Class B, high-achiever students seemed to have used the "feedback messages" far less than low-achiever students. Low-achiever students relied more on feedback.

Table 9: Feedback usage in Class A and Class B

Number of use in different group	Class A (N=24)	Class B (N=28)
High-achiever	0.54	0.84
Medium-achiever	0.71	1.31
Low-achiever	1.25	2.09
Average usage	0.86	1.40

Further observations were made concerning students' collaborative activities (in Class A) in the process of game

playing, which includes three learning activities to be completed in the game.

Pre-activity: Result number unknown
Before formal learning activities, a pre-activity was executed, two objectives in this activity: familiar system operation and warm up student's calculation. The question model is A ±B =□ which is the level one difficulty- a basic skill in arithmetic. There were 23 of 24 students in collaborative groups who finished this activity. If students can finish this activity, they will have ability to play next three activities.

Learning activity 1: Remove the operator
Four different patterns of collaborative problem solving were found in their activities of "remove the operator": whole-group-deciding, two-member-deciding, leader-deciding and individual deciding. Group 6 made the decision by all group members. Three groups, Group 1, Group 3 and Group7 decided the answer individually. Two groups took the two-member deciding pattern and the rest two groups took leader-deciding pattern. The following figures (Figure 11 to Figure 14) shows different layout of the game in different collaborative methods. For example, in figure 11, three students in group 6 (one student in one color of "+") post their answer as 4777 +++ 4611 +++ 1799 = 11154, six "+" and one "=". All these three students operate the addition correctly. Therefore we could judge that this group's answer was decided by the whole group. In figure 13 there is only one answer being pasted, when we referred to the video recording, we found this group was absolutely leader-deciding.

Figure 11. whole-group-deciding
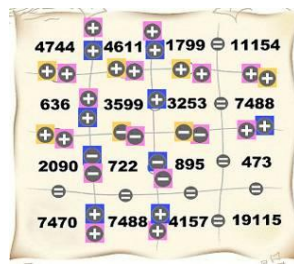
Figure 12. two-member-deciding

Figure 13. leader-deciding
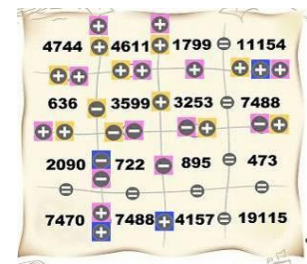
Figure 14. individual deciding

Learning activity 2: Filling in the Unknown Number
To enable learners get the unknown number in the puzzle by observing, calculating those given numbers and estimating the result, for example , A ± □ = B & □ ± A = B, tasks division and coordination were necessary in one group. From the procedural layouts of the game on the screen we got some insights of methods of students' collaboration and their strategies to complete the calculation. The results were shown in Table 10.

Table 10: Methods of collaboration in Class A (8 groups)

Methods	Description	Group	Ratio of different method used
Individual calculation	Group members did the calculation by themselves individually. Little collaboration occurred.	G1,G2	25.0%
Comparison	Started from different thread and compare each other's result at the intersection	G3,G5	25.0%
Relay	One finish one section and another take over to continue calculating	G4	12.5%
Assisted calculation	One of the group members is in charge of all calculation and other members checking his/her calculating process	G6	12.5%
Through-out calculation	Some members calculate from the beginning to the end and other members calculate from the end to the beginning then they compare at the intersection.	G7,G8	25.0%

Comparing Tables 10 and 11, we identify the most interesting learning strategies: most medium-achievers group used the method of cross calculation, and high-achievers seemed to prefer individual calculation.

Learning activity 3: Fill in the Multi-unknown Number
This most difficult task (Level 5), students would fit in multiple unknowns' equation like □＋□＝C or □－□＝C.

By tracing the working path and the group's problem solving strategies, we found that cross calculation is the most favorite, which was used by 50% of groups. The following table summarizes the group strategies used.

Table 11: Methods of collaboration in Class A (8 groups)

Methods	Description	Group	Ratio of different methods used
Individual calculation	Students did the calculation by themselves individually.	G1	12.5%
Cross calculation	Students started from different paths and compare each other's result at the intersection	G2,G3,G4,G5	50.0%
Reverse calculation	Some members in the group calculated from a vertical or a horizontal path, other members calculated from the result to get the answers.	G6,G7,G8	37.5%

Teacher's voice
Teachers also noticed better collaborations in Class A. Students of Class A were motivated and had good sharing in their group tasks:

"Most students were encouraged to have more discussions in this class. One of the high-achiever groups had conflicts during the discussion because everybody exhibited high confidence and expectation. Another medium-achieving group showed great enthusiasm in collaborative learning with one of them playing the role as a leader."

"Every student in Class A could get feedback from the system as well as from other members. The consensus achieved in the group made the whole class improve. However in Class B, students had great diversity in their responses. Some students produced good responses when they understood but for some others, they were not sure and thus they talked with their neighbors. And some of them just immersed themselves in individual work and require the teacher to guide them when they encountered difficulties."

Findings from the post-questionnaire
A post-questionnaire of the experiment was administered and analyzed according to Likert's five-point scale standard (Strongly agree, agree, Neutral, disagree and strongly disagree). We investigated the five facets of the experiment to analyze the students' perceptions and experiences in the Cross Number puzzle activities in Class A and Class B and found positive results, as seen in table 12.

Table 12: Findings from questionnaires

No.	Question	Class	Mean	Sig.
System functions				
Q1	I can use function of sketch: paste, move, writing	Individual	4.07	.001**
		Collaborative	4.83	
Q2	This system is easy to operate	Individual	3.79	.003**
		Collaborative	4.54	
Q3	I feel the flow of wireless connectivity is fluent and not slow	Individual	3.79	.144
		Collaborative	4.25	
Q4	It is very easy to use touch-pen to write down the steps in the calculations	Individual	4.25	.092
		Collaborative	4.63	
Feedback usage				
Q5	I will check the system "Hints" when my answer is wrong	Individual	4.25	.454
		Collaborative	4.46	
Q6	The hints from the computer enable me to think in a different way	Individual	4.32	.249
		Collaborative	4.63	
Q7	The hints from the computer motivate my calculations	Individual	4.14	.124
		Collaborative	4.58	
Q8	The hints from the computer can correct my wrong concepts	Individual	4.32	.185
		Collaborative	4.67	
Q9	The hints from the computer can help me learn	Individual	4.14	.087

	better	Collaborative	4.58	
Engagement				
Q15	I can complete all activities and answer all questions	Individual	4.04	.002**
		Collaborative	4.79	
Q16	I will try all possible solution methods	Individual	3.64	.001**
		Collaborative	4.63	
Q17	I hope to do more cross number puzzle games in my mathematical lesson	Individual	4.71	.030
		Collaborative	4.92	
Learning attitudes				
Q18	I like this kind of discussion in mathematical lesson	Individual	4.00	.000**
		Collaborative	4.79	
Q19	I think this game will let me have more confidence in mathematical learning	Individual	3.93	.000**
		Collaborative	4.79	
Q20	I will spend more learning time in this puzzle game	Individual	3.96	.096
		Collaborative	4.46	
Q21	This activity will let me understand the operations involving the unknown number	Individual	4.04	.002**
		Collaborative	4.79	
Q22	I think by computer-based learning helps m understanding more than traditional classroom teaching	Individual	4.46	.015*
		Collaborative	4.92	
Q23	I can focus in learn mathematics in this number puzzle learning activity	Individual	4.43	.007**
		Collaborative	4.88	

(1) System functions: The mean of Question 1 and Question 2 are (4.07, 4.83) and (3.79, 4.54) for collaborative and individual class. P-values are less than 0.01, suggesting that the students found the system easy to manipulate. But the average scores in the individual class are less than collaborative class. The collaborative class students can talk with members to understand system functions, and in the individual class, the students sought the teacher's help. This condition is also shown in Q3 and Q4.

(2) Feedback usage. The mean of the responses to the questions here are over 4 points which showed that feedback usage was helpful for students. These data support the previous finding about feedback usage in class A and class B.

(3) Engagement: The students were very engaged in the cross number puzzle and they attempted to explore all solution methods. Most of students in collaborative class wanted this puzzle system to be used in classroom learning.

(4) Learning attitudes: Both classes (A and B) showed positive attitudes towards this learning environment. The mean for the collaborative class students' confidence is 4.79 higher than that of individual class. Another statistical data before and after experiment was shown in Table 13, showing that 87.5% students in collaborative class had their confidence enhanced in this system. More than 80% of the participants stated that they liked to work with their group members to solve problems. Over 85% of them thought that they could easy understand arithmetical skills in game processing. It indicates that their strong willingness in learning through playing the cross number puzzle game and consequently they were fully motivated to learn.

Table 13: Confidence analysis before and after experiment

Confidence Analysis								
		Collaborative class (24)				Individual class (26)		
		Before experiment		After experiment		Before experiment		After experiment	
		Sum of students	Percent	Sum of students	Percent	Sum of Students	Percent	Sum of students	Percent
Degree	5	7	**29.2%**	21	**87.5%**	6	**23.1%**	9	**34.6%**
	4	8	**33.3%**	1	**4.2%**	6	**23.1%**	10	**38.5%**
	3	8	33.3%	2	8.3%	10	35.7%	7	26.9%
	2	0	0.0%	0	0.0%	2	7.15%	0	0.0%
	1	1	4.2%	0	0.0%	2	7.15%	0	0.0%
Max.		5		5		5		5	
Min.		1		3		1		3	
SD		1.007		.588		1.174		.796	

Mean	3.83	4.79	3.46	4.08
t-value	4.337		2.173	
P-value	.000**		.040*	

** p<.01   Degree: 5.strongly agree, 4.agree, 3.neutral, 2.disagree, 1.atrongly disagree

Collaboration

Table 14 shows that 85% students tried to do cooperation and discussion before they submitted the answer. There was one high-achiever student who did not discuss with others when he did his calculations. In the follow-up interview, he explained that he was quite confident and only shared his results with others when he completed all his calculations. 87.5% students claimed that it was much easier to complete the calculations with collaboration than to have to do it individually. Those students without confidence in mathematics found it easier to share their own ideas with others and co-complete the calculation. All students agreed that they derived benefits from discussion with other classmates.

Table 14: Questionnaires analysis in collaborative class

No.	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean
Q10	I can find the right answer by group discussion	20 83.4%	2 8.3%	2 8.3%	0 0.0%	0 0.0%	4.75
Q11	I will discuss with my group member, then write down the answer	18 75.0%	2 8.3%	3 12.5%	1 4.2%	0 0.0%	4.54
Q12	Collaboration with group members will help me find the solution rather than myself doing it	21 87.5%	3 12.5%	0 0.0%	0 0.0%	0 0.0%	4.75
Q13	I will talk freely about my thinking in the group	20 83.4%	2 8.3%	2 8.3%	0 0.0%	0 0.0%	4.75
Q14	My communication with group members helps me in my learning activity	19 79.2%	5 20.8%	0 0.0%	0 0.0%	0 0.0%	4.79

DISCUSSION

This paper investigated the benefits of learning addition and subtraction through the game "Cross Number Puzzle" on Group Scribbles. Our observations and investigations of the two classes who played the game individually and collaboratively respectively showed some interesting differences. First, after statistical analyses these two classes have more improvement than traditional class. Between two classes use "Cross Number Puzzle" system; the collaborative learning groups (Class A) were found to have made greater progress than individual learning groups (Class B). It suggests that collaborative learning may have enhanced learning effectiveness. From the statistics, we can conclude the low-achiever in collaborative class' students benefited the most in this "Cross Number Puzzle" game. Further analysis of the low-achievers show that they made significant progress in "basic computing skills" has significant progress, thus suggesting that this puzzle game can help low-achieving students to improve their basic skill practicing. Collaboration also plays an important role in enhancing learning in Class A with the incorporation of the "feedback system" and collaboration strategies. After doing the practices in this puzzle game, the students in collaborative class built up more confidence than those in the individual class. Thus, this puzzle game system may have better performance in collaborative environment, but more experiments need to be carried out to verify this result.

High-achieving students can do individual practices to improve their skills. Although there is no clear evidence shown that high-achievers from the collaborative class benefited, we cannot yet infer that high-achiever students are not suitable for collaborative learning in "Cross Number Puzzle" system.

In both classes, the low-achiever students accessed the "Hints" most often while the high-achiever accessed the least. The individual learning groups in Class B had much higher frequency of access to "Hints". It indicates that the collaboration among group members in Class A did assist students' problem-solving. They relied less on the "feedback" system because they could get help from group members. However, in both classes, the low-achiever students had the highest demand for "Hints" for help.

About methods of problem solving: students in collaborative learning groups presented four different methods of problem solving in their activities of "removing the operator": whole-group-deciding, two-member-deciding,

leader-deciding and individual deciding. In the activity of "fill in the figure in the expression," the students had five methods of calculations: individual calculation, comparison, relay, assisted calculation and through-out calculation. Students also showed four different ways of calculation: free calculation, calculate from the top, calculate from the bottom and calculate from both the top and bottom. They did the calculation in three different collaborative ways: each student calculates the whole thing him/herself; one student started from the top and the other started from the bottom; and they did backwards calculation for checking.

FUTURE WORK
Based on these findings in this study, we draw the following recommendations for future research.

More time on the "Cross Number Puzzle" learning activity: Our study has some limitations concerning the duration of the learning activities and the scale. For broader applicability, we need more experiments and a larger population of students to verify the findings of this current study.

Bigger screen for sharing: With a concern for the eyesight and health of young children, a big screen to display the public board for all group members could assist the discussion within a group by providing a focal point of attention. The individual board could still be retained in the screen of the students' personal Tablet PC for their private cognition.

Adaptive feedback: Although feedback system can help students, we only offered phased hints to students in this "Feedback system". The feedback only includes the general direction of calculation concept and the problem solving process. If system can diagnose and evaluate the individual student's errors, system can provide each student with the individual corresponding solutions or suggestions to fit his skills.

Incorporate a timer: From our analysis of the frequency of feedback in this study, a timer could be added to the system to record the duration of problem solving by each user and let game system more challenge. This would also enable the teacher to gauge the time used by the students at each stage of their problem-solving. But time constraint also could be a pressure increase difficult so an adjust timer controlled by teacher will be suitable.

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A COMMUNITY OF PRACTICE APPROACH TO LEARNING PROGRAMMING

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ABSTRACT
In programming courses, teaching students who have varied levels of knowledge and skills the requisite competencies to perform in real-world software development teams is indeed difficult. To address this problem, this paper proposes a community of practice (CoP) approach and provides some guidelines to simulate a real-world CoP in a blended learning environment. It simulates not only the role structure and tasks but also the participation process. The design of this approach is based on the situated learning perspective that considers learning to be a trajectory in which learners move from legitimate peripheral participation to full participation in CoPs. The results from the data analysis and questionnaires indicated that the students were very engaged in this activity and believed that this approach helped them to develop necessary programming knowledge and skills. This study also reports certain constraints and suggestions for teachers who want to adapt this approach for their courses.

INTRODUCTION

One of the most important skills for the computer science student is programming. In general, computer science students first learn programming skills in an introductory computer science course, often termed CS1. The students who enroll in this course possess widely different learning attitudes and programming backgrounds, therefore making it difficult for the instructor to provide a learning environment that benefits all students. Moreover, learning to program involves acquiring programming knowledge and developing various skills that are required in real-world software development processes such as designing, planning, coding, and testing (Robins, Rountree, & Rountree, 2003). First-year computer science students face many challenges in learning these valuable soft skills and acquiring the requisite knowledge. Traditional teacher-centered instructional approaches aimed at averaging the majority of students are not effective. To be effective and to benefit all students, teachers usually must employ other learning activities in their programming courses to complement their instruction.

To support learning in the programming courses, this paper proposes a community of practice (CoP) approach. This approach provides guidelines to simulate a real-world CoP in a blended learning environment. It simulates not only the role structure and tasks but also the participation process. In the simulated community, each student is assigned a role based on his/her learning status. Each role has its respective tasks and responsibilities and incorporates different skills. When the individual who is assigned that role has demonstrated competency in certain predefined criteria, he/she will be promoted to more central roles. In this way, all students have the opportunity to assume every role and to develop the different levels of knowledge and skills associated with each of the independent roles. Because this approach requires out-of-class effort and work, a Wiki system is used to design an online learning environment that provides students an interactive, knowledge-sharing space. We have implemented this approach in a programming course. In this paper, we report our findings and suggestions.

1. RELATED WORK

1.1. Situated Learning

In recent decades, the focus on education has changed from an acquisition metaphor to a participation metaphor. The acquisition metaphor is based on cognitive theories and assumes that knowledge consists of symbolic mental representations in which learning is a process of acquiring and manipulating these symbols (Sasha A. Barab & Duffy, 2000). In contrast to learning as knowledge acquisition, the participation perspective is grounded upon situated learning (Lave & Wenger, 1991); that is, it views knowledge as situated in the activity, context, and culture in which it is developed and used. As such, learning becomes a trajectory in which learners' transition from legitimate peripheral participation (LPP) to full participation in CoPs. Learning occurs in a participation framework rather than in an individual mind.

CoP and LPP are two major characteristics of situated learning. A CoP is a living context in which learners with a common interest in a subject collaboratively share ideas, find solutions, and solve problems. It serves as both context and content, providing support for learners as they acquire appropriate skills, knowledge, experiences, beliefs, and values related to the CoP (S. A. Barab, Barnett, & Squire, 2002; Henri & Pudelko, 2003; Wenger,

McDermott, & Snyder, 2002).

Learning in a CoP is attained by increasing the access of learners 'to participating roles in expert performance' (Lave and Wenger, 1991, p. 17). When newcomers enter a CoP, LPP provides them with the opportunity to imitate and observe old-timers and motivates them to engage in community activities. In this way, the newcomers are able to form a general idea of what constitutes the CoP. Gradually, they are given more responsibilities and more complex tasks within the community, and they begin to engage in practices that are more central to the operations of the CoP. As they do so, they monitor and adjust their motivations, knowledge, skills, identities, beliefs, and values. They also have increased opportunities to interact with community members on multiple levels. The interactions on these various levels affords the member multiple and diverse opportunities for learning and contributing to the community (Wenger, 1998). Eventually, as they become more experienced in the CoP, they develop increased skill levels and greater knowledge and reach old-timer status. Fig. 1 shows how a newcomer moves from peripheral to central participation as well as how he/she changes his/her roles and tasks within the community.
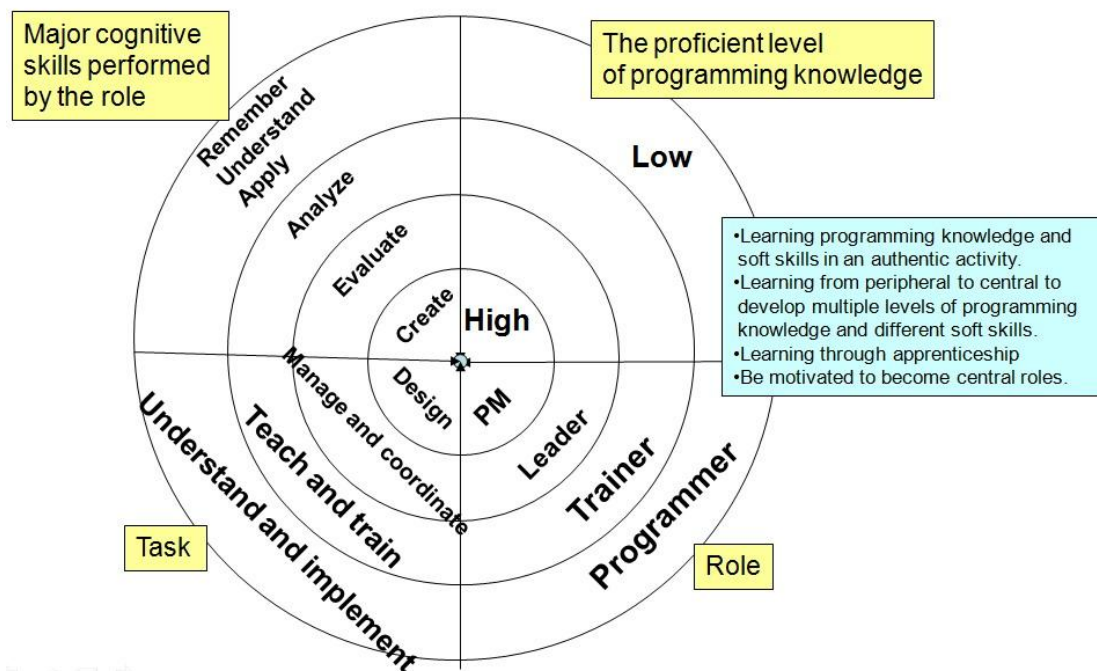
Fig. 1. Learning Transitions from Peripheral to Central

According to the above descriptions, we summarize advantages that situated learning provides the learner. These advantages, listed below, are inherent to most CoPs.
1. Learning practical knowledge and skills in an authentic context.
2. Learning transitions from peripheral to central participation, developing multiple levels of knowledge and different soft skills.
3. Learning through apprenticeship.
4. Being motivated to assume central roles through increased participation.

1.2. Learning activities designed for supporting programming courses
Several approaches have been proposed for improving CS1 courses. For example, the apprenticeship-approach encourages students to read and extend programs written by experienced programmers (Astrachan & Reed, 1995; Kölling & Barnes, 2004). The peer-assessment activity allows students to read, review, and assess each other's programs. (Hamer, Purchase, Denny, & Luxton-Reilly, 2009; Zeller, 2000). The group cooperation approach, which divides students into groups to solve real-world problems or to complete a program, is also widely used (Hsieha & Jr., 2002; Joy, 2005; Kalles, 2008).

Each of these approaches has value. However, none of them takes into account the fact that students' abilities and attitudes towards learning are varied. Students with a range of approaches to learning are all assigned the same tasks or roles, though some students may not be able to complete the assigned tasks or to play the assigned roles. Furthermore, the more passive students may plagiarize from peers or become free-riders in the cooperative activities (Raban & Litchfield, 2007; Strijbos, Martens, & Jochems, 2004).

To address these concerns, information and computer technology (ICT) systems have been incorporated to develop adaptive learning systems and to construct collaborative learning environments in which students support each other and share knowledge to achieve common goals. These systems and environments are designed based on the work of Vygotsky, who proposed the zone of proximal development (ZPD) (Vygotsky, 1978). Li & Chen (2009), for example, developed an adaptive coursework support system to provide students adaptive programming exercises and learning support. Chang, Chen, & Li (2008) designed a web-based coursework environment for students to share and review programming knowledge in an online community.

Wiki-like systems such as MediaWiki (http://www.mediawiki.org/wiki/MediaWiki) and CoWeb (Guzdial, Rick, & Kehoe, 2001) are generally used as Web-collaborative platforms. They allow any user to edit any existing page or to create new pages. They make it easy for teachers and students to create collaborative Web-based activities. Some studies have used Wiki systems to support programming courses. For example, Xu (2007), in a compiler construction course, used a Wiki system to support team project management, and Bennett (2009) used a Wiki system as the medium for a student-authored CS1 programming textbook. These studies indicate that using Wiki in programming courses can generate high quality content, improve knowledge sharing, and support communication and coordination tasks. However, other studies have found that only providing Wiki systems did not facilitate collaboration, as students using the Wiki systems still largely worked as individuals. Therefore, they further suggested that Wiki systems must be well-integrated with collaborative activities, curriculum, and assessment (Choy & Ng, 2007; Cole, 2009; Judd, Kennedy, & Cropper, 2010; Karasavvidis, 2010; Weaver, Viper, Latter, & McIntosh, 2010).

Because of the advantages of situated learning, this paper proposes a CoP approach to simulate a real-world CoP in the classroom. In the simulated community, students with varied abilities will support each other to achieve common goals and will be provided opportunities to learn multiple levels of programming knowledge and skills. In addition, a Wiki system is used to support this approach outside of the normal classroom hours. We believe that integrating the Wiki system will motivate students to participate in collaborative activities and will further help them to develop course knowledge and soft skills outside of class.

2. GUIDELINES FOR IMPLEMENTING THE COP APPROACH

A CoP is an open environment that allows anyone to join and leave at any time. Member identity is formed naturally based on one's level of involvement. However, a learning community is, typically, a closed community. All students are newcomers at the beginning of a course, and one cannot join the community without the teacher's approval. The identity of students cannot be formed naturally. Therefore, it is difficult to simulate the participation process of a real-world CoP in the classroom. We provide several guidelines for teachers to create an activity that simulates a real-world CoP with the legitimate peripheral participation process. These guidelines are as follows:

1. The structure of the roles must be designed to be hierarchical, and those who play more central roles must assume those tasks that involve higher level knowledge and skills.

Because the role structure is hierarchical, students can be endowed with different roles based on their learning status. Greater higher-level knowledge and skills are required for the central roles, and greater responsibilities are associated with these more central roles. Therefore, those students who perform well and display strong skills should be promoted and assigned to the more central roles. The central roles should be filled by the more capable students, as they guide those in the peripheral roles to collaboratively complete common tasks. Those in the peripheral roles should observe and imitate those in the central roles, thereby developing and enhancing their knowledge and skills.

2. In the beginning of a course, it follows that the teachers and teachers' assistants will fulfill the more central roles.

At the beginning of the course, all students are, essentially, beginners. The only experts are the teachers and the teaching assistants (TAs). Therefore, teachers and TAs must play the central roles at the beginning of a course, thus placing greater demand on the workload of teachers and TAs. To reduce the demand on the teachers, teachers often enlist the aid of capable students who successfully completed the course the last year. Teachers also can conduct activities to assess the skills and knowledge of students and then enlist the more capable students in the class to assume the responsibilities associated with more central roles.

3. A role promotion mechanism that can assess students' skills and determine students' roles should be designed.

In a real CoP, member roles are formed naturally based on levels of involvement. Because a learning community is closed, however, all students are newcomers at the beginning of a course. To determine the role of each student, a role promotion mechanism should be implemented. Accordingly, students can be promoted to more central roles if and when they demonstrate or master predefined criteria.

4. This approach should be implemented within the context of the class on a regular basis, similar to that of regular school work and weekly coursework.

- Students' roles must be adjusted over time, and the teacher must have a preconceived idea of what constitutes suitable or adequate time. It is our conclusion that a student's skills and knowledge should be assessed at the end of an old assignment and at the beginning of a new assignment. This allows the teacher to reference the students' previous learning performance based on the old assignment for role promotion, and students can use new roles to complete the new assignment. If this is the case, we must separate this activity into several assignments. After each assignment, students should be given the opportunity to change their roles. Therefore, we suggest that this approach should be implemented in the context of regularly school work, such as weekly coursework. Through the assessment of the students' regular school work, the teachers can routinely check students' statuses and adjust their roles.

5. Teachers must help students to understand and recognize the tasks, responsibilities, and objectives of each role.

When students sufficiently understand and recognize their roles and tasks, they will focus on their responsibilities and their contributions to the community as a whole. Therefore, teachers must help students to understand and recognize the responsibilities and tasks associated with each role, the objectives of each task, and the advantages they can gain when playing a specific role (e.g., what rewards they can earn and what they can learn). Various strategies can be used toward this end. For example, teachers can introduce the roles at the beginning of the course and publish the evaluation rubric for each role on the Internet. They also can publicly praise the students who have performed a role well or correct the mistakes of the students who have failed to perform a role successfully.

6. Teachers must encourage students to engage in the activity.

Not all students in a class are willing to engage in a learning activity. Teachers, therefore, must encourage all students to engage in the learning activity, and some strategies for this exist. For instance, teachers can structure positive social interdependent communities (Johnson, 2003; Johnson & Johnson, 2002). In addition, detailed information on the performance of all students in the activity can be accessible on a Web page, thus subjecting students to peer pressure and/or encouragement. Furthermore, teachers can send an alert by email to notify students regarding the status of various tasks, for example, which task is overdue and which task must be finished.

7. ICT can be used to provide an authentic and interactive context for outside classwork.

In general, students attend a course only two or three hours a week. This is not enough time for teachers to conduct such an in-depth collaborative activity. Therefore, the approach must be implemented outside of the normal classroom environment. ICT can provide interactive Internet and multimedia applications to simulate realistic situations and to connect with remote persons and applications. It also can be used to create authentic contexts and to support students' interactions and discussions with peers outside the classroom walls.

3. CASE STUDY
We have implemented this approach in a mandatory course entitled 'Basic Computer Concepts' in which fifty first-year computer science students studied the C# programming language. One teacher lectured for three hours each week in the classroom, and one teaching assistant facilitated the students' participation in an out-of-class activity based on the above-mentioned approach in the Web environment.

3.1. The Activity
The learning activity simulated the role structure and process of participating on a software development team. A software development team is typically composed of a project manager and one to three small teams; each small

team is composed of a team leader, a trainer, and two or three programmers. A project manager must design a group assignment for his/her small teams. Each small team then conducts a software development process, planning, design, coding, and testing to complete a program for each assignment. There are specified tasks for every role. When working on these tasks, members are given responsibilities and are required to perform the corresponding skills. For example, a team leader must distinguish the parts of a group assignment, divide it into several subtasks for his/her members, and organize each member's task outcomes into a final report. Thus, the team leader must use the cognitive skills of analysis and synthesis to accomplish his/her tasks. Figure 1 represents the roles, tasks, and learning process in the activity.

The activity was used for coursework, and assignments were issued every two weeks. The software development process was used for every assignment. Every two weeks, the teacher determined the topic of an assignment according to the course syllabus. Before the students began the assignment, each project manager was required to design a group assignment for his/her small teams. The remainder of the two-week period was used for the assignment (during the first week) and for reviewing and revising (during the second week). Before the end of the first week, the team leader was required to integrate all members' task outcomes into a final report and submit it via a Wiki system for later review.

The agenda for the second week was scheduled to include three days for an expert assessment and four days for revisions. After the submission deadline, each project manager reviewed the submitted programs for his/her small teams and provided comments about the end result after which each small team revised its program according to its project manager's comments. Finally, each small team submitted the revised program via the Wiki system and demonstrated the program for the class.

After the assignment, the teacher adjusted the students' roles for the next assignment based on the role promotion criteria, including students' performance on the last assignment, the results of a peer assessment that was conducted at the end of each assignment, and the teacher's observations.

In addition to working on group assignments, students were also encouraged to share their knowledge and learning on the Wiki system, such as what they had learned, problems they had encountered, and websites they had found useful. The individual contributions were also rewarded.

3.2. *The Procedure*
Fourteen assignments were given over two semesters. Students were allocated two or three weeks for each assignment. Seven assignments (1~7) were given in the first semester, and seven assignments (8~14) were given in second semester.

At the beginning of this course, student learning status was unknown. Therefore, the teacher used three assignments to probe the learning status of each student. For each of the first through third assignments, the teacher prepared three alternative programming exercises for all students. After these three assignments, the teacher divided all students into ten small teams, according to their learning statuses. Ten students were promoted to the role of 'team leader,' and ten students were identified as 'trainers'. At that moment, the teacher and the teacher's assistant played the role of 'project manager'. For the fourth through eighth assignments, the teacher assigned a group assignment to each team. Each small team was required to complete a program by a given deadline. After these five assignments, the teacher selected the individual most capable of playing the role of 'project manager' from the team leaders. Thus, the software development teams were formed. Later, all of the roles were played by the students. The teacher and teacher's assistant only monitored the flow of the activity.

3.3. *The Web learning environment*
The implementation of the Web environment used MediaWiki. It provided support for teachers to manage the flow of the activity. It also provided support for students to manage assignments and personal and group information, to discuss with peers, to share knowledge, and to inquire about their status on the Web. In addition to the basic pages including history and discussion pages in each Wiki, there are four kinds of pages the students and TA create for the activity.

- The course announcement page: This page is created by the TA. It is the homepage of the Wiki system, and it is used for class announcements such as schedules, timelines,, teaching materials.
- The assignment page: The procedure of a group assignment is presented in a series of steps: designing a group assignment, planning a schedule for the assignment, submitting the completed assignment, and evaluating the submitted assignment. All information about the assignment, such as the assignment description, task arrangement, task outcomes, integrated final report, and comments on the submitted

assignment is published on the assignment pages. Fig. 2 is a snapshot presenting an assignment page.
- The group and personal page: Each team has its own group page in which members can post their group portrait. There are four types of information that must be included on a group page: a group picture, a basic introduction of each member (name, role, and programming experience), hyperlinks to each member's personal page in which a student can post his/her portrait, and hyperlinks to each assignment page of the small team. The group and personal pages display the group and personal portraits and other information about the group to promote positive identity interdependence.
- The knowledge sharing page: Both instructor and students can freely create and modify pages in this section. These pages serve as common accessible source for sharing and exchanging knowledge. Students are encouraged to build and share knowledge on this page.
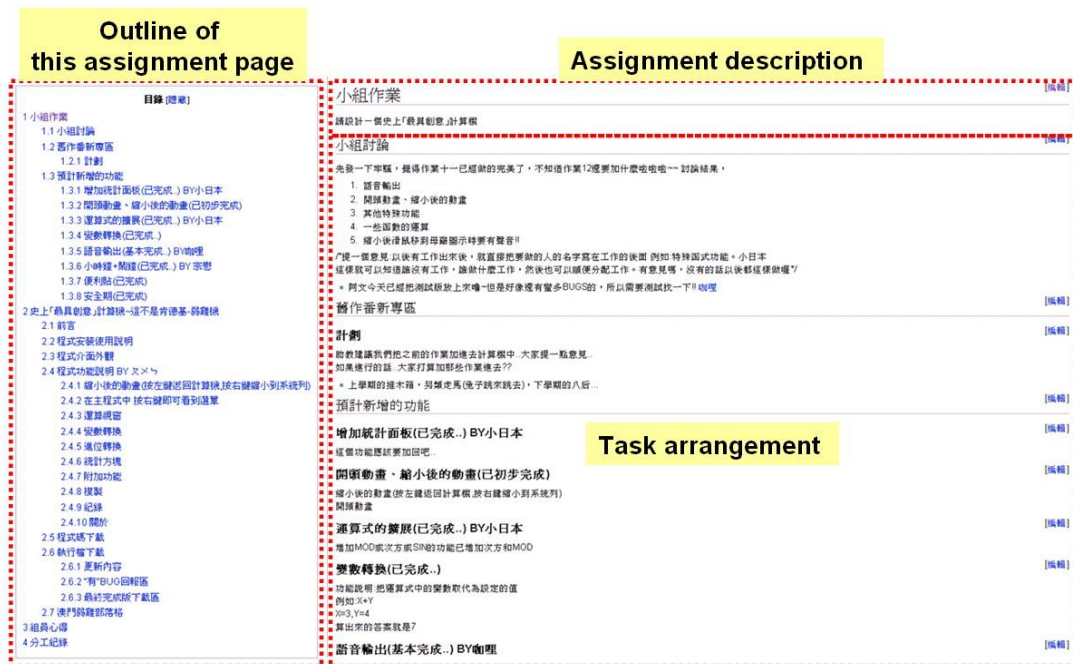
Fig. 2. A snapshot of a posted group assignment

3.4. Data Collection

To understand the effect of this approach on student learning and collaboration, we collected a combination of quantitative and qualitative data that included the following: (1) students' portfolios, which the students posted on the Wiki system, including discussions with other students, completed assignments, and students' comments related to each assignment; (2) a structured questionnaire that the students completed at the end of the course, based on a Likert scale rating system (1=Completely Disagree, 5=Completely Agree); and (3) notes from semi-structured interviews and informal discussions with students. The data were analyzed to answer the following questions.

1. To what degree did the students participate in this activity?
2. Did the students perceive that this approach helped them develop soft skills?
3. What were the roles of the TA?

4. RESULTS

4.1. Participation in the activity

From interviews, we found the students usually met two times in group face-to-face discussions for each assignment - once for the division of labor and once for the assignment integration. There were two ways of dividing the labor that the students performed. 1) The leader divided the assignment into several subtasks. Then the leader and trainer individually guided one or two programmers to complete the subtasks. Finally, the leader and trainer worked together to integrate the outcomes of the subtasks into the final report. 2) The leader first divided the assignment into several subtasks. Then he/she monitored the progress of each programmer, while the trainer supported programmers to complete their tasks. Finally, the leader integrated the outcomes of the subtasks into a final report. The major consideration or difference between the two methods was related to the role of trainer and was based on the programming ability of the trainer. If the programming ability of the trainer was similar to that of the leader, the group adopted the first method. If the programming ability of the trainer

appeared to be lacking, the group employed the second method.

We also found that the diversity of the programming ability of members within the group affected how well and to what degree the students collaborated. If the programming ability of the members in a group was more equal, the positive interdependence of this group was high. However, if the diversity of the members was great, the members with lower programming ability relied heavily on other members of the team (usually the leader and trainer). As a result, these students did not do anything as members of the collaborative team and, thus, were unable to learn the requisite skills.

Our approach, which promotes capable leaders as project managers, can solve the problem. When a leader is promoted to the role of project manager, the remaining members have no one to rely on. Thus, it forces the members to complete the assignment by themselves. For example, one student commented on the Wiki after his leader was promoted to project manager:

> I feel the workload of every member in this team has increased after Jimmy became the project manager. But I think it is good for me because I had to do more and had more opportunities to learn from doing my group assignments. Like this assignment, I was responsible for writing program code. I am very glad for completing the program.

Additionally, the students also developed their own strategies to solve the problem. For example, after finding that some members did not do anything, the leader of the sixth group asked the members to complete the assignment by themselves. He just answered their questions and gave them suggestions. He announced the plan on the Wiki system

> I will not do programming tasks in this assignment. I hope you can finish this assignment by yourselves. If you have any questions, I will answer them.

We also found that there was a team in which none of the programmers were capable of completing their tasks in any of the assignments. Therefore, the leader actively asked the programmers to participate in an after-class meeting in which he taught the programmers how to program, thus, enhancing their programming knowledge and skills.

In addition to meeting face-to-face, the students also discussed and shared information on the Wiki system. The students posted and responded to the generated ideas, the task arrangements (division of labor), the task outcomes (the code and executed results of the program), the knowledge and skills that they learned, and the related resources used for the assignment in the assignment pages. We found that the students did not use the Wiki discussion page but, rather, posted questions directly on their group assignment pages for collaboration. However, they did not post any questions or comments on the assignment pages of the other groups. Most of the questions they discussed were related to the division of labor.

Table 2 presents descriptive statistics automatically generated by the Wiki system. In this study, the students created many pages for their assignments. The average number of edits per page is 5.5, which may indicate that the students often used the Wiki to record and discuss their assignment. In addition, the average number of pages read per user is 1525. This may indicate that the students thought the articles were valuable and were willing to read to enhance their learning. The descriptive statistics may also demonstrate that the students were engaged in the activity.

Table 1: The descriptive statistics in the Wiki system

Items	Number
The number of content pages that is authorized as high quality by MediaWiki system	216
The average number of edits per page	5.50
The average number of times each user read pages	1525.20
The average number of times each user edited pages	241.90

4.2. Role migration

Fig. 3 presents the numbers for each role in each assignment. Those in the peripheral roles migrate gradually to the central roles. At the end of the course, thirteen students had played the role of 'project manager', seven students had played the role of 'team leader', and eight students had played the role of 'trainer'. In other words,

these students were recognized for their abilities, showing that they had been trained in their respective soft skills. It also represents that the promotion mechanism caused students to appreciate and understand their positions within the community. Students were then motivated and wanted to take on central roles.
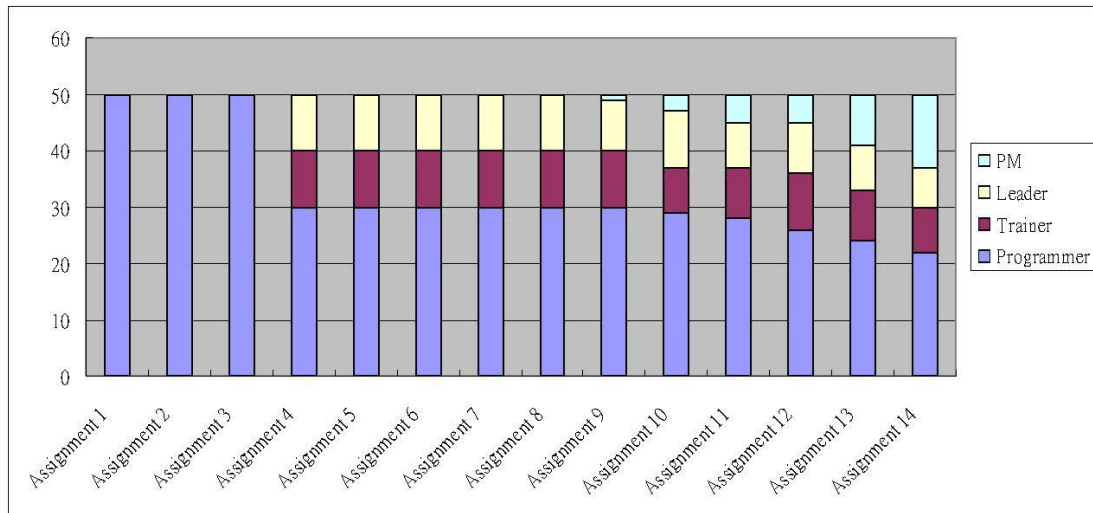
Fig. 3. Role migration

In addition to upgrading students' roles, however, six students were downgraded at some point during the process. There were three primary reasons that the six students were downgraded.

1. The leaders or trainers had other personal tasks such as after-class activities and/or part-time jobs and did not have enough time to take care of their responsibilities. (n = 2).
2. The leaders or trainers were incompetent. Their members suggested downgrading them. (n = 2).
3. The leaders or trainers thought that they did not have abilities to lead their members (n = 2).

When we first (assignment 4) divided the students into ten small teams, each team was composed of five students. However, at the end of the course, there were thirteen students playing the role of 'project manager'. The number of members in each small team was decreased (seven small teams consisted of four students, and three teams consisted of three students). Thus, students' workloads were increased on each team. Although the workload of every student was increased, we found that the students did not complain. In fact, they felt it provided them more opportunities to practice their programming skills.

Project managers were required to design and evaluate the group assignment. Thus, their workload was considerably less than other members of the teams. We found that in addition to answering questions, however, most of the project managers created a knowledge-sharing page where they gathered information and wrote articles related to C# programming in the pages. Some students responded that "*these articles are useful and I frequently read them for learning programming and completing my tasks.*"

4.3. Students' perception

A structure questionnaire that the students completed at the end of the course, using a Likert-scale rating system (1=Completely Disagree to 5=Completely Agree) was designed to investigate whether the students perceived that playing particular roles helped them to cultivate particular soft skills. The results are listed in Table 1 and indicate that the students highly agreed that they actually developed the skills by playing these roles.

From the students' portfolios, we found that there may be two reasons why the students developed their skills in the activity. First, the students learned from observing and imitating those in the central roles. For example, the team leader of the tenth team guided the team successfully to complete each assignment; thus, he was upgraded to project manager for assignment 11. Meanwhile, the trainer of this team was upgraded to team leader. We found that this new team leader divided and planned a group assignment in a way very similar to the previous team leader. The new leader told us that "*because the previous leader played the role very well, I imitated what he did.*"

Second, the students can learn skills through interactions and collaborations with those in different roles. For example, a student was upgraded as a team leader even though he was not familiar with the tasks of the role in

the beginning. When collaborating with other members (the project manager, trainer, and programmers), however, he received comments and feedback from them and gradually began to understand what he should do and how he should do it. This student posted the following statement when he first assumed the role of "team leader":

> I want to thank my project manager, as he helped me very much in this assignment. But I think I am not suitable to play the role of "team leader" because I cannot guide my members to complete a good program.

After he played the role of team leader two times, he posted the following statement:

> I very much appreciate the TA who gave me the opportunity to become a team leader so I can learn how to guide a team to successfully complete a program and how to coordinate with my team members. I also appreciate my members. They always gave me some significant comments to let me know what I should do and how I should do it, although there were some conflicts between us.

Table 2: Students perceived that playing these roles is helpful for developing skills

Question (the questionnaire has been translated from Chinese)	Mean	SD
Answered by those students who have ever played the role of 'Project Manager' (N=13)		
Reviewing peers' assignments is helpful in cultivating my evaluation ability	3.50	0.80
Designing group assignments is helpful in cultivating my creativity	3.83	1.03
Answered by those students who have ever played the role of 'Team Leader' (N=21)		
I can learn how to divide a group assignment based on every team member's ability when I am a team leader	4.33	0.66
Answered by those students who have ever played the role of 'Trainer' (N=20)		
I can learn how to guide members in completing their tasks when I am a trainer	3.55	0.69
Answered by those students who have ever played the roles of PM, Team Leader, or Trainer (N=32)		
I can learn various skills (e.g., designing, planning, evaluating, and coding) by playing different roles	4.09	0.80
Answered by all students (N=50)		
Comparing with self-study, I learned more in this activity	4.12	0.80
Participating in the activity is helpful for learning programming skills and knowledge	4.20	0.57
Participating in the activity is helpful for learning communication and social skills	4.12	0.63

4.4.   Teacher assistant's roles

The students encountered many learning and emotional obstacles while participating in the activity. The TA needed to provide a rich context complete with the needed resources and also was required to solve students' problems. Without the support of the TA, the activity could not be successful. We summarize four kinds of roles that the TA played in this activity. First, the TA is the old-timer, the one with previous experience and knowledge. At the beginning of this course, all students were newcomers; the only old-timer was the TA. Therefore, she was required to assume the role of 'project manager', 'team leader', and 'trainer' and transfer her experiences to the students. Second, the TA is the mediator of conflicts. Members of a team bring a diversity of experiences and perspectives, thus creating a learning environment in which task-related and relationship-related conflicts often occur. The TA must continuously monitor each team and resolve their conflicts efficiently and effectively. Third, the TA must provide students with emotional support. The students' roles may change from one assignment to the next. Some emotional challenges may arise as a result of these changes. The TA must resolve these problems and provide the necessary support. For example, when one student is downgraded, he/she may be frustrated. The TA must pacify this student and let him/her know why he/she was downgraded and then encourage him/her to work harder on the next assignment. Fourth, the TA is the key person to facilitate students' participation. She not only encouraged interactivity and contributions but also invited students to guide the more silent, passive students to join in the activity. For example, the TA promoted some students to assume the roles of leaders and trainers as they were viewed to be capable and enthusiastic students. These students then guided and encouraged the programmers (silent students) to participate in the activity.

5.   DISCUSSION AND CONCLUSIONS

Situated learning depicts learning as a participation process in which learners move from legitimate peripheral participation to full participation. In this process, learners gradually become more involved in the community activities and, thus, their motivations, values, and identities change. The legitimate periphery provides learners the appropriate context to understand the community. The identity change gives them new roles, tasks and responsibilities and provides them the opportunity to develop new knowledge and skills required by the

community. Without the legitimate peripheral participation and identity changes, learners do not have the opportunity to become the experts.

Based on situated learning, this study proposed a CoP approach that provides some guidelines for simulating the role structure and participatory process of a software development team in the Wiki system. The teacher endowed each student with a role according to his/her learning status. Based on these roles, students took responsibility for their tasks and mastered new skills by observing and imitating more experienced, more knowledgeable members and by collaborating and interacting with those in other roles. The results indicated that the students were very engaged in this activity and perceived that this approach provided a context that helped them to develop soft skills and programming knowledge. Although the approach was implemented in a programming course in this study, we believe that it can also be used in other courses in which students need to cultivate various real-world skills.

While this approach provides some advantages, it also demonstrates several constraints. First, some project managers did not think that reviewing peers' assignments enhanced their evaluation ability (mean=3.50); some trainers did not think that they could learn how to guide members to complete their tasks (mean=3.55). The role of the project manager is most central. Unlike those in the other three roles, the project managers received less support and less feedback from other students. Therefore, they usually could not understand whether their evaluations and comments were acceptable when they evaluated their peers' assignments. In addition, teaching or helping peers to solve a problem is a complex process. It is necessary that instructors continuously monitor their learners' levels of self-regulation and then offer proper scaffolding to assist students through the zone of proximity development (Tharp & Gallimore, 1988). To solve these problems, we suggest that teachers provide clear guidelines for every role such as how to review peers' assignments, how to use different approaches to help members complete their tasks (Johnson & Johnson, 2002), how to offer adapted feedback to let students know how well they have performed in a task and how to improve for different roles, especially for that of the project manager (Hsieha & Jr., 2002).

Two issues must be considered when promoting and changing roles. One is that the workload of the peripheral roles may have increased significantly after more students have taken on central roles. Although the students did not complain about this, we suggest that teachers or project managers consider students' workloads when they design a group assignment. Sometimes, teachers can also ask project managers to support these teams that were incapable of completing their assignments. The other issue that requires attention is the effect of downgrading a student as he/she might become frustrated. To reduce students' negative reactions, we suggest that the teacher privately talk to the student and explain that he/she will be downgraded on the next assignment and then encourage him/her to work hard on the next assignment. Furthermore, it is advisable to acquire his/her permission before posting the roles for the next assignment on the Wiki system.

Some students felt role conflict. A classroom community is one kind of CoP. A student participating in a classroom community experiences a process change from peripheral to central participation. In the beginning, all students are recognized as the same identity "newcomer". After participating for a period of time, students will be tacitly endowed with different identities according to their learning performance, personality, and social skills. . In contrast to the classroom community, our approach explicitly endows roles for each student. Some students are endowed as project managers, thus they are recognized as central participants. Some students are endowed as programmers, thus they are recognized as peripheral participants. The tacit roles in the classroom community and explicit roles in our activity make some students exhibit or experience role conflict. For example, some members thought that their leaders or trainers did not have the abilities to effectively lead them, and some leaders or trainers though that they did not have the requisite abilities to lead their members.

The TA is the most important person for the success of the activity. He or she not only assumes the role of the old-timer in the beginning of the activity, but also acts as the intellectual, social, managerial, and technical facilitator throughout the whole process. Assuming these roles greatly increases the workload. On average, the TA spends two hours per day reading students' articles, providing comments, answering their questions on the Wiki system and discussing with students via instant messaging or face-to-face. However, the TA's responsibilities gradually decrease as more students begin to fulfill central roles.

The students primarily used the Wiki to present the outcomes of their assignments. The number of discussions in the Wiki system remained nominal. Most of the questions posted were related to the division of labor or how to use and navigate the Wiki system. Very little discussion was related to programming knowledge. The infrequent postings may be caused by the nature of the Wiki as it appears more suitable for collaborative writing tasks than

for discussion (Choy & Ng, 2007; Elgort, Smith, & Toland, 2008). To support asynchronous discussion, the threaded discussion forum remains the best option.

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A DIGITAL GAME-BASED LEARNING SYSTEM FOR ENERGY EDUCATION: AN ENERGY CONSERVATION PET

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ABSTRACT
Energy education has been conducted to equip learners with relevant energy conservation knowledge for many years. However, learners seldom put the knowledge into practice and even have few ideas about how to reduce energy consumption. To this end, there is a need to address this issue to improve the efficiency of energy education. One of the strategies is digital game-based learning, which can enhance learning motivation and interaction with learners. In this vein, this study develops an Energy COnservation PET (ECOPET) system using a game-based learning strategy. With the use of a pet avatar, learners were encouraged to use home-energy conservatively in a playful and engaging way. The aim is not simply to teach learners how to reduce energy use, but to engage them in adopting appropriate energy conservation measures. An empirical study was conducted to examine if the ECOPET system could promote learners' understanding of energy conservation. The results demonstrated that the system significantly promoted learners' self-awareness, learning motivation, as well as willingness to conserve energy.
Keywords: energy education; energy conservation; digital game-based learning; self-awareness; learning motivation; pet-nurturing

1. INTRODUCTION

Recently, energy conservation has become a central and rather urgent issue (Shafiee & Topal, 2009) and limiting energy consumption has been taken as a critical solution (Rasanen, Ruuskanen, & Kolehmainen, 2008). In this light, energy education is needed, as it can act well in educating consumers the knowledge of energy conservation (Dias, Mattos, & Balestieri, 2004). As indicated by Yilmaz, Boone and Andersen (2004), students could gradually exhibit a positive attitude toward energy conservation through energy education. However, the effects of energy education in the reduction of energy consumption are still limited (Abrahamse, Steg, Vlek, & Rothengatter, 2005). This may be due to the fact that people have difficulties in putting knowledge into practice. Dahle and Neumayer (2001) indicate that consumers can effectively use such knowledge only when they are aware of energy conservation. In addition to energy awareness, motivation and willingness are also influential factors. McCalley and Midden (2002) state that motivation and willingness activate and maintain certain behavior of energy conservation. Therefore, it is necessary to develop effective strategies to promote self-awareness of energy conservation. Moreover, there is also a need to use strategies, which can increase learning motivation and willingness as well.

One of the strategies is digital game-based learning, which not only promotes learning motivation and willingness, but also increases self-awareness (Owston, 2009). Due to such benefits, game-based learning can be effective in both formal and informal learning contexts (Becker, 2007; Shaffer, 2006; Yang & Chen, 2010; Yien, Hung, Hwang, & Lin, 2011). Research indicates game-based learning encourages active learning through enabling players' control of an in-game avatar (Gee, 2004). Cyber-pets as avatars in a game-based learning environment are also considered as an effective way to encourage learners to adopt a more motivated approach to their learning because pets have positive effects in the improvement of emotion with human-pet interaction (Chen, Chou, Deng, & Chan, 2007).

The abovementioned studies indicate that it is necessary to develop an effective way to promote energy conservation in energy education. Digital game-based learning along with the integration of a cyber-pet would be a possible solution. To this end, the aims of this study are two-fold. Firstly, a digital game-based learning system was developed as a learning strategy to promote the self-awareness regarding energy conservation and enable learning energy conservation with higher motivation and willingness. The system achieves this aim through the successful nurturing of a cyber-pet in a game-based learning environment. Within this environment, learners need to appropriately operate electric appliances to ensure a balance between the comfort and survival of the pet and the reduction of the energy consumption. Secondly, an empirical study was conducted to examine how this system affected learners' self-awareness, learning motivation, and willingness to conserve energy.

2. LITERATURE REVIEW
2.1 Energy education
Energy education has been conducted for many years. Energy education facilitates consumers to identify the effective way to save energy (DeWaters & Powers, 2011). Nevertheless, a study has shown that, while almost everybody states that they want to conserve energy, this often does not translate into action (Vastamaki, Sinkkonen, & Leinonen, 2005). For this reason, energy consumption has not decreased significantly in reality (Boyde, 2002). This obstacle may be due to the fact that consumers usually neither know how much electricity their household appliances consume nor have any idea of how to save electricity in an appropriate manner. Therefore, providing feedback at the right moment helps consumers learn how to adopt appropriate levels of electricity consumption (Haakana, Sillanpaa, & Talsi, 1997). More specifically, feedback regarding energy use can encourage conservation behavior (Brandon & Lewis, 1999), and feedback with adaptive energy saving tips can increase the average energy saving rate (Tao, Wei, Guoping, Jiang, & Xiyu, 2007).In addition, it is important that the goal of energy saving should be reachable. Goals that are too simple or too complex often result in external attribution of failure. van Houwelingen and van Raaij (1989) found that assigning energy conservation goals with a level of difficulty to electric appliances would lead to greater energy savings than using feedback alone.

Energy education is a process that helps learners put energy conservation into practice. Before learners can implement the practical methods of energy conservation, they must develop a social consciousness toward energy consumption (Roberts & Bacon, 1997). For fostering the development of social consciousness of energy conservation, it is necessary to increase learner's self-awareness to measure the effectiveness of energy conservation (Allen, 1982). Thus, there is a need to develop useful instruments to help learners make simulated energy-saving decisions with the design of feedback and task complexity mechanisms for promoting the understanding of energy conservation. A digital game-based learning system is one of the potentially effective instruments.

2.2 Digital game-based learning
Due to the fact that digital games have potential impacts on education, much attention has been paid to the relationship between digital games and education (Chiang, Lin, Cheng, & Liu, 2011; Yang, Chen, & Jeng, 2010). For example, a study by Kirriemuir and McFarlane (2004) identifies two key themes that are common to the development of educational games, including the desire to harness the motivational power of games to make learning fun and a belief that the process of learning by playing games is a powerful learning tool. Digital games have various factors which are valuable for education (de Felix & Johnston, 1994; Prensky, 2001). These factors can be divided into several categories: fun/fantasy, rules, goals, outcomes and feedback, conflict/competition/challenge/opposition, interaction, and representation and story.

Aside from the aforementioned factors, the majority of educational games tend to be exploratory that enable learners to be motivated and gratified with learning activities in the games (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Chen, Yang, Shen, & Jeng, 2007). Besides, curiosity seems to be the primary component of motivational power which attracts learners' attention to actively seek out varied sources of challenge in game play (Moon & Baek, 2009). Past research also demonstrate that educational games enable learners to enjoy learning through game play (Chang, Yang, Yu, & Chan, 2003; Hong et al., 2009).

With regard to the design of educational games, Garris, Ahlers and Driskell (2002) propose the Input-Process-Outcome game model, which focuses on instructional programs that demonstrate certain characteristics of digital games. These characteristics trigger a cycle that includes processes of user judgments or reactions (such as enjoyment or interest), user behavior (such as greater persistence or time spent on task), and further system feedback.

2.3 Environmental and conservation awareness games

Past research indicates that digital games can be utilized for energy education with various topics in environmental and conservation awareness. Several studies apply board games as tools for increasing environmental and conservation awareness. A study by Hewitt (1997) demonstrates that children can be taught environmental topics through the use of board games and significantly improve their knowledge and understanding of various environmental concepts and behavior. Another study by Evans et al. (2007) uses board games as various environmental dilemmas to examine participants' environmental awareness. Results show that participants not only have positive attitudes regarding the environment but also behave in an environmentally responsible manner.

Simulation games are the other type of games that are used for supporting environmental and conservation awareness. A study by Torres and Macedo (2000) demonstrates that simulation games can be used to promote environmental awareness and explore attitudes toward environmental conservation. Moreover, Hansmann, Scholz, Francke and Weymann (2005) show that the simulation game can effectively improve the environmental knowledge, attitudes, and behavior of the players.

To achieve the goal of energy conservation awareness, learning motivation, willingness to conserve energy, as well as behavioral change, several useful features in the aforementioned environmental and conservation awareness games are needed to be considered during the design process of a digital game-based learning system. Those features include interaction and feedback with explanation tips, simple or complex levels of game tasks, and possible outcomes for a real world environment.

3. SYSTEM DESIGN AND IMPLEMENTATION

3.1 Design rationale

The design rationale for the proposed Energy COnservation PET (ECOPET) system is depicted in Figure 1. It illustrates that learners transform their knowledge of energy conservation into a consciousness of energy conservation by measuring self-awareness through conducting game-based learning.
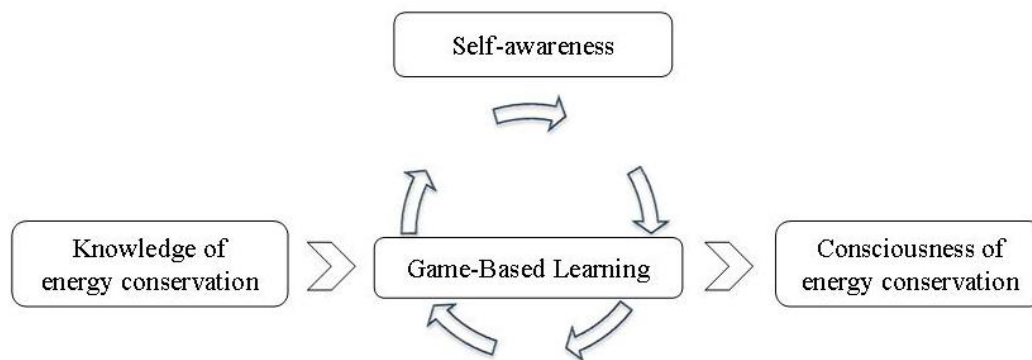
Figure 1: Design rationale of the ECOPET system.

Based on the design rationale, learners are responsible for nurturing a cyber-pet dog that is present in various virtual scenes, each of which contains various electric appliances. The pet can then "suggest" those electric appliances that are required at each moment according to the virtual environment and the inner variation of the "desire" of the pet. Within this scenario, learners need to respond to the demands of the pet by controlling interfaces of electric appliances. During the game, learners are given specific quotas of electricity for each game. They need to make decisions based on the dual goals of taking care of the pet properly and saving as much electricity as possible.

Since different levels of knowledge on energy conservation may influence electricity usage, feedback and task complexity mechanisms were designed. The feedback mechanism provides information such as the amount of electricity consumption and energy saving tips for each electric appliance. Such feedback can help learners use electric appliances properly. On the other hand, the task complexity mechanism provides various tasks with different levels of complexity. The complexity of tasks varies according to the amount of feedback and control panels and the level of knowledge to use electric appliances appropriately. Learners need more knowledge to operate electric appliances precisely for more complex tasks.

Based on the aforementioned design, there are two phases in the system. Learners may enter the second phase if they satisfy to keep the pet alive for more than a specific duration without breaching any restrictions or consuming excessive electricity. At the second phase, the game becomes increasingly difficult as the available electricity is reduced. Learners may lose the game if they exceed the duration set in the game or fail to provide significant care to the pet.

3.2 Learning model

Figure 2 shows the learning model of the ECOPET system, which is designed based on the game model by Garris et al. (2002). The learning model comprises three steps: input, process and outcome. The input includes energy saving tips while using electric appliances and information about the estimated consumption of electric appliances in common use. These characteristics trigger a cycle of elements, which include user judgments (switching on electric appliances), user behavior (adjusting the control panels of electric appliances), and system feedback (tips of saving energy after switching on electric appliances). During the process, learners are always aware of their energy consumption which guides them to transform knowledge into a consciousness of energy conservation. Consequently, the learning outcome of taking the system would promote learners' self-awareness, learning motivation, and willingness of energy conservation.
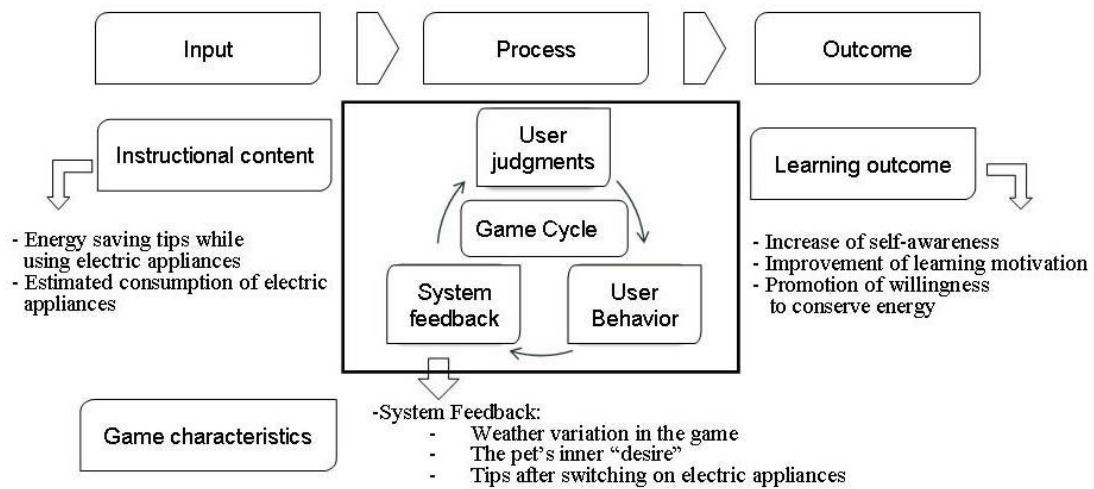
Figure 2: Learning model of the ECOPET system.

3.3 User interface

Figure 3 illustrates the user interface of the system, which is made up of two categories: information and function. In the information category, learners are given information about the states of the game, including current scene, game level, level of electricity consumption, virtual time, temperature, humidity, and brightness. In the function category, learners can control functions provided by the system, including the system function, switching scene, changing the settings of electric appliances, and interacting with the pet.
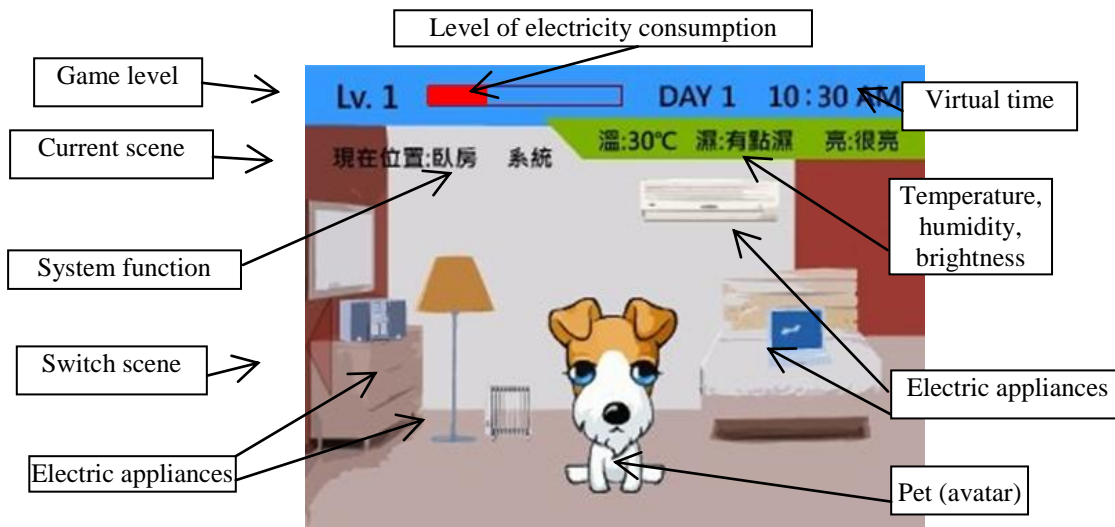
Figure 3: User interface of the ECOPET system.

There are four scenes in the game, and each represents a living space. Learners can switch between the four scenes throughout the game, as illustrated in Figure 4. Different scenes may contain various electric appliances. For instance, a balcony scene is furnished with a washing machine, a tumble dryer and an electric hot-water heater. The information about how much electricity is consumed and the current status is displayed on the screen for learner reference.

Figure 4: Four scenes from the game.

The ECOPET system provides a feedback mechanism to help learners consume less electricity, offering information such as the current status of electricity consumption and energy saving tips about the electric appliances. The system simulates and monitors the most comfortable environmental variables of the scenes where the pet lives. Once the environmental variables in the living space are beyond the most comfortable range, the system triggers feedback, e.g. "It's too hot." The learner should respond to the feedback appropriately, such as adjusting the target temperature to meet the feedback requirements. Through the interactions under the feedback mechanism, learners' awareness of energy conservation will be increased.

Different electric appliances are equipped with different control panels depending on their distinct attributes, e.g. a floor lamp has only a power switch panel but an air conditioner has various control panels including a power switch, timer set, and temperature set. According to the design of complexity mechanism, the system provides tasks with different levels of complexity. For the simple tasks, learners only need to know how much electricity is consumed, e.g. how many kilowatts per hour a floor lamp consumes for using it appropriately. More complex tasks require learners to be aware of more detailed information. For example, learners need to know how many kilowatts are consumed per hour, how much electricity can be saved for increasing one degree centigrade, what the indoor thermal and humid comfort range is, and how much time is required to create a comfortable environment when using an air conditioner. Figure 5 illustrates examples of simple and complex tasks with corresponding feedback while the learner is interacting with the system. As shown, only the information of electricity consumption is displayed for the simple task; various control panels accompanied with feedback are displayed for the complex task.
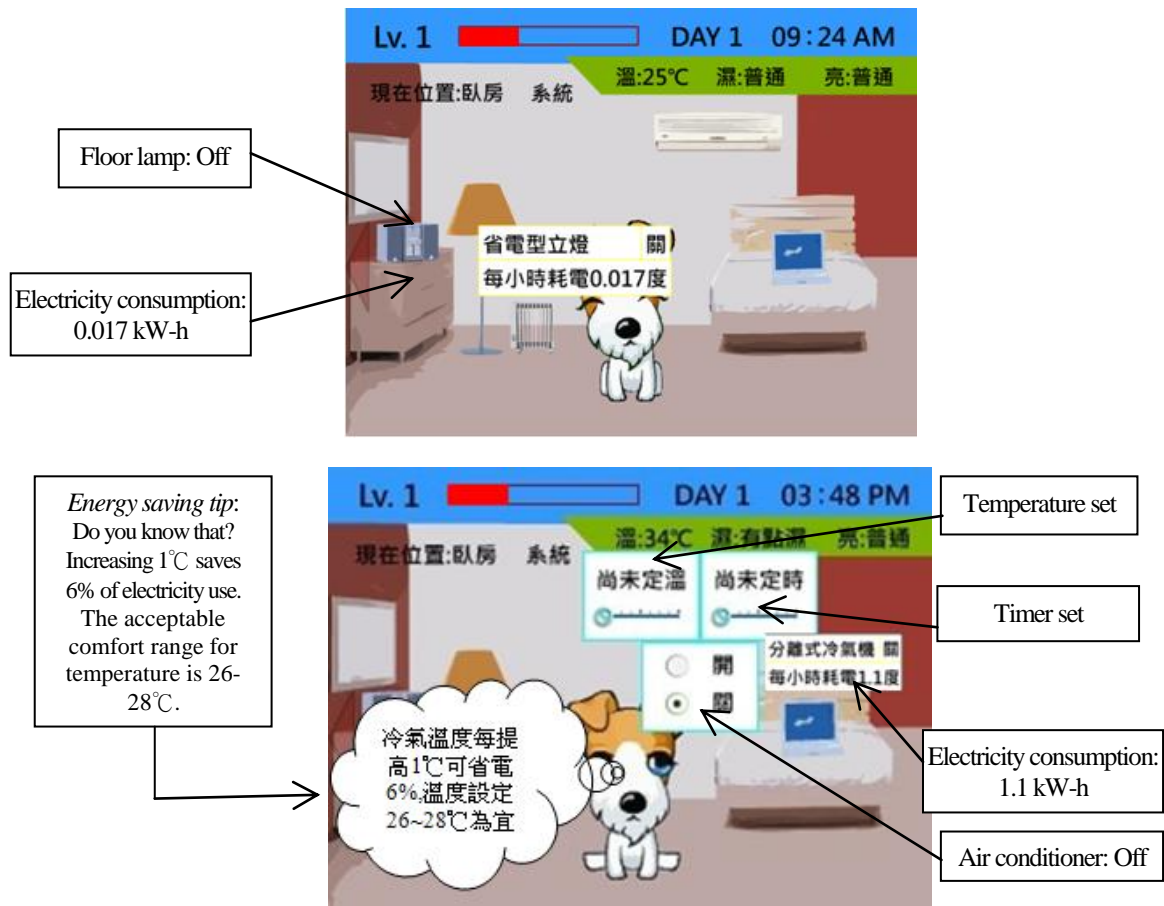
Figure 5: Examples of simple (upper) and complex (lower) tasks with corresponding feedback.

4. METHODS

The participants were students enrolled in a graduate institute in Taiwan. They were randomly chosen from a pool of volunteers. Fifteen of the participants were male and eight were female. Their ages ranged from 23 to 31 years old.

The instruments implemented in this study included three questionnaires and a videotape of the participants operating the system. The questionnaires were used to assess participants' self-awareness of energy conservation, learning motivations toward ARCS (Keller, 1983), and willingness to conserve energy. The questionnaire for accessing participants' self-awareness of energy conservation adapted from Allen (1982) contained 12 questions and was used for both pre-test and post-test to compare the difference in participants' perceptions about energy problems. The other two questionnaires were only conducted in the end of the study to examine participants' learning motivation and willingness to conserve energy. These two questionnaires contained 16 questions and five questions, respectively. All of the three questionnaires used a five-point Likert scale consisting of the response options: strongly agree, agree, neutral, disagree, and strongly disagree.

This study adopted Cronbach's alpha coefficient to measure the internal consistency reliability of the aforesaid three questionnaires. Table 1 shows that the values of Cronbach's alpha for the pre-test and post-test of participants' self-awareness of energy conservation were 0.77 and 0.62, respectively. Besides, the values of Cronbach's alpha for the learning motivation and willingness to conserve energy were 0.74 and 0.78, respectively. These results indicate that the internal consistencies of the three questionnaires were acceptable.

Table 1: Reliability of the three questionnaires.

Questionnaires	Cronbach's alpha
Self-awareness of energy conservation	0.77 (pre-test), 0.62 (post-test)
Learning motivation	0.74
Willingness to conserve energy	0.78

The experimental procedure was conducted as follows. Participants were given an instruction at the beginning, and they were then asked to fill in the pre-test questionnaire on the self-awareness of energy conservation.

Subsequently, participants started to operate the system. Meanwhile, video recording began at the same time. The recorded video was used to further analyze learners' behavior while operating the system. The system ran for 90 minutes and stopped, regardless whether participants finished the tasks or not. Finally, participants completed the three questionnaires right after they finished the session.

The data collected from the three questionnaires were coded for quantitative analyses. The participants' responses given on the Likert scale were coded as follows: 5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree. Descriptive statistics for the three questionnaires were analyzed in terms of mean and standard deviation. Additionally, a paired samples t-test was also applied to conduct data analyses on the questionnaire of the participants' self-awareness of energy conservation. Furthermore, an analysis of the video recordings was conducted to observe learner behavior.

5. RESULTS AND DISCUSSIONS
5.1 Self-awareness of energy conservation
A comparison was made between the results of the pre-test and those of post-test to analyze the changes of participants' self-awareness of energy conservation before and after taking the ECOPET system. Table 2 shows the results, indicating that there is a significant difference between the pre-test and post-test in participants' self-awareness of energy conservation ($p=0.013<0.1$). More specifically, the mean of the post-test is higher than those of the pre-test. This reveals that participants' self-awareness of energy conservation is significantly improved after using the system. This result echoes the findings of previous studies (Torres & Macedo, 2000), which show that digital games can enhance learners' environmental awareness. A possible explanation may be because the process of operating the system includes various kinds of manipulations on energy conservation. In particular, the design of feedback and task complexity mechanisms played important roles to increase participants' self-awareness of energy conservation.

Table 2: Results of participants' self-awareness of energy conservation.

	Mean	SD	T	p
Pretest-posttest	-.33	.53	-2.726	0.013

5.2 Learning motivation toward ARCS
According to the ARCS motivational model, the items of the questionnaire on learning motivation were divided into four categories. Table 3 shows the results of participants' learning motivation toward ARCS, which indicate that participants highly rated all of the four categories. More specifically, the average mean of the four categories is 3.99, which indicates that the ECOPET system promoted participants' learning motivation. The details of the four categories are described below.

Table 3: Results of participants' learning motivation toward ARCS.

Categories	Mean	SD
Attention	3.90	.89
Relevance	4.20	.78
Confidence	3.73	.90
Satisfaction	4.12	.75
Average	3.99	.83

The mean of the *attention* category is 3.90, which reveals that participants maintained sufficient attention during the game-play. The mean of *relevance* category is 4.20, which indicates that participants considered the contents of the system relevant to them. This means that participants comprehended what this study was conducted for. The mean of *confidence* category is 3.73, which indicates that participants were quite clear about the significance of every action and the manner in which the game proceeded. For example, in response to the question "I would try my best to find the most economic ways to save electricity", 100% of the participants agreed. This indicates that participants not only satisfied the needs of the pet, but also tried to seek the most economic ways to save electricity. In other words, participants were confident of the learning contents provided in the system. Only 50% (with mean 3.35) of the participants agreed with the question "I can personally identify with the pet.", which is lower compared to other ones. This may be because the pet would not operate electric appliances in the real world though it might invoke pity from the participants. Finally, the mean of the *satisfaction* category is 4.12. This result reveals that participants were satisfied with the contents provided in the system, which was helpful to their emotions and their understanding of energy conservation. For example, in the question "I know more about the electricity consumption of electric appliances", 90% of the participants agreed. This shows that participants' knowledge about the electricity consumption of electric appliances could be improved after using the system.

The aforementioned results are consistent with those of past studies (Ryan, Rigby, & Przybylski, 2006; Yee, 2006), which demonstrate that digital games can effectively improve learning motivation. This may be because the ECOPET system provides an interesting environment where participants can manipulate various electric appliances to save electricity through nurturing a cyber-pet. Although the mean for the confidence category is lower than other categories, it is still higher than the average of the five-point Likert scale. Future research need to address the issue of introducing cyber-pets into a human environment.

5.3 Willingness to conserve energy

Table 4 shows the results of the questionnaire in terms of participants' willingness to conserve energy. The results show that participants answered the majority of the questions in an affirmative way. More specifically, over 80% of the participants agreed with the questions about their willingness to conserve energy, especially for Questions 2 and 4 which had a high rate of agreement (95%). It indicates that participants could obtain the knowledge of energy conservation and were willing to decrease consumption of energy by changing their current habits regarding the use of electric appliances. Besides, the results also show that most participants agreed with each of the other questions, which all had mean scores of over 3.95 as well. These results are in line with those of Al Mahmud, Dadlani, Mubin, Shahid and Midden (2007), which demonstrate that digital games can motivate people to change their willingness to conserve energy. This reveals that most of the participants were willing to put energy conservation in practice after taking the ECOPET system. These results indicate that participants not only became likely to change their behavior toward saving energy, but also acquired a sound understanding and skills for changing actions. Actually, these are the major objectives that the ECOPET system intends to achieve.

Table 4: Results of participants' willingness to conserve energy.

Questions	Agree	Disagree	Mean	SD
1. The understanding and skills that I have learned from the system have changed my attitude toward energy saving.	85%	5%	3.95	.69
2. The understanding and skills that I have learned from the system will help me change the habit of using electric appliances.	95%	5%	4.10	.64
3. I will start to think whether I habitually use electric appliances correctly.	80%	0%	3.95	.61
4. I would consider to decrease my consumption of energy by changing the habit of using electric appliances.	95%	0%	4.20	.52
5. I would suggest others decrease their consumption of energy by changing the habit of using electric appliances.	80%	5%	3.95	.76
Average			4.03	.64

5.4 Behavior of learners

According to the analyses of the recorded video, participants' learning behavior can be classified into four categories: adjusting the control panels of electric appliances, adjusting the default value of using electric appliances, adjusting the duration parameters to find out the lowest satisfaction level of each electric appliance for the pet, and reviewing the information of electric appliances after receiving tips. Different categories represent participants' different levels of understanding on operating electric appliances in the system. Analyses on the behavior of learners could be useful to explain the results of the study.

The first category involves the investigation of whether participants have tried to adjust the control panels of electric appliances. The result shows that 100% of the participants implemented this adjustment. This could be due to participants' curiosity on the variety of functions and control panels provided by the system. The findings indicate that the participants paid attention to the proper use of the control panels of the electric appliances. It may be because participants' curiosity motivated them to make the aforementioned adjustments. It suggests that catching users' attention is a useful approach for energy saving. This result confirms those of the past study (Kashdan, Rose, & Fincham, 2004), which indicates that curiosity could be the primary force to motivate participants to engage in the game. In other words, appropriate levels of curiosity generate high values of entertainment (Yannakakis & Hallam, 2007).

The second and third categories are two different levels, basic and advanced levels of the acquired knowledge related to the adjustment of electric appliances. The second category involves assessing whether participants have tried to adjust the default values used in the electric appliances. The result shows that 75% of the participants adjusted the default values. This may be due to the aim of the game to satisfy the pet using as little electricity as possible. For example, the pet was satisfied as long as the air conditioner was set to 28 degrees centigrade; however, the default temperature of the air conditioner was set to 24 degrees centigrade. Participants could reduce the electricity consumption and still allow the pet to live comfortably by increasing the temperature

from the default value to the appropriate value which they perceived. Moreover, the third category involves the investigation of whether participants tried to adjust the duration parameters to identify the lowest satisfaction level of each electric appliance for the pet. The result shows that 65% of the participants implemented this adjustment, which indicates that they tried to adjust the time parameters of the electric appliances repeatedly by estimating the lowest satisfying level. Indeed, this action could help participants learn what the best duration to use each electric appliance was. In other words, participants were able to identify the most economic way to use the electric appliances. The aforementioned findings reveal that participants made great efforts in the adjustment of electricity of using electric appliances to save energy. Participants' behavior could be delineated using the social learning theory (Bandura, 1977). More specifically, after many trial and error endeavors, the best approach could be found by the participants. It reveals that participants became accustomed to using electric appliances in an electricity-saving manner. These results reflect the goal of the system, which assists participants to seek out the most economic use of electricity. Although the ways to acquire the knowledge of saving electricity are similar for the aforementioned two levels, there is still little difference between them. The participants who acquired the advanced level of knowledge needed to pay much more attention to seek out the most economic level of energy consumption in using the electric appliances.

The fourth category involves the investigation of whether participants reviewed information about electric appliances after they had received energy saving tips. The result shows that 55% of the participants implemented what they have learned into practice. Although the tips for saving electricity were related to each electric appliance, insufficient corresponding adjustments were made for all the electric appliances during operating the system, i.e. more clear and corresponding adjustments information is needed to facilitate participants to use electric appliances in a saving manner. Nonetheless, more than half of participants reconsidered and reviewed how to use electric appliances after reading the tips. This result echoes those of Garris et al. (2002), which propose that learners transform their understanding of energy conservation into conscious actions of energy conservation. These findings indicate that the participants could use their knowledge learned from the system. It is in line with the elaboration likelihood model of persuasion theory (Petty & Cacioppo, 1986), which shows that participants were persuaded by the provided information, e.g. energy saving tips in this study, and considered such information as the guidelines to change their behavior. These findings suggest that incorporating useful features into educational games can promote energy education.

6. CONCLUSION

This study adopted a game-based learning strategy with the aim of developing a learning environment based on the notion of pet-nurturing. Participants need to make efforts in nurturing the pet successfully, as well as conserving energy. In the proposed ECOPET system, participants learned how to keep balance between satisfying the pet's needs and saving electricity. During the process of game-play, participants acquired knowledge about how to use electric appliances, and became more aware of their own energy conservation by repeating the game cycle in the system. The results of the empirical study have demonstrated that the system can positively promote participants' self-awareness of energy conservation, learning motivation, and willingness to embrace energy conservation.

This study has explored possible features for designing a game-based learning system for energy education, including feedback and task complexity mechanisms. Additionally, the system utilizes a virtual environment that is connected to the energy consumption issue in the real-world. The system enables electric appliance interaction to promote sustainable behavior and create awareness around electricity use. Evidence shows that participants adopt positive attitudes to find the best way of adjustment for saving electricity. The abovementioned design features are innovative compared to traditional teacher-centered teaching fashion on energy education. While traditional teaching methods often fail to provide learners with actual energy conservation experiences in learning by doing, the ECOPET system, with designed features, creates a challenging edutainment environment and simulated real-world scenery to promote participants' awareness and behavior of energy conservation. Accordingly, participants develop self-awareness of energy conservation during the game-play by practice and learning. This finding suggests that incorporating useful features into educational games can promote energy education.

The abovementioned findings demonstrate the values of providing support of a digital game for energy education. Although the present study has yielded findings that have pedagogical improvements, the design of the cyber-pet nurturing in the digital game may raise some issues, such as the relevance of introducing the cyber-pet into a human family for directing the use of electric appliances. Therefore, further empirical studies need to clarify this avatar concern and examine the differences between various avatars in the digital game-based learning system. In this study, graduate students were selected as the participants to prove that energy conservation is not only affected by energy knowledge but it also associates with energy awareness, motivation and willingness.

However, different results may be produced if the study is conducted on a younger population. It is also of value to conduct a study, by using the game, on two different age groups to see which group really responds to change behavior of energy conservation. There is also a need to conduct future research in a number of areas, such as enhancing the variety and suitability of the game options, adding more learning contents that are related to energy conservation education, and conducting a long-term experiment that is able to examine learning effectiveness.

ACKNOWLEDGEMENTS

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A STUDY ON TEACHING QUALITY OF TAIWAN GOVERNMENT TRAINING CIVIL SERVANTS WITH EDUCATIONAL TECHNOLOGY

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ABSTRACT
When economic globalization, informatization, and marketization are rapidly developing, the world is reaching the globally industrial society based on information technology. In such a fierce competition, human resource is gradually placed on the critical role. This study aims to 1.understand the present situation of Educational Technology and Teaching Quality, 2.discuss the correlations between Educational Technology and Teaching Quality, and 3.investigate the differences of Educational Technology and Teaching Quality among civil servants with various demographic variables. With the questionnaire of Educational Technology and Teaching Quality, civil servants in Taiwan are selected as the research subjects. Total 1,000 copies are distributed and 672 valid ones are retrieved, with the retrieval rate 67%. Suggestions are further proposed for the reference of governmental branches in Taiwan and future research.

INTRODUCTION
The power of a country is an index of the strength; while human resource development is the basis for establishing the power a country. In the early period, human resource was not emphasized until the emergence of human resource theory, when the economic function was focused. It was discovered as the major source of economic capability as well as a key factor in political development and social progress. Investment on educating people became beneficial. The cultivation of human capability was then stressed in the world that the reinforcement of education, training, employment information, health, and work conditions could help enhance productivity and facilitate economic growth. The concept of human resource development was therefore generated. When Civil Service Reform Commission re-examined the civil service system (in the USA) in 1989, it reported that trainings should be the priority in the government reform allowing the development of excellent public managers. Apparently, effective trainings were closely related to the success of reform. When civil servants received quality trainings, they were likely to acquire professional knowledge and capability, establish favorable services, and rapidly and appropriately deal with complicated public affairs (Hsiao, 2010). For this reason, this study selected civil servants as the research subjects and expected to understand and enhance the quality of civil servants.

Technology, on the other hand, is hastening the paths of human. In the 21st century with information explosion and rapid knowledge renewal, acquiring latest knowledge and message through technology has become one of the objectives for modern people. Since time and space were restricted in tradition learning models, people could hardly be satisfied with the pursuit of lifelong learning. In such a technology innovation era, the improvement of education, i.e. the innovation of Educational Technology, is regarded the only way to satisfy the learning desire of human. As a consequence, learners could promote learning interests, creative thinking, problem-solving, and communication skills by continuously innovating Educational Technology, expanding professional knowledge and enhancing teaching skills, designing courses with the application of information technology, and integrating into various subjects to enhance Teaching Quality.

LITERATURE REVIEW
1. Educational Technology
Jones (1999) regarded Educational Technology as two separate terms but with absolute correlations that it taught the reason of doing something. Users of Teaching Technology had to be aware of the basic theory and the applications so as to select a suitable tool (including the Internet, multimedia, digital technology) for each classroom. Users of Educational Technology should present basic knowledge and understanding of technology and make proper decisions, according to the systematized teaching design, to solve learners' problems in the learning process. Beattie (1999) mentioned the exchange of Teaching Technology and Educational Technology and believed that everyone appeared individual definition on the terms. From "learned things" to "the closely combination of behaviors and physical science", the used tools, the things done by the used tools, and how to do these things were covered in Educational Technology. In other words, Educational Technology emphasized effective integration and applications of teaching resources, individualized learning theories in learning processes, strategy-oriented teaching theories, and systematized rules for design (Chang & Chu, 1998).

The applications of Educational Technology could overcome the differences in time and space and provide students with distinct world views. For instance, students in Carnegie Mellon University applied video

conference, course management website, and e-mail to real-time interactions with students from other countries in Technology Enhanced Learning. In the Global Learning and Observations to Benefit the Environment, the Internet was utilized for collecting student data from different areas and presenting them on the website; besides, both e-mail and online chat room were used for exchange with scientists (Elder, 2003). Moor & Zazkis (2000) indicated that, when figures were used for instructions and further integrated into tests, students were likely to enhance the learning achievements, as figures provided more effective review and comments than texts did, comparing with traditional text narrative. Moor & Zazkis (2000) discovered that Educational Technology appeared positive effects on the learning attitude, self-concept, and the learning achievements of students. Wang (2000) classified the key factors in information technology into four dimensions, including Individual, Structure, Technology, and Environment, which were further applied to the variables of Educational Technology in this study.

2. Teaching Quality
Wu (2001) indicated that, when total quality management was applied to education, education was regarded as a service to satisfy the demands of students, parents, and the society, who were considered as consumers or clients. Being a kind of service industry, quality would be emphasized that the concept of quality control was applied to education institutions for Teaching Quality. In terms of the applicability of Teaching Quality, Jao & Cheng (1997) considered that Teaching Quality would relatively change with educational objectives and requirements for education in the era. Wilson (1988) regarded Teaching Quality as providing the most suitable curriculum from planning, instruction, to evaluation for students with various backgrounds. Teaching Quality was the teaching performance which gave considerations to both subjective feelings of students and objective achievements of teaching goals. Under different time and educational purposes, the contents of Teaching Quality would be changed (Kuo, 2000). In regard to the consistency of Teaching Quality, it was the difference between teaching plans and actual teaching (Lin, 1994), tended to discuss the essence or the efficacy of teaching and further evaluate the superiority or the effectiveness (Jao & Cheng, 1997), and aimed to examine the consistency of the development and the index of teaching activities in order to establish the performance accountability system (Tien & Huang, 2002).

Pan (2002) defined Teaching Quality as (1) the standard of teaching quality being defined by the requirements of clients, (2) the emphasis and the satisfaction of teachers and students with the learning activities and the working environment, in present and fixed teaching system, being the critical index for the definition of Teaching Quality that the results should be reflected to improvements, and (3) the promotion of Teaching Quality being the responsibility of people related to learning activities, including teachers, students, administrators, and supervisors. Teaching Quality was considered as the integration of the educational system and the functions of schools and teachers, the generation of efficient learning through evaluations, and the achievement of the set educational objectives in order to reach the objective course goals and subjective student demands in the process of planned teaching activities.

Wu (1999) concluded effective teaching behaviors of teachers, in *Study of School Effectiveness*, as (1) paying attention to students' acquisition of basic capability, (2) presenting high expectation on students, (3) being able to communicate with students over unit objectives, (4) systematically presenting the unit outline and mastering in the topic, (5) examining the understanding of students anytime, and (6) properly providing students with practice and feedback and often monitoring the progress of students. Tang (2002) also pointed out three factors in effective teaching, namely (1) Teaching skills, including drawing plans, teaching goals and methods, managing students and time resource, evaluation, assignation of homework, and high expectation, (2) Professional traits of teachers, containing thinking (analytic and conceptual thinking), planning and expectation (continuous progress, active data collection), interactions with others (team motive, effects, and understanding others), leadership (flexible requirements, establishing students responsibility, stimulating learning interests), and professionalism (challenge, support, confidence, creation, trust, and respecting others), and (3) Learning atmosphere, such as creating effective learning environment (clearing setting objectives and standard, establishing orderly, fair, secure, and supportive atmosphere, providing students with participation opportunities, appealing learning interests). Regarding Teaching Quality, Chiang (2000) based on SERVQUAL Scale, proposed by Parasuraman, Zeithaml & Berry, and developed the evaluation dimensions for Teaching Quality, including (1)Teaching Facilities, (2)Teaching Capabilities, and (3)Care for Students, which were further utilized for the variables of Teaching Quality in this study.

3. Studies on correlations between Educational Technology and Teaching Quality
Chen (2007) defined Teaching Quality as the feelings or attitudes toward learning activities that, when learners appeared pleasant feelings or active attitude, they were satisfied with Teaching Quality; or, they were dissatisfied when revealing unpleasant feelings or passive attitude. In this case, the innovation of Educational Technology

showed significantly positive correlations with Teaching Quality. Abraugh (2000) considered that learners utilized individual feelings or attitude in the learning process of Educational Technology as the judgment of Teaching Quality. Consequently, Educational Technology appeared outstanding effects on Teaching Quality. Nevertheless, Teaching Quality was the satisfaction of student demands in the learning process that the level and the methods of requirements would change with individual differences and the learning environment. However, teachers could enhance the satisfactions of students with innovative Educational Technology. The innovation of Educational Technology therefore displayed remarkably positive effects on Teaching Quality (Kuo, Kao & Huang, 2007).

According to the above domestic and international points of view, the following hypotheses were further proposed in this study.

H1: Educational Technology shows notably positive correlations with Teaching Facilities in Teaching Quality.

H2: Educational Technology presents remarkably positive correlations with Teaching Capabilities in Teaching Quality.

H3: Educational Technology displays significantly positive correlations with Care for Students in Teaching Quality.

H4: The correlations between Educational Technology and Teaching Quality appear outstanding differences on gender.

H5: The correlations between Educational Technology and Teaching Quality show notably differences on age.

H6: The correlations between Educational Technology and Teaching Quality present significant differences on grade level.

H7: The correlations between Educational Technology and Teaching Quality reveal remarkable differences on disposable income.

RESEARCH METHOD
1. Research framework
Having organized the literatures on Educational Technology and Teaching Quality, the research framework was proposed to discuss the correlations between Educational Technology and Teaching Quality.
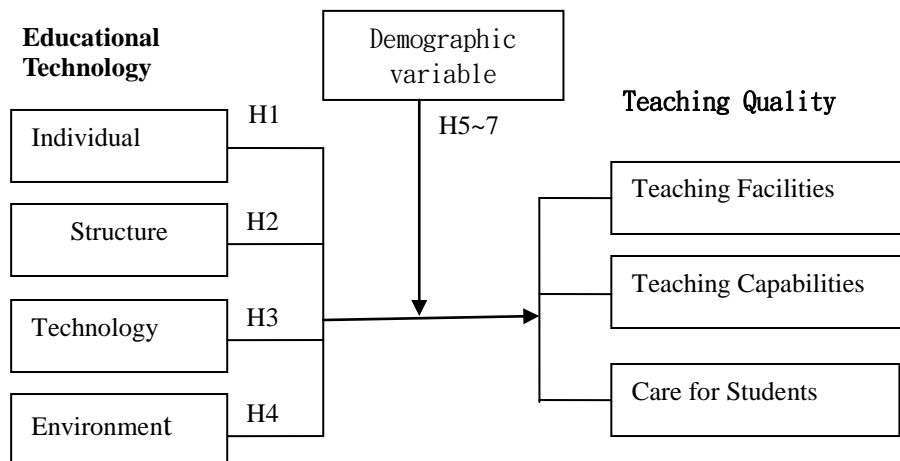
2. Research subjects and sampling
With civil servants in Taiwan as the research subjects, convenience sampling was applied to the questionnaire survey. Total 1000 copies were distributed and 672 valid ones were retrieved, with the retrieval rate 67%.

ANALYSES AND DISCUSSIONS

1. Factor Analysis of Educational Technology

The Educational Technology scale was based on the dimensions and the questionnaire proposed by Wang (2000). With Factor Analysis, the Cronbach α reliability of the four dimensions showed 0.87(Individual), 0.82(Structure), 0.89(Technology), and 0.92(Environment). The questionnaires were further proceeded Principal Component Factor Analysis and oblique rotation that the explained variance appeared 84.762%.

2. Correlation Analysis of Educational Technology and Teaching Facilities in Teaching Quality

With Multiple Regression Analysis to test H1, the analysis results, Table 1, presented the significant effects of Individual (t=1.776, p<0.05), Structure (t=2.024, p<0.01), Technology (t=1.762, p<0.05), and Environment (β=1.449, p<0.05) on Teaching Facilities that H1 was agreed.

Table 1: Multiple Regression Analysis of Educational Technology toward Teaching Facilities in Teaching Quality

Predictor	Unstandardized coefficient		Standardized coefficient	t
	β estimate	Standard error	β distribution	
Individual	0.614	0.085	0.152	1.776*
Structure	1.256	0.173	0.242	2.042**
Technology	1.583	0.059	0.337	1.762*
Environment	1.187	0.117	0.269	1.449*

Note: * stands for p<0.05, ** for p<0.01

3. Correlation Analysis of Educational Technology and Teaching Capabilities in Teaching Quality

With Multiple Regression Analysis to test H2, the analysis results, Table 2, showed the remarkable effects of Individual (t=1.526, p<0.05), Structure (t=1.421, p<0.05), Technology (t=2.537, p<0.01), and Environment (β=2.019, p<0.01) on Teaching Capabilities that H2 was agreed.

Table 2: Multiple Regression Analysis of Educational Technology toward Teaching Capabilities in Teaching Quality

Predictor	Unstandardized coefficient		Standardized coefficient	t
	β estimate	Standard error	β distribution	
Individual	1.382	0.174	0.233	1.526*
Structure	1.426	0.138	0.152	1.421*
Technology	2.351	0.252	0.353	2.537**
Environment	1.967	0.181	0.244	2.019**

Note: * stands for p<0.05, ** for p<0.01

4. Correlation Analysis of Educational Technology and Care for Students in Teaching Quality

With Multiple Regression Analysis to test H3, the analysis results, Table 3, revealed the outstanding effects of Individual (t=1.774, p<0.05), Structure (t=1.802, p<0.05), Technology (t=2.376, p<0.01), and Environment (β=2.573, p<0.01) on Care for Students that H3 was agreed.

Table 3: Multiple Regression Analysis of Educational Technology toward Care for Students in Teaching Quality

Predictor	Unstandardized coefficient		Standardized coefficient	t
	β estimate	Standard error	β distribution	
Individual	1.337	0.155	0.176	1.774*
Structure	1.526	0.212	0.238	1.802*
Technology	2.088	0.247	0.366	2.376**
Environment	2.170	0.306	0.402	2.572**

Note: * stands for p<0.05, ** for p<0.01

5. Interference of demographic variables

(1) Effects of gender on the relations between Educational Technology and Teaching Quality

With Analysis of Variance, Table 4, gender appeared notable differences between Individual, Structure and Teaching Facilities; between Structure, Technology and Teaching Capabilities; and between Individual, Technology and Care for Students that H4 was partially agreed.

Table 4: Effects of gender on the relations between Educational Technology and Teaching Quality

	Teaching Facilities	Structure Frequency	Care for Students
Individual	Significant	Not significant	Significant
Structure	Significant	Significant	Not significant
Technology	Not significant	Significant	Significant
Environment	Not significant	Not significant	Not significant
Hypothesis test	H4 partially agreed		

(2) Effects of age on the relations between Educational Technology and Teaching Quality
With Analysis of Variance, Table 5, age revealed remarkable differences between Individual, Structure, Environment and Teaching Facilities; between Individual, Technology and Teaching Capabilities; and between Individual and Care for Students that H5 was partially agreed.

Table 5: Effects of age on the relations between Educational Technology and Teaching Quality

	Teaching Facilities	Structure Frequency	Care for Students
Individual	Significant	Significant	Significant
Structure	Significant	Not significant	Not significant
Technology	Not significant	Significant	Not significant
Environment	Significant	Not significant	Not significant
Hypothesis test	H5 partially agreed		

(3) Effects of grade level on the relations between Educational Technology and Teaching Quality
With Analysis of Variance, Table 6, grade level displayed significant differences between Individual and Teaching Facilities; between Structure and Teaching Capabilities; and between Individual, Structure and Care for Students that H6 was partially agreed.

Table 6: Effects of grade level on the relations between Educational Technology and Teaching Quality

	Teaching Facilities	Structure Frequency	Care for Students
Individual	Significant	Not significant	Significant
Structure	Not significant	Significant	Significant
Technology	Not significant	Not significant	Not significant
Environment	Not significant	Not significant	Not significant
Hypothesis test	H6 partially agreed		

(4) Effects of disposable income on the relations between Educational Technology and Teaching Quality
With Analysis of Variance, Table 7, disposable income showed remarkable differences between Technology and Teaching Facilities; between Individual, Structure, Environment and Teaching Capabilities; and between Individual, Technology and Care for Students that H7 was partially agreed.

Table 7: Effects of disposable income on the relations between Educational Technology and Teaching Quality

	Teaching Facilities	Structure Frequency	Care for Students
Individual	Not significant	Significant	Significant
Structure	Not significant	Significant	Not significant
Technology	Significant	Not significant	Significant
Environment	Not significant	Significant	Not significant
Hypothesis test	H7 partially agreed		

CONCLUSIONS AND SUGGESTIONS
According to the outcomes, Educational Technology appeared significant effects on Teaching Quality. Aiming at promoting Teaching Quality of civil servants with Educational Technology, the following suggestions are further proposed. It is suggested to cooperate with enterprises to establish an open teaching platform for talents cultivation. Such a platform could cultivate practice capability and innovation capability of civil servants through the practical trainings in enterprises so that civil servants could receive actual experiences, not simply the theories. It is similar to schools largely promoting the collaborative talent cultivation plan between industry and

academia. In the practical courses, the training contents could be changed to e-files by abundant network resources that the documents or the video files could be posted on the teaching platform for civil servants to learn anytime and anywhere. Moreover, excellent employees could be selected to be the project assistants who are trained to exchange and learn with technicians in enterprises and teachers in schools through the network platform, to participate in research and development, and to coordinate work in various sections so that civil servants could acquire trainings on technological knowledge, interpersonal relationship, and communication ability. It aims to promote the active participation of civil servants who could acquire actual benefits and experiences for practical applications, to enhance the participation of civil servants in various cooperative projects, and to have middle-aged and young civil servants become the main power. The overall Teaching Quality therefore could be promoted by Educational Technology.

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AN EVALUATION STUDY OF A CALL APPLICATION: WITH BELT OR WITHOUT BELT

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ABSTRACT
The present study tried to evaluate the 6th grade students' attitudes towards the use of a CALL program which is called BELT Success used in English language learning course in a private school, the relationship to students' attitudes to their English language proficiency level, and finally teachers` experiences and opinions towards the use of BELT Success in the classroom environment. Both quantitative and qualitative data collection methods were used for the study. The data was obtained through BELT attitude questionnaire, field notes, unstructured group interview for students and semi-structured teachers interview. Descriptive statistics, inferential statistics, and content analysis were used to analyze quantitative and qualitative data. The results obtained from instruments revealed encouraging evidence that 6th grade students have a moderate positive attitude towards the use of BELT Success in English language course, additionally, students' language learning skills such as listening, reading, writing, grammar, and vocabulary are improved by the system, students gain self-confidence, and there is no statistically significant difference between groups representing different English language proficiency levels based on attitude towards the use of BELT Success into instruction.

INTRODUCTION

It is a fact that the rapid development and enormous advancement in computer technologies have been affecting all aspects of life for more than three decades. The discipline of education is one of the most important areas that have been influenced by this huge improvement. Therefore, the educational system immediately needs the application of computer technologies in order to improve the quality of teaching and learning (Liaw, 2002). Scheffler and Logan (1999) indicated that "teaching no longer centers around the transfer of knowledge from teacher to student; learning comes from students inquiry, critical thinking, and problem solving based on information accessed from a variety of sources" (p.305). Hence, one of the most important constructs related to the successful implementation of computers into instruction is students' attitudes towards them.

Since the 1990s, the use of computers as a medium has increased access to information and communication especially in language teaching and the learning environment and students are using a variety of technologies more and more (Gomleksiz, 2005; Greenfield, 2003). Dudeney and Hockley (2007) explained that computer-based materials for language teaching, often called CALL (Computer Assisted Language Learning), including filling in the gapped texts, matching sentences, or doing multiple choice exercises on the computer screen, are being used extensively in classrooms today. Thus, the use of CALLs by language teachers is becoming ordinary part of English Language Teaching (ELT) not only in developed countries but also in a few developing countries (e.g. Tezci, 2009; Albirini, 2006; Trinder, 2002; Neumeier, 2005; Ozerol, 2009).

The integration of computer technologies through CALL programs into English language learning classrooms improves learning by providing more opportunities for interaction with numbers of engaging materials and tasks (Lim and Shen, 2006). In various studies, numerous advantages for learners related to general use of computers such as increased motivation, improvement self-concept, more student-centered learning and more active processing have been mentioned (e.g. Stepp-Greany, 2002; Lim and Shen, 2006; McGrath, 1998). Because of its reported positive effects on learning, research studies on educational technologies have been centered around the issues dealing with their effectiveness in language learning (Wiebe and Kabata, 2010). Hence, a considerable number of studies have investigated students' perceptions of CALL since the early 1990s (Sagarra and Zapata, 2008).

Most of the research studies regarding the evaluation of CALL applications have been reported to have a positive effect on learners' attitudes (e.g. Fernandez, 2003; Ayres, 2002; Klassen and Milton, 1999; Okan and Torun, 2007; Chang, 2007; Holmes, 1998). For example, one of the studies concerned with students' attitudes toward CALL is that of Klassen and Milton (1999). They evaluated the effectiveness of a multimedia-based English language learning program. The result of the study showed that learners who completed the syllabus in a multimedia-enhanced mode demonstrated significant improvement in listening skills when compared to learners who completed the same syllabus in a traditional classroom mode. The results also indicated the positive attitudinal changes for a multimedia-enhanced mode of learning.

Another important evaluation study was carried out by Jamieson, Chapelle and Preiss in 2005. This study offers an example of a context-based evaluation operationalizing criteria for CALL evaluation and administrating the instruments to three groups of stakeholders: students, a teacher and developers of the CALL program. The result showed overall positive perception in all three groups. Ayres (2002) also examined students' attitudes towards CALL. The result indicated that students do not see CALL as a worthwhile replacement for classroom-based learning but they see it as an important and extremely useful aspect of their studies.

On the other hand, a few studies showed students' negative attitudes towards CALL. For example, Stracke (2007) examined the opinions of learners of blended language learning (BLL), a combination of face to face (f2f) and CALL. The analysis demonstrated that students held negative attitudes towards the class in which BLL was provided for three reasons: lack of support and connection between f2f and CALL; a lack of usage of paper medium materials; and the rejection of the computer as a medium for language learning.

Needs to be met by the program
Since attitude affects behavior and is linked to usage, it is important for students to have a positive attitude towards CALL in English language learning, especially in countries where English language is taught as foreign language because the integration of computer technology and its applications provide students with wide range of possibilities including authentic reading and listening materials, and various kinds of grammar and vocabulary exercises to learn and practice English successfully. However, little effort was spent on investigating the attitudes and opinions of students towards the integration of CALL applications in English language learning settings in Turkey. Therefore, the present study aims to evaluate the 6th grade students' attitudes towards a software program which is called BELT used in English language learning in Istanbul, Turkey.

Evaluation Questions
There is a need to determine students' attitudes towards the use of CALL applications in English language learning environments in Turkey because a positive attitude is the main determiner for successful future computer use in the classroom. Therefore, the present study was conducted to fill in the research gap and it was aimed to answer the following research questions.

1) What is the general attitude of the 6th grade students towards the use of BELT Success in English language learning?
2) Is there a significant difference in the 6th grade students' attitude towards the use of BELT Success by English language proficiency level?
3) What are English language teachers' experiences and opinions about the use of BELT Success?

Evaluation Design
Although the essence of the present evaluation study is based on the naturalistic design, both quantitative and qualitative data collection methods were used. The data was obtained through a questionnaire, field notes, and interviews, thus the study incorporated mixed methods to analyze the data. Mixed methods analysis have generally been used by CALL researchers to strengthen and cross-check the data before conclusions are made (e.g. Lim and Shen, 2006; Trinder, 2002). As an evaluation model, the researcher chose to implement the process evaluation model of Stufflebeam's (1971) CIPP model (Context, Input, Process and Product) in the study (cited in Nunan 1992).

In the process evaluation, "the focus is on the evaluator providing on going feedback during and at the conclusion of a program, so that evaluation data may be fed back into, and thereby assist in the improvement of the program" (Nunan, 1992, p.193). Process evaluation also involves describing implementation problems of the running program, assessing how well the stakeholders address them and reporting how participants judge the quality of the process (Stufflebeam, 2002). Therefore, the process evaluation model was accepted as the best appropriate model in order to determine the attitudes towards BELT in this context.

METHOD
Evaluation Participants:
At the beginning of the study, the samples consisted of Sixty-six 6th grade students- all 6th grade students in the school- in a private school in Istanbul, Turkey. However, nine students were excluded from the study because the questionnaire that they had filled out involved some missing data. Thus, the number of the students who participated in the study dropped to fifty-seven. According to the demographic data 54% of the participants (n=31) were female and 46% of them (n= 26) were male. Moreover, samples of the research had varying degrees of English language proficiency. Demographic data indicated that 39% students (n=22) were in A level (pre-intermediate), 35% of the samples (n=20) were in B level (elementary) and 26% of the participants (n=15) were

in C level (beginner). For the teacher interview, out of eight English language teachers, 4 volunteer teachers who taught BELT course participated in the study. One male teacher had three years of experience in teaching BELT course and three female teachers had one year of experience in teaching BELT. These teachers were interviewed to understand their experiences and opinions with regard to the program implemented.

Setting

The present study was carried out in a private school, which involves 500 students from kindergarten to the 8th grade, in Istanbul, Turkey in December 2010. Although English language teaching is started in the 4th grade in public schools, it begins in kindergarten in private schools in Turkey. Besides, the weekly hours of English courses in private schools are higher than the hours in public schools. Therefore, private institutions can easily provide extra opportunities in terms of teaching English such as a native speaker or CALL applications to their students.

In the context of the present study, English courses in the 6th grades was divided as six hours for traditional English teaching with a main course book, two hours for speaking and listening with a native speaker, and one hour for CALL with BELT success software program in a week. Since the aim of the present study was to assess the attitudes towards the BELT program, other variables were not used in the study.

Evaluation Material

The BELT Study System is being used from the 2nd grade to the 6th grade for an hour a week in this school for three years. All the courses were studied in the computer language lab in which all the computers were equipped with the necessary parts to allow the use of BELT. Each BELT package involves a workbook and a smart card that is for school use only.

Based on the information collected from the official website of the BELT study system (date not provided), this product is designed and produced by Binary Logic which has worked in Greece for over 25 years. BELT is specially designed for and directly promoted to schools and educational institutions. Since BELT is not a self-study product for private use at home, it is not sold in bookshops or multimedia stores. It is specifically designed for students who learn English as a foreign or second language and it is intended to be used in schools, educational institutions, and training centers. The study system is designed separately as BELT Kindergarten, BELT Primary, and BELT Success. In the context of the present study, BELT Success is being used by 6th grade students.

BELT Success is specifically designed for teenagers and adults and it includes integrated skills reading, listening, writing, speaking, and grammar. It also involves five different levels from beginner to upper-intermediate and comprises 15 units (30 graded lessons) in each level. Each lesson is presented in the form of presentation, production and practice and communicative approach is the essence of all BELT study systems.

In the BELT course, each student has their own BELT smart card that enables students to log in their own study page. Since BELT is designed as a self-study system, each learner works on a different unit and is responsible for their own learning. At the end of each lesson, students have to do exercise parts so that the teacher can see students' achievement scores in terms of a percentage on his/her computer. Additionally, the BELT workbook helps learners to study on different exercises either in classroom or at home.

In the present study, the beginner level of BELT Success was studied by the 6th grade students for only one hour in the language computer lab a week. Although students' English language proficiency level was different- A (pre-intermediate) level, B (elementary) level and C (beginner) level- all students who had different levels participated in the same BELT class. The course was not arranged according to learners' level of proficiency. The role of the teacher in the classroom was just being an observer rather than teaching English relating to the subjects in the units of BELT. Teachers provided technical support in terms of using computers, ensuring silence in the lab, or answering students' questions about activities which were not understood.

Data Collection Method and Instruments:

In order to determine the 6th grade students' attitudes and portray their opinions towards the use of BELT in an English language teaching environment, both quantitative and qualitative data were collected for this evaluation study in December 2010. Quantitative data were obtained from fifty-seven students by using a survey instrument, which was called the "BELT Attitude Scale". (see Appendix A). After a broad study of literature, the BELT attitude scale was developed by the researcher herself for this study. The researcher made a comprehensive examination of the questioned points through related research studies, books, and theses conducted both in Turkey and abroad. Furthermore, one unstructured group interview with three students and

three hours classroom observation of students' interaction with BELT Success program were conducted so as to obtain in=depth opinions regarding the topics of concern. In other words, the main reason behind conducting interviews and observations was to determine the items of the questionnaire. During the interview, the researcher aimed to elicit the learners' general attitudes towards the use of BELT, its strengths and the weaknesses, and the learning environment. In classroom observations, the researcher tried to collect data in an informal way, on the user-friendliness of BELT Success, possible technical problems, and to get a general impression of participants' reaction to the program.

Finally, in accordance with the relevant literature, the focus group interview findings, and observation results, the researcher designed the BELT Attitude Scale. This questionnaire is a five-point Likert Type scale, each statement was labelled from "1" "completely disagree" to "5" "completely agree". This questionnaire has 21 items towards the behavioral aspects of BELT attitude. The items, 8, 10, 13, 20, and 21 in the scale were negatively worded. While analyzing the data it was reversed in order to maintain a homogenous score. A total score of the 21-item scale gave insight into general attitudes towards the use of BELT in English language learning.

In addition to the quantitative method, the qualitative part of the data was collected through semi-structured interviews (see Appendix B) from four volunteers English language teachers in order to supplement the data obtained from the questionnaire and to get in-depth data about teachers' experiences and opinions of the current BELT program implemented in the 6th grade. The interviewees were chosen according to their teaching experience in the BELT class. The interview schedule consisted of eight open-ended questions related to BELT Success program and each interviewee was met individually.

Data Analysis
The data obtained from the questionnaire was analyzed by using SPSS version 16.0. In order to identify the average scores, mean and standard deviation of the participants' responses to the items in BELT Attitude Scale, descriptive statistics, and inferential statistics, Kruskal-Wallis, were used. Additionally, qualitative data has been supported by analysis of qualitative data obtained from recorded semi-structured teacher interviews. After transcribing the interview data, it was grouped according to the answers given to the same question. The interview transcripts were subjected to content analysis in order to identify emerging themes and trends.

RESULT
Students' attitudes towards the use of BELT Success
In order to identify the attitudes of the 6th grade students' attitudes towards the use of the BELT Success program in English language learning environment, descriptive statistics was conducted. The attitude was assessed by 21 positively and negatively (shown in bold in Table 1) worded statements rated through 1 "strongly disagree" to 5 "strongly agree". As can be seen in Table 1, the mean and standard deviations scores were computed for the variable. The overall mean score for all the items based on students' attitudes towards BELT Success was little above the mid-point of the scale M= 3.48 (SD= .40). Based on the scale used in the questionnaire, this mean score was somewhere between "undecided" and "agree". Therefore, according to the total general attitude score, the result of the descriptive statistics indicated that the 6th grade students who had been exposed to the BELT success program in their language learning experience held moderate attitude- quite positive- towards the use of BELT Success into English language instruction. However, certain items had noticeably higher means when compared with general attitude mean. For example, 65% of the students "completely agreed" that "the use of BELT makes English language courses more interesting" (item1), M= 4.54 (SD= .75). Similarly, for item 4, "I think the activities used in the BELT are useful" M= 4.29 (SD=.70), 44% of the participants "completely agreed" and 42% of them "agreed" in the BELT attitude scale. Additionally, 79% of the students chose completely agree and agree for item 2 " I think that BELT increases the level of my English" M= 4.01 (SD=.81).

Furthermore, the mean scores in the scale showed that students liked doing writing activities using computers and keyboards rather than using a pen and a workbook because 65% of the respondents completely agreed and 11% of them agreed that the statement "I like doing writing activities by means of keyboard" (item 18), M= 4.12 (SD=1.41). Besides, 65% of them disagreed on the item 19 that "I prefer doing writing activities in the BELT workbook", M= 2.28 (SD=1.57). There were also some items which mentioned that the BELT program improves students' listening skills in the questionnaire. For example, for item 11, 77% of the participants indicated that BELT increases their listening skills M= 4.10 (SD=.97). Moreover, the result of the descriptive analysis showed that 75% of those samples believed that the reading activities in BELT help to increase their reading skill in other English courses (item 16), M=3.98 (SD=1.06).

Table 1. Students' attitudes towards the use of BELT

Statements	Completely Disagree		Disagree		Undecided		Agree		Completely Agree			
	f	%	f	%	f	%	f	%	f	%	Mean	SD
Item1	1	1.8	0	0	3	5.3	16	28.1	37	64.9	4.54	.75
Item2	0	0	3	5.3	9	15.8	29	50.9	16	28.1	4.01	.81
Item3	2	3.5	1	1.8	5	8.8	25	43.9	24	42.1	4.19	.93
Item4	0	0	0	0	8	14	24	42.1	25	43.9	4.29	.70
Item5	6	10.5	15	26.3	9	15.8	14	24.6	13	22.8	3.22	1.34
Item6	4	7	12	21.1	9	15.8	16	28.1	16	28.1	3.49	1.29
Item7	2	3.5	10	17.5	6	10.5	23	40.4	16	28.1	3.71	1.16
Item8	**17**	**29.8**	**11**	**19.3**	**1**	**1.8**	**8**	**14**	**20**	**35.1**	**3.05**	**1.72**
Item9	0	0	11	19.3	13	22.8	15	26.3	18	31.6	3.70	1.11
Item10	**16**	**28.1**	**7**	**12.3**	**13**	**22.8**	**10**	**17.5**	**11**	**19.3**	**2.87**	**1.48**
Item11	1	1.8	3	5.3	9	15.8	20	35.1	24	42.1	4.10	.97
Item12	4	7	4	7	9	15.8	16	28.1	24	42.1	3.91	1.22
Item13	**19**	**33.3**	**12**	**21.1**	**7**	**12.3**	**12**	**21.1**	**7**	**12.3**	**2.57**	**1.45**
Item14	4	7	6	10.5	12	21.1	16	28.1	19	33.3	3.70	1.23
Item15	6	10.5	2	3.5	9	15.8	12	21.1	28	49.1	3.94	1.32
Item16	2	3.5	4	7	8	14	22	38.6	21	36.8	3.98	1.06
Item17	16	28.1	12	21.1	13	22.8	8	14	8	14	2.64	1.39
Item18	7	12.3	2	3.5	5	8.8	6	10.5	37	64.9	4.12	1.41
Item19	29	50.9	8	14	5	8.8	5	8.8	10	17.5	2.28	1.57
Item20	**25**	**43.9**	**15**	**26.3**	**10**	**17.5**	**5**	**8.8**	**2**	**3.5**	**2.01**	**1.14**
Item21	**11**	**19.3**	**12**	**21.1**	**18**	**31.6**	**12**	**21.1**	**4**	**7**	**2.75**	**1.19**
Total Attitude											3.48	.40

Students' attitudes according to English language proficiency levels

In order to identify whether there is a difference between the 6th grade students' attitudes towards the use of BELT success into instruction in terms of English language proficiency levels, Inferential statistics was conducted for the study. Since the number of the students participated in the study was not enough to have normal distribution and to use parametric tests, a nonparametric test which was called "Kruskal-Wallis test" was conducted. Students' levels of proficiency were identified as A level (pre-intermediate), B level (elementary), and C level (beginner). The Table 2 shows the mean scores of students based on their proficiency levels. According to Table 3, the result of Kruskal-Wallis test indicated that there is no statistically significant difference between the groups representing different English language proficiency levels based on attitude towards the use of BELT Success into instruction (sig(two-tailed)= ,24 ; p< 0,05). It seems that the attitude towards the use of the BELT program does not depend on students' English language proficiency levels in the present study.

Table 2. Mean scores according to levels of proficiency

Ranks

	Level of Proficiency	N	Mean Rank
General Attitude	A	22	29.93
	B	20	24.42
	C	15	33.73
	Total	57	

Table 3. Kruskal-Wallis test result according to levels of proficiency

Test Statistics

	General Attitude
Chi-Square	2.818
df	2
Asymp. Sig.	.244

Teachers' experiences and opinions towards BELT Success program

The semi-structured interview, including eight questions, was administered to four teachers, who had experience in teaching the BELT program, to reveal their experiences and opinions towards the use of BELT in their English language teaching. The interview questions addressed teachers' experience using BELT in their teaching, their views about how the BELT program influences instruction, their attitudes towards its use, the factors that affect BELT integration, the kinds of technical problems during the application, and teachers' suggestions in terms of improving the quality of the BELT application. The qualitative data obtained from the questions was presented through narrative sentences. Additionally, some answers from the participants were outlined below by means of quotes to support the quantitative findings.

According to interview data all teachers believed that not only the 6th grade students but also the students in other grades like using the BELT program in English Language courses. The teachers indicated that since the new generation like spending time in front of computers and the Internet, software programs designed for language teaching attract students' attention a lot. Students saw English language teaching programs as computer games. Teachers also reported that this kind of learning environment was especially enjoyable because of the medium, which provided variety and interactivity. Therefore, students unconsciously learnt English as they played games. The following quotations from the teachers illustrate these beliefs:

> *"If you want to learn something, first you have to like it. The subject that you are going to learn must attract your attention. Otherwise you cannot learn easily. BELT helps students to attract their attention on learning English. This is what we want it."*

All teachers also believed that the use of BELT program helped students to learn and improve their English more effectively and they stated that students sometimes could use vocabulary or an expression learnt in a BELT class in other English classes. One of the informants' statements shows this belief:

> *"One day, one of my students used a word that was not taught in the classroom before. When I asked him where he learnt it, he said that in the BELT class. So, this made me very happy."*

Furthermore, all teachers stated that the BELT program provided different authentic listening activities, which improved students' listening abilities because they believed that students listened to the passage based on their own pace. The following comments explain the reasons why teachers think like that:

> *"In the BELT class, students can listen to the passages over and over again, until they understand them. It depends on the students and their learning pace. However, in regular classrooms, teachers play the tape most of the time twice. So, students sometimes do not understand what they hear or they may miss important points."*

Teachers who taught in BELT classes also informed that students improve their writing abilities through typing because using a keyboard was as easy as using a pen for new generations. Most of dictation activities provided students with opportunities to type on the screen or to write on the activity book. Therefore, all teachers believed that students had positive attitudes towards using BELT in English courses. Besides, they never wanted to miss the class due to any activities arranged by the school. The following sentences illustrate this belief:

> *" One day an entertainment show was arranged for the students in the conference hall. This show started at the time of my BELT class. All of the students begged me not to go there to see the show because they preferred working on BELT"*

All teachers thought that BELT was a student-centered program rather than teacher-centered because teachers did not involve themselves and participate in any activities during the BELT course. All students worked alone and were responsible for their learning. Therefore, teachers mentioned that this kind of involvement increased

students` self-confidence. Teachers were only guides that helped students to solve any problems that either arose from the computer itself or related to activities and exercises.

Contrary to the strengths of the BELT program teachers also mentioned the weaknesses of it. For example, the interview data revealed that the company that produced BELT never provided any in-service training or short term seminars that explained the use of BELT or other kind of technical problems to the teachers before the begining of the academic term . Second, teachers suggested that the parents should also be informed about the strength of BELT by the producer because, according to the teachers, parents spent lots of money each year and wanted to know whether it was worth it or not. Third, one teacher suggested that the BELT program should have been used both in schools and at home under parental guidence because one hour was not enough to follow the BELT syllabus. She indicated that these kinds of software programs always created some problems and she was always fixing either card readers, or head phones, or keyboards most of the time. Students could at least do their exercises related to the workbook at home. Fourth, all teachers complained that the syllabus of BELT sometimes did not act in accordance with the syllabus followed in the school. Teachers said that, therefore, they sometimes did not let students go on to the next unit in the BELT program until they had finished it in other English language courses. Finally, all teachers wanted a program evaluation, which would have to be carried out by the designer of BELT. They stated that they had lots of things to say either positive or negative, to the program designers because they never asked teachers` opinions about updating the program according to the current needs. One teacher`s sentences nicely illustrate this issue.

> *"In our school BELT has been used for three years, but one of our schools for ten years. From ten years the BELT has never changed, even the characters. I think it should be updated because many things used ten years ago are not used right know or vice versa."*

Regarding being a teacher in a BELT class, half of the teachers were not happy to be involved in BELT course as a teacher. They thought that since they did not teach anything related directlyto the English language itself, they felt useless as a teacher in this kind of class. They believed that any Information technology teacher who knew a little English could do better than English teachers did in that class because English teachers generally dealt with technical problems related to computers rather than English in the BELT class. They said that most of the time English teachers felt themselves insufficient in technical issues, and asked for help to fix these kinds of problems all the time. One of the comments given clarifies viewpoint of the teachers

> *"It is nonsense to put English teachers into this kind of CALL course, because I am just an observer or useless technician rather than a teacher. I do not perform anything related to English. Students do everything. It is time consuming for me. I have lots of other things to do."*

On the other hand, half of the teachers were happy to be in the BELT class as a teacher because they said that they could have free time during the class. They could do their other duties such as writing their lesson plans or reading the quizzes when students worked on BELT. As a result, they stated that one hour of BELT- not more - was enough for teachers.

DISCUSSION AND RECOMMENDATIONS
In the present study, the 6th grade students' attitudes towards the use of BELT in the English language learning environment, the relationship to their attitudes to a selected independent variable, English language proficiency level, and finally teachers` experiences and opinions towards the use of BELT in the classroom environment were evaluated. It is obvious that students are the main component of the successful integration of CALL applications into instructions. Therefore, their attitudes towards them are an essential part of the integration process. Based on the findings of the study, it can be extrapolated that students in general have moderate positive attitudes towards the use of BELT in the English language course and these attitudes do not change according to the participants' level of proficiency. This finding is in agreement with other studies reporting a positive perception and attitudes towards CALL applications in second and foreign language learning environments (e.g. Sagarra and Zapata, 2005; Ayres, 2002; Bulut and AbuSeileek, 2009; Jamieson, Chapelle and Preiss, 2005; Lim and Shen, 2006; Fernandez, 2005; Holmes, 1998).

This result is also supported by the findings of the teachers' interview because all teachers put forward that the BELT application increases students' attention to English language learning and attitudes towards it. Thus, it is worth considering the effects of the use of the BELT program on improving the learners' confidence in their abilities as independent learners. The result is in accordance with Okan and Torun's study (2007) and Stepp-Greany's (2002) that the findings of the unstructured group interviews with students and the questionnaire

indicates that a majority of the students gain self-confidence in their ability to use technology successfully through the BELT program.

Furthermore, in teacher interviews, all the respondents believed that the involvement of the BELT program improved students' language skills, including listening, writing, grammar, and vocabulary and created more self-directed learners. Several research studies such as Bulut and AbuSeileek, (2009); Okan and Torun, (2007); Klassen and Milton, (1999); Chang (2007), and Stepp-Greany's (2002) support the findings of the present study that CALL activities seem to help students mostly in improving their listening skills. The result also shows that students agree that their writing and reading skills improve in English as a result of the BELT activities. These perceptions of improved writing and reading skills with technology lend support to findings of improved reading skills reported by Stepp-Greany's (2002) and learners' perception of improved writing skills reported by Bulut and AbuSeileek, (2009) and Stepp-Greany's (2002). However, Okan and Torun, (2007) concludes that there is apparently a negative response on the contribution of CALL to the writing skills of students because of the lack of writing activities within the CALL curriculum in the term that the study was conducted. Although the findings of the questionnaire in this study show that BELT increases the students' perceptions on writing, this result must be evaluated cautiously, because it contradicts the result of informal classroom observation and student interviews. During the observations and student interviews, it was seen that most of the students complained about writing activities in the BELT program because any typo made by the students resulted in the program assessing the whole sentence as incorrect. Therefore, students paid more attention to not making any spelling mistakes than thinking about what they wrote.

Additionally, the result of the study reports that students increase their grammar and vocabulary knowledge through the use of BELT and they use them in other English classes. It corroborates another study that the majority of the participants praise the online materials as essential in advancing their second language grammatical and lexical knowledge (Sagarra and Zapata, 2008).

The present study indicates that students' and teachers' attitudes towards the use of BELT program do not always match. There seems to be some resistance to the employment of the program in terms of teachers' perspective. One of the most important negative feelings teachers have towards computer integration into instruction is the role of teachers in a CALL environment. It is obvious that new computer technologies force a different point of view on the role of the instructors in the process of language program design and classroom instruction. Teachers are a facilitator and a co-learner rather than a knowledge transmitter and information provider (Lim and Shen, 2006; Stepp-Greany, 2002). Therefore, necessary pedagogical and technical skills required by the CALL applications should be provided to teachers for the successful integration of the technological materials into the classroom. School administrators and program designers can arrange an in-service training which includes skills necessary for teachers to function appropriately in the CALL classroom before the academic term begins. Thus, familiarization with the CALL application helps teachers to integrate the program into the instruction properly and fruitfully.

The design of the computer-based language course is also an important issue to be addressed. Although there is no difference between students' attitudes towards the use of BELT in terms of English language proficiency level in the present study, this type of course should be carefully planned and graded. Thus, coherence between students can be easily provided. Furthermore, it was revealed in the observation process that unevaluated language activities encourage students not to pay attention to the exercises and to produce insignificant work during the BELT class. The multimedia-based exercises should be measured and implemented in the activities done in the regular English courses so that students attribute relevancy and educational benefits to technology enhanced instruction (Stepp-Greany, 2002).

Finally, it is obvious that few technology integration projects have been implemented by the ministry of national education not only in private schools but also in public schools in Turkey and the integration of computer technologies into instruction is always welcomed and supported by the parents in these schools. However, the parents in private schools want to know if it is worth spending so much money on software programs especially for language learning. Like many language course books, softwares designed for language learning are imported from either the UK or USA to Turkey and each year parents in private schools have to spend $ 300 an average per student for English language learning materials. Therefore, parents as one of the members of the stakeholders should be informed about the properties of CALL applications used in schools.

CONCLUSION
According to the data collected from students and teachers, BELT Success exhibited desirable qualities which were appropriate for the 6th grade students in the private school in which the present study was conducted.

Additionally, 6th grade students showed moderate positive attitudes towards the use of BELT Success in the English language learning environment. Learning in the CALL-based English class provides several benefits such as engaging different kinds of authentic and interactive tasks, enhancing language skills through multimedia applications, and increasing self-confidence, for the students in the language classroom. However it is clear that measuring students' attitudes towards the use of CALL applications under the computer medium is a complex process and results depend on many personal factors. Thus, the long-term effects of CALL applications on English language learning, focusing particularly on students' learning styles and language skills, could be investigated by further studies.

There are a few limitations in the present study. Although the results of the research revealed important findings, the relatively small sample size may limit the generalizability of the results in this study. Moreover, factors that may influence students' attitudes including their prior computer experiences, their language learning styles, their differing levels of intelligence were not taken into consideration in the present study. Furthermore, since there were not many 6th grade students, the reliability and the validity of the BELT Attitude Scale were not studied by the researcher but at least the scale had been piloted before conducting the study. On the other hand, the present study provides valuable information about how CALL programs are perceived by Turkish students because little research focuses on students' attitudes towards CALL applications in English language learning environments in Turkey.

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Appendix-A
BELT STUDENT ATTITUDE SCALE

Please circle the number that best suits you

Level of Proficiency :   A   B   C   **Gender:**   Male   Female

	Completely Disagree	Disagree	Undecided	Agree	Completely Agree
1) The use of BELT in an English language course makes it more interesting.	1	2	3	4	5
2) I think that BELT increases the level of my English.	1	2	3	4	5
3) I like learning English by myself through BELT	1	2	3	4	5
4) I think the activities used in BELT are useful.	1	2	3	4	5
5) BELT increases the level of my computer knowledge.	1	2	3	4	5
6) BELT increases my self-confidence in terms of doing English exercises.	1	2	3	4	5
7) I can understand all exercises and activities offered in BELT without asking my teacher.	1	2	3	4	5
8) Computer related technical problems during the BELT course negatively affects my attention.	1	2	3	4	5
9) I can easily understand the spoken language used in the listening activities in BELT.	1	2	3	4	5
10) The spoken language used in the listening activities in BELT is fast for me.	1	2	3	4	5
11) I think that BELT increases my listening skill.	1	2	3	4	5
12) BELT increases my English vocabulary knowledge.	1	2	3	4	5
13) I do not understand the grammar rules appearing on the computer screen in the BELT course without the help of my teacher.	1	2	3	4	5
14) I can use the vocabulary and the grammar rules taught in BELT in my other English courses	1	2	3	4	5
15) Reading an English passage on the computer screen is more enjoyable than reading from the book.	1	2	3	4	5
16) The reading activities in BELT help to increase my reading skill in other English courses.	1	2	3	4	5
17) I often use the dictionary section in BELT in order to understand the unknown words.	1	2	3	4	5
18) I like doing writing activities by means of keyboard.	1	2	3	4	5
19) I prefer doing writing activities in the BELT workbook.	1	2	3	4	5
20) The exercises in BELT are more difficult than the exercises in other English courses.	1	2	3	4	5
21) I sometimes do BELT exercises without understanding.	1	2	3	4	5

Appendix-B
TEACHERS INTERVIEW QUESTIONS

1) Do you think that the use of BELT in the school helps students to learn English? If so, for which skills is BELT helpful?
2) Do you see the effects of the BELT in other English courses that you teach? If so, please give an example.
3) What are the advantages of using BELT for teachers and students?
4) What are the disadvantages of using BELT for teachers and students?
5) What kind of difficulties do you encounter during the application of BELT?
6) What do you think about the students` attitudes towards BELT?
7) Are you happy as a teacher of a course in which BELT is used?
8) Do you have any suggestion in terms of improving the quality of the BELT application?

ATTITUDES OF TEACHER CANDIDATES STUDYING AT TECHNICAL EDUCATION ON ABILITY TO TAKE THE ROLE OF A TEACHER

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ABSTRACT
In this research, attitudes of teacher candidates ($N = 583$) studying at the Faculty of Technical Education on ability to take general roles of teachers are analyzed with respect to class, gender, educational level of parents, reason to do major at the university, feeling themselves appropriate to the major, seeing themselves adequate, and desire to change the major. In the research, where 5 point likert scale was used, it is designated that at the level that teacher candidates can "absolutely" take general teaching roles, especially in "communication skills" group, they have ($M = 4,35$). It has been observed that this situation does not show any difference in class 1 and 2 as well as in 3 and 4. The attitudes of candidates in class 3 and 4 in taking general roles of teachers change with respect to department and gender.
Keywords: Vocational school teacher candidate, roles of a teacher, proficiency, attitude

INTRODUCTION

One of the variables with regard to what kind of generation bring up is the question of "What kind of a teacher?" How the teacher must be may vary depending on socio-political, economic and other reasons of the period; therefore, naturally it is seen that educational process takes a role accordingly. Under these circumstances, the role of teachers and their place in the social life need to be analyzed and redefined.

Who is the teacher then? He comes across us with different roles when we evaluate him at school and on the street. For a teacher who uses these roles, it will be the shortest cut to say, "a teacher is the one who raises all the citizens and expert personnel of a country, transfers existing culture to new individuals, and thus maintains the individuals to be socialized." (Özden, 1999).

Turkish National Education also defined teaching and required those who want to carry out this profession to abide by the following definition (National Education Basic Law no 1739, Article 43): "Teaching is a specialization profession that undertakes the tasks of education, teaching and management duties related to them. Teachers are obliged to execute teaching profession in accordance with the aims and basic principles of Turkish National Education. Preparation to the teaching profession can be provided with general culture, specific field training and pedagogical formation." (Milli Eğitim Bakanlığı [MEB], 1973).

It is not an exaggeration to say that teaching is the leading profession among those in which there must not be conflicts between what the professionals say and do. As a matter of fact, process of education, owing to its nature, is the process of persuasion, assurance, convincing, making itself willing, encouraging, and making it volunteer. These activities, most of which consist of shapes of psychological behavior (Özsoy, 1987), have become obligatory to the profession of teaching. On the other hand, some educational institutions limit the tasks of teachers to maintaining the silence in the classroom, keeping the students in the classroom within the class-hour, and deliver his/her lecture during this period (Kaygısız & Akarsu, 1997). Although such an attitude does not cover general skills of teaching profession, due to limited financial, spiritual and social facilities that the teachers have may lead them to the attitudes of restrictions (Baloğlu, 1990).

Three fields about the roles to be taken by the teacher candidates have been designated in recent years: Organization-planning and teaching approaches, professionalism, and social skills (Yüksel, 2001). The role of a guide, which is especially required for teachers of vocational and technical school education teacher, has a special importance. Because vocational education is application-oriented, it requires more intimate teacher-student relationships. In vocational schools, most of the educational time is spent in laboratories, workshops, and fields of application, which necessitates one-to-one education, group works, and project based education.

How to facilitate teacher candidates' adaptation of professional roles in teacher training institutions is another topic of research. Teaching profession requires teachers to have some certain qualities of personality such as determination, patience, and being focused (Marmara University Faculty of Technical Education). Teachers are also expected to refresh themselves constantly, not to be fed up from failures, and not to give up education under any unfavorable circumstances (Özcan, 2011). Mostly during their third and fourth years of education at the university, teacher candidates take courses such as Teaching Applications, Private Teaching Methods I, II and

Classroom Management, where they learn and, through application, adapt to teacher roles and attitudes (MEB, 1998). However, teacher candidates' willingness and motivation to undertake these roles may vary by personality characteristics. Optimally, it is desired, even for a teacher candidate who does not smile at all at the beginning of a teacher training program, to adapt a smiling and gracious attitude during the course of his/her teacher training (Madi, 2006). Given the importance of teachers' and teacher candidates' attitudes, there is substantial research on attitudes towards teaching profession (Oral, 2004; Şeker, Deniz, & Görgen, 2005) and, relatedly, teachers' beliefs regarding proficiency (Eroğlu, 1999; Erişen, & Çeliköz, 2003; Akbaş & Çelikkaleli, 2006).

Erişen and Çeliköz (2003) found that teacher candidates considered themselves partly proficient in general teaching attitudes, and their perceptions of proficiency did not differ significantly by gender, major or university. On the other hand, teacher candidates in Özgür's (1994) study were eager to start teaching. Teacher candidates' attitudes towards the teaching profession were affected by their own perceptions of status, social perception, and the value given by the government (Özgür, 1994).

Özdemir and Çanakçı (2005) found that teacher candidates who took the School Experience I course evaluated the importance of teachers' roles in education more appropriately than those who did not take the course. Özdemir and Çanakçı's study also illustrated that cognitive field knowledge about the roles could be comprehended more. However, Özdemir and Çanakçı did not provide information about adaptation and acceptance of these roles by the teachers.

In a study by Ocak and Gündüz (2006), teacher candidates developed metaphors for teaching profession that emphasized the significance of teachers' roles in education and the society. Teacher candidates in Ocak and Gündüz's study (2006) highly adapted the role of a "self-sacrificing teacher" before taking the course of Introduction to the Teaching Profession. After learning the details of teaching profession in the course, teacher candidates preferred teachers' role as a "source of information".

Sağlam (2008) identified a positive correlation between prospective music teachers' level of sympathy for their profession and their attitudes towards teaching. Her/His study showed that overall attitudes are significantly different in terms of class level and causes of choosing the department. According to sex variable, it was concluded that women develop more positive attitudes than men.

Bulut (2009) studied the attitudes of teacher candidates from two different universities towards teaching profession and found high positive attitudes. The study, applied to 411 teacher candidates, proposed that while there is no significant difference in terms of sex and class, there are differences between departments.

Bay and his friends (2009) concluded that teacher candidates developed very affirmative attitudes towards teachers' constructive roles in social constructive learning environments. While this study gave us information on the necessity and effectiveness of these roles and teacher candidates' ability to undertake these roles, it did not provide any information on candidates' attitudes on adopting these roles.

Yeşilyurt (2010) found that third-year teacher candidates in schools of education and technical education adapted roles of teachers such as listening to different opinions, being democratic and fair, fulfilling responsibilities, paying attention to making a common decision, establishing communication, valuing different personalities, not developing grudge against anyone, and valuing cooperation. Yeşilyurt (2010) concluded that teacher candidates in the school of technical education and female teacher candidates, probably due to general justice and cooperative attitudes inherent in women, were more cooperative.

Whereas some research has been conducted with teacher candidates in schools of education regarding their attitudes towards the profession of teaching and their beliefs about proficiency, research on teacher candidates in schools of technical education is scarce. Thus, in the current study we sought to examine attitudes of teacher candidates in a school of technical education regarding undertaking the role of a teacher and see how these attitudes varied.

OBJECTIVE
The changing circumstances have placed what kind of roles teachers should undertake or are required to undertake, education methods, teaching profession and the format of classroom management into the main center of research. Entering into the process of education with their different levels of readiness and cultural characteristics, teacher candidates' predisposition to the teaching profession, their willingness to participate to the process of education when becoming teachers, and what teacher roles they can undertake in this process are

very important variables. For this reason, the willingness of professional and technical teacher candidates towards the variety of teacher roles are investigated in this general survey method. In this research, whether the attitudes of ability to undertake teacher roles differentiate or not, and whether there is or there is not an optional relationship among various role groups according to the candidate's class, gender, educational status of the family and his thoughts related to his branch are aimed to be investigated.

METHOD
Universe and Sampling
The sample which consisted of college students (N = 583) studying at various classes of spring semester in 2009-2010 academic year of Textile Education, Metallurgy Education, Electrical Education, Mechanical Education, Printing Education at Technical Education Faculty at a state university located in Istanbul constitutes the study group of this research.

Data Collection
The perception scale of teacher candidate's role proficiency was used as a means of data collection. In the scale, 9 articles related to personal information, 5 dimensions and 26 articles for determining the perceptions of the ability to undertake general teaching roles by prospective teachers are included. Firstly, a list of teacher roles is created by scanning various resources (Ünal & Ada, 2008; Sönmez, 2008; Hesapçıoğlu, 1998; Alkan, & Kurt, 2007; Küçükahmet, 1999; Erden, 2009) in order to determine the content validity of the scale. At this stage, it was noted that the resources that were used in this research were written especially for the purpose of teacher training and were used as textbooks at education faculties. At the second phase of the developmental stage of data collection tool; the opinions of the teacher candidates were gathered in order to include new teacher roles that may occur due to changing circumstances and cultural differences. For this purpose, a total of 361 vocational teacher candidates, studying at 4th year of Electrical Education, Textile Education, Mechanical Education, Metallurgy Education and Printing Education at Technical Education Faculty at a state university located in Istanbul in the fall semester of 2009-2010 academic year, were asked at which roles they met teachers throughout their educational lives and were requested to write answers on the papers distributed to them. By adjusting the teacher roles obtained this way, 34 of them, which are expressed by at least 10 people, were seen to be noteworthy. 10 of these roles (senior brother/sister, mediator, friend, educated, wise, mate, resource, officer, model, and pedagogue) could be considered to be rare and unusually encountered or not encountered in the literature and were included in the survey in order to be used in the research.

Literary references and the list of teacher roles obtained from the opinions of teacher candidates were grouped, within themselves, under four headings such as "social roles", "roles of communication skills", "vocational and teaching roles" and "management roles." Data collection instrument was formed in two sections consisting of nine (9) pieces of personal information, and twenty-six (26) pieces of teacher roles. While personal information was multiple choice, attitudes were arranged in a way to be expressed in 5-point Likert-type attitude scale in the form of "Definitely I can" (5,00 to 4,21), "Partically I can be" (4,20 to 3,41), "I am undecided" (3,40-2,61), "I cannot be" (2,60-1,81), and "I can never be" (1,80-1,00). The scope and structure validity of the data collection tool were provided by consulting to an expert opinion and for its internal parameter, Cronbach Alpha value was calculated as 0,87 (M = 110,94 / SD = 11,04). In order to determine the opinions of candidates on teacher roles, frequency percentage, mean and standard deviation techniques were used.

Data Classification and Analysis
In the research, personal information and perception of the ability to undertake teacher roles of a total of 583 teacher candidates were examined using an attitude scale. To identify teacher candidates' demographic characteristics, frequencies and percentages were calculated. Analysis of variance (ANOVA), followed by post-hoc tests, was used to examine differences among groups in terms of independent variables. For statistical analysis, SPSS-16 statistical data analysis program was used.

Findings and Interpretation
How teacher candidates' perceptions about their willingness to undertake teaching roles differed by their class, by the program they attend, gender, educational status of parents, reasons for choosing the department, whether they found their professions appropriate to their own personalities, whether they considered themselves competent in terms of professional knowledge and skill, and whether they wanted to change their departments if they were given the opportunity, were examined using statistical data analysis, and the results are presented below.

Table 1: *Data About the Sampling*

| Variables | N | Percent | Means for Role Groups | | | | |
			Social	Communication skills	Professional and Teaching	Management	Average
Classes							
1;2 classes	330	56,6	4,17	4,35	4,24	4,29	4,25
3;4 classes	253	43,39	4,21	4,35	4,23	4,29	4,26
Gender							
Girl	181	31	4,24	4,30	4,34	4,27	4,26
Boy	402	69	4,17	4,32	4,18	4,30	4,26
Department							
Textile	126	21,6	4,20	4,42	4,34	4,32	4,27
Metallurgy	121	20,8	4,27	4,32	4,22	4,36	4,25
Electric	128	22	4,17	4,32	4,16	4,15	4,24
Machine	110	18,9	4,12	4,34	4,16	4,30	4,22
Printing	98	16,8	4,17	4,36	4,27	4,33	4,23
Total	583	100	4,19	4,35	4,23	4,29	4,24

Table 2: *Data About the Educational Level of Parents of Teacher Candidates.*

| Educational Status of Parents | Frequencies | | Percentage | | Means | |
	Father	Mother	Father	Mother	Father	Mother
Masters and above	7	1	1,2	0,2	3,82	4,73
Illiterate	9	75	1,5	12,9	3,97	4,24
Undergraduate	52	28	8,9	4,8	4,28	4,18
Middle School	117	84	20,1	14,4	4,27	4,26
High School	133	77	22,8	13,2	4,26	4,30
Primary School	265	318	45,5	54,5	4,27	4,26

1st and 2nd year ($n_1 = 330$) teacher candidates, who have not yet acquired the required role behaviors in teaching profession, and 3rd and 4th year ($n_2 = 253$) teacher candidates, who were offered courses in acquiring these role behaviors, participated in the research (see Tables 1 and 2). The arithmetic average of all teacher candidates' perceptions of the ability to undertake teacher roles was $M = 110,79 / SD = 11,04$. In other words, the average score of 4,24 suggested that teacher candidates believed they "could definitely be a teacher" (5,00-4,21). In terms of role groups, teacher candidates' perceptions of the ability to undertake teaching roles were the highest in the "communication skills" ($M = 4,35$) group and the lowest in the "social roles" ($M = 4,19$) group. The educational status of the parents of a large proportion of teacher candidates was primary school. After that, it was observed at high school and secondary school level respectively. A very small portion was found to be at the level of undergraduate, graduate or above.

The Perception of Ability to Undertake Roles According to Classes
An ANOVA test was conducted to determine if there was a change in perceptions of the ability to undertake roles according to the courses in which teacher candidates could acquire teaching roles. It was observed that there was no serious differentiation between first and second-year teacher candidates, who had not taken the courses yet, and third- and fourth-year teacher candidates, who completed the courses ($p = 0,52 > 0,05$).

Table 3: *Data of the Roles of the Teachers' Taking Responsibilities According to the Classes.*

| Years | n | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
					Lower Bound	Upper Bound		
1;2 years	330	110,68	11,036	,608	109,49	111,88	26	130
3;4 classes	253	110,95	11,071	,696	109,58	112,32	71	130
Total	583	110,80	11,042	,457	109,90	111,70	26	130

Table 4: *ANOVA Test Data According to the Classes of the Candidates.*

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	9,963	1	9,963	,082	,775
Within Groups	70955,556	581	122,127		
Total	70965,520	582			

As a result of the ANOVA test, it was seen that class differentiation did not affect perceptions of the ability to undertake teacher roles ($F = 0,08$; $p = 0,77 > 0,05$). This result showed that there was no significant difference between the groups under examination in terms of influencing the dependent variable. It was also confirmed that there was not any difference between groups when they were compared in terms of role groups.

Data on the Attitudes of the Ability to Undertake Roles of the Candidates Studying at 3rd and 4th Year
After finding that class factor did not affect the perception of the ability to undertake roles, it was useful to examine which independent variables affected the perceptions of the candidates studying 3rd and 4th years to undertake teacher roles, when the courses aiming at acquiring these roles were intensely offered.

Table 5: *Demographic Data of Candidates in 3.and 4. Years.*

	Demographic Features		Social Rolls	Roles of Communication Skills	Profession and Teaching Roles	Management Roles	General
Distribution according to Gender	n	%	M	M	M	M	M
Girls	73	28,9	4,31	4,49	4,43	4,32	4,39
Boys	180	71,1	4,19	4,31	4,17	4,30	4,24
Total	253	100	4,25	4,40	4,30	4,31	
Distribution according to departments							
Textile	35	13,8	4,22	4,48	4,38	4,36	4,36
Metallurgy	55	21,7	4,34	4,32	4,24	4,42	4,33
Electrical	62	24,5	4,11	4,28	4,13	4,09	4,15
Machine	50	19,8	4,18	4,34	4,11	4,32	4,24
Printing	51	20,2	4,24	4,43	4,37	4,34	4,35
Total	253	100	4,22	4,37	4,25	4,31	4,29

The Perception of the Ability to Undertake Roles According to Gender
The perception of teacher candidates' ability to undertake roles according to their gender was comparatively provided in Figure 1. It was observed that the perceptions of female candidates' ability to undertake roles ($n = 73$; $M = 114,3 / 4,39$) had higher frequencies male candidates ($n = 180$; $M = 109,5 / 4,24$). When distributions of both genders according to role groups were compared, their communication skills roles ($M = 4,37$) were higher compared to other role groups.
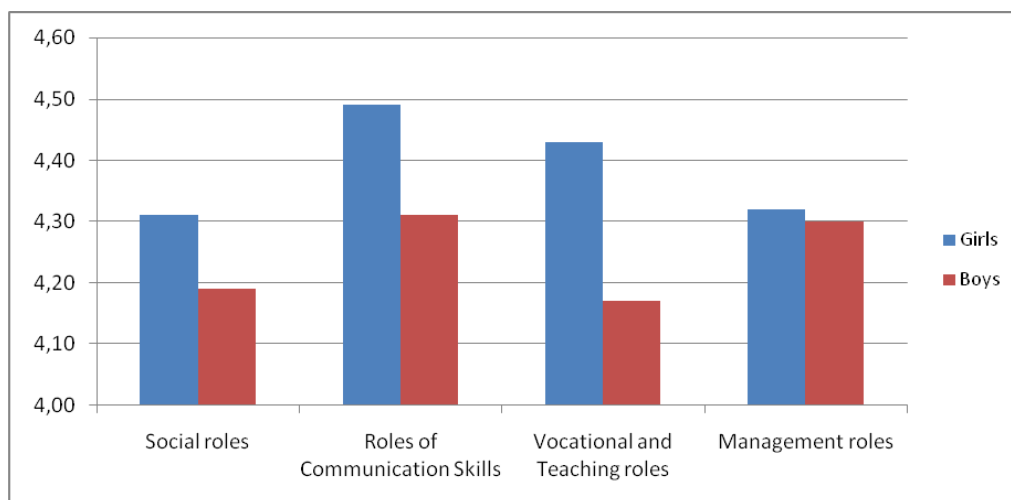
Figure 1. Column chart of the arithmetical average of the perception of the ability to undertake roles by gender according to the role groups.

On the other hand, the perceptions of the ability to undertake social roles ($M = 4,22$) were lower compared to other group roles. Particularly, the perception of the ability to undertake professional and teaching roles was lower ($M = 4,25$) than the other groups. In the homogeneity of variance test, which was performed to understand whether gender factor had an effect on the perception of the role competence of teacher, it was seen that there was no difference between variances since $p = 0,17 > 0,05$ was obtained as a result. As a result of the ANOVA test, gender differences were seen to affect the perception scores of the ability to undertake teacher roles ($F = 10,32$; $p = 0,001 < 0,05$).

The Perception of the Ability to Undertake Roles According to Departments
When the perceptions of the ability to undertake teaching roles were compared, candidates studying in the Textile Education department ($n = 35$; $M = 113,4$) preferred more than students from other departments. Students in the Electrical Education department ($n = 62$; $M = 107,98$) had the lowest frequency of perception score of the ability to undertake the roles. Figure 2 provides a more visual representation of the role attitudes distribution of the teacher candidates in various departments by role groups.
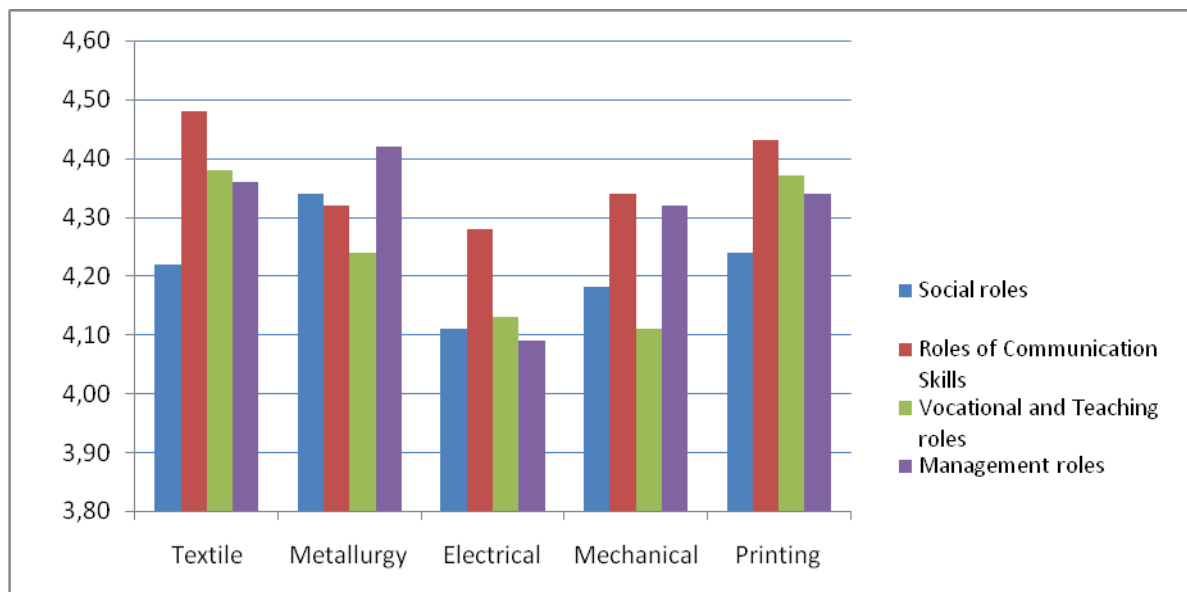
Figure 2. Chart of the distribution of role groups according to the factor of departments (M).

Except for Metallurgy Education department, the most frequently preferred role group was in the communication skills role group ($M = 4,37$), and as for the ability to undertake roles the least frequency was observed in the Social role group ($M = 4,22$). Even though there was not a large degree of differentiation among departments in terms of averages, it was noteworthy that the ones every role group were Textile Education ($M = 4,36$) and Printing Education ($M = 4,35$) departments. Teacher candidates in the Electrical Education perceived themselves to be able to undertake the roles with the least frequency. The department that expressed, with the least frequency, the ability to undertake teaching roles was Electrical Education ($M = 4,15$). Except for the Electrical Education department, other departments' choice of management roles as the ability to undertake top level roles at second place was another most striking point. In order to understand whether the department factor had an effect on the perception scores of the teacher candidates' ability to undertake roles, the homogeneity of variance was tested, and the $p = 0,077$ value was obtained. In this case, since $p = 0,07 > 0,05$, it can be concluded that there was no difference between variances according to departments. As a result of the ANOVA test, it was seen that the differences in departments affected the perception scores of the ability to undertake teacher roles ($F = 2,43$; $p = 0,048 < 0,05$). Even though there was no serious divergence observed in terms of arithmetic mean in analysis of significance between departments, when the standard deviations were considered, it was observed that Textile Education department ($M = 113,46$; $SD = 8,71$), compared to other departments, had accumulation in a narrow and upper area (Min: 92, Max.: 127) and preferred attitudes in higher numbers. In comparison to this, Mechanical Education department ($M = 109,50$; $SD = 13,31$) demonstrated an attitude that spread over a larger area (Min.: 71, Max.: 130).

Table 6: *Tukey Test Results According to Department Factors.*

	(I) B	(J) B	Mean Difference (I-J)	Std. Error	95% Confidence Interval	
					Sig.	Upper Bound
1 Textile	2	1,421	2,367	,975	-5,08	7,93
	5	5,473	2,314	,129	-,89	11,83
	6	3,957	2,413	,473	-2,67	10,59
	7	,379	2,403	1,000	-6,22	6,98
2 Metallurgy	1	-1,421	2,367	,975	-7,93	5,08
	5	4,052	2,028	,270	-1,52	9,62
	6	2,536	2,139	,760	-3,34	8,41
	7	-1,042	2,128	,988	-6,89	4,81
5 Electrical	1	-5,473	2,314	,129	-11,83	,89
	2	-4,052	2,028	,270	-9,62	1,52
	6	-1,516	2,081	,950	-7,23	4,20
	7	-5,095	2,069	,103	-10,78	,59
6 Mechanics	1	-3,957	2,413	,473	-10,59	2,67
	2	-2,536	2,139	,760	-8,41	3,34
	5	1,516	2,081	,950	-4,20	7,23
	7	-3,578	2,179	,472	-9,57	2,41
7 Printing	1	-,379	2,403	1,000	-6,98	6,22
	2	1,042	2,128	,988	-4,81	6,89
	5	5,095	2,069	,103	-,59	10,78
	6	3,578	2,179	,472	-2,41	9,57

In the table, it was remarkable that teacher candidates in Electrical Education and Mechanical Education departments had significantly weaker perceptions of their ability to undertake roles, and in the multiple comparisons of candidates studying in other departments, their perceptions generally were stronger. While among Textile Education ($M = 113,46$), Electrical Education ($F = 5,47$) and Mechanical Education ($F = 3,95$) a difference in favor of Textile Education was observed; yet in comparison with Metallurgy Education ($F = 1,42$) and Printing Education ($F = 0,37$), a low level difference in favor of Textile Education was not observed. While in the comparison between Metallurgy Education ($M = 112,04$), Electrical Education ($F = 4,05$) and Mechanical Education ($F = 2,53$), a difference in favor of Metallurgy Education was observed; in the comparison between Textile Education ($F = -1,42$) and Printing Education, a difference ($F = -1,04$) in favor of Textile Education was not observed. When Electrical Education ($M = 107,98$) was compared with other departments, results were observed to be against Electrical Education ($F = -1,51 – -5,57$). While in the comparison between Mechanical Education ($M = 109,50$) and Electrical Education, a significant difference, even though slight, was observed in favor of Mechanical Education ($F = 1,51$); whereas in the comparison with other departments a difference against Mechanical Education was found. In the comparison between Printing Education ($M = 113,08$) and Textile Education a difference against Printing Education ($F = -0,37$) was observed; whereas, with Electrical Education $F = 5,09$, with Mechanical Education $F = 3,57$, and with Metallurgy Education a significant difference of $F = 5,09$ in favor of Printing Education was observed. The difference among the perception scores of the teacher candidates' ability to undertake roles studying at different departments was seen to be in favor of Textile Education ($M = 113,46$).

The Perception of the Ability to Undertake Roles According to Father's Educational Status
Whether there was a difference in the perceptions of teacher candidates' ability to undertake roles according to their fathers' educational status was evaluated. Considering the scores the participants obtained, a large proportion of the candidates' fathers ($n = 109$) were seen to be primary school graduates. Looking at the score comparisons, no matter how little it was ($n = 5$), it was seen that teaching role perceptions of the candidates whose fathers were the graduates of masters and higher were seen to possess the lowest score of the group ($M = 97,00$). It was observed that candidates whose fathers were illiterate obtained a lower score ($M = 107,33$) than others. Considering the members of other groups that participated in the research, it was seen that the rate of those whose fathers were graduates of secondary school, high school, masters or higher, varied between $M = 110,81 – 112,26$. In order to understand whether the factor of father's educational status affected the perception

scores of the teacher candidates' ability to undertake roles, homogeneity of variance and ANOVA tests were applied. Since $p = 0,122 > 0,05$ was obtained, it was concluded that there was no difference between variances according to father's educational status. As a result of ANOVA test, looking at the significance of difference between groups, it was observed that differences in father's educational status did not affect the perception scores of the ability to undertake teacher roles ($F = 1,88$; $p = 0,098 > 0,05$). These results showed that there was no difference between the groups in terms of dependent variables.

As a result of the evaluation of the Tukey test applied in the comparisons between groups, while those whose fathers were illiterate ($M = 107,33$) and whose fathers were university graduates ($M = 97,00$) showed a different negative perception compared to other groups, whereas the perceptions of other groups generally were seen to show higher difference. Between these groups, when teacher candidates, whose fathers were high school graduates ($n = 57$; $M = 112,26$) were compared with other groups, their perceptions of the ability to undertake roles were higher. For the more detailed assessment of the direction of difference between the educational statuses of the teacher candidates' fathers and candidates' perceptions of the ability to undertake roles, the values at the Tukey test was examined and it was seen that those whose fathers were illiterate ($n = 3$) expressed higher ability to undertake more teaching roles ($F = 10,33$) in comparison with those whose fathers were graduates of masters or higher.

While the difference between the teacher candidates whose fathers were secondary school graduates ($n = 51$; $M = 110,88$) and the teacher candidates whose fathers were graduates of masters or higher was $F = 13,88$, with those having illiterate fathers a favorable difference was $F = 3,54$, and between the university ($F = -0,93$) and high school graduates ($F = -1,38$) an unfavorable difference was observed. The difference of $F = 0,07$ between primary school graduates was not significant enough. While in the comparison between the teacher candidates whose fathers held a graduate degree ($n = 28$; $M = 111,82$) and the other groups, a very significant and favorable difference of $F = 14,82$ was observed especially in those whose fathers were graduates of masters or higher, a favorable difference stood out with those whose fathers were illiterate by the difference of $F = 4,48$, with primary school graduates by the difference of $F = 1,01$ and with secondary school graduates by the difference of $F = 0,93$. However, when compared with those whose fathers were high school graduates, an unfavorable difference of $F = -0,44$ was observed.

When the perceptions of the ability to undertake roles of teacher candidates whose fathers were primary school graduates ($n = 109$; $M = 110,81$) were compared with the perceptions of those whose fathers were graduates of masters or higher, $F = 13,80$ was obtained, whereas when the perceptions of the ability to undertake roles of those whose fathers were primary school graduates were compared, a difference of $F = 3,47$ was obtained in favor of those whose fathers were primary school graduates. When the perceptions of the ability to undertake roles were compared with other groups, a difference ranging between $F = -0,75$ and $-1,45$ was observed in favor of those whose fathers are primary school graduates. In the comparison of significance between teacher candidates whose fathers were high school graduates ($n = 57$; $M = 112,26$) and the perceptions of the ability to undertake roles of teacher candidates from other groups, the perceptions of those whose fathers were high school graduates, compared to those whose fathers were graduates of masters or higher ($n = 5$; $M = 97,00$), were seen to indicate attitudes in a more positive direction with the difference of $F = 15,26$. In the comparison of significance with the perceptions of the ability to undertake roles of those whose fathers were illiterate and whose fathers were high school graduates, a significance was obtained in favor of those whose fathers were high school graduates with a difference value of $F = 4,93$. However, differences changing between $F = 0,44$ and $1,45$ were obtained in the attitudes put forward by the candidates of other groups. In the comparison of significance between the perceptions of the ability to undertake roles of the teacher candidates whose fathers were university graduates and the perceptions of the ability to undertake roles of teacher candidates at other groups, an unfavorable difference ranging between $F = -10,33$ and $F = -15,26$ was observed in every group. These values show that teacher candidates, whose fathers were graduates of masters or higher, considered themselves inadequate in terms of the ability to undertake teaching roles.

The Perception of the Ability to Undertake Roles According to the Reason to Choose the Department
A large majority ($n = 103$) of the teacher candidates chose their departments in order to have careers, and mentioned another reason in the second place ($n = 67$), and indicated in the third place that their scores were only enough for this department ($n = 42$). Other participants, who constituted a small part of the group, attributed their reasons to choose departments for other reasons. In the homogeneity of variance test conducted, the value of $p = 0,39 > 0,05$ showed the conclusion that there was no difference between the variances according to departments. As a result of ANOVA test, it was seen that the reasons to choose department did not affect the perception scores of the ability to undertake teacher roles ($F = 1,15$; $p = 0,32 > 0,05$). In order to determine among which groups the difference was groups were compared with each other.

Table 7: *Tukey Test Results According to Department Selection Reasons.*

(I) Department Choice	(J) Department Choice	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1 Beginning to work at early age	2	10,825	5,569	,453	-5,73	27,38
	3	2,421	4,059	,997	-9,65	14,49
	4	,325	3,841	1,000	-11,09	11,74
	5	,778	5,824	1,000	-16,54	18,09
	6	2,164	4,471	,999	-11,13	15,46
	7	,559	3,923	1,000	-11,10	12,22
2 Continuing the family profession	1	-10,825	5,569	,453	-27,38	5,73
	3	-8,405	4,511	,507	-21,82	5,01
	4	-10,501	4,316	,189	-23,33	2,33
	5	-10,048	6,148	,660	-28,32	8,23
	6	-8,662	4,886	,568	-23,19	5,86
	7	-10,267	4,389	,230	-23,32	2,78
3 My score was sufficient for this department	1	-2,421	4,059	,997	-14,49	9,65
	2	8,405	4,511	,507	-5,01	21,82
	4	-2,096	2,023	,945	-8,11	3,92
	5	-1,643	4,823	1,000	-15,98	12,69
	6	-,257	3,055	1,000	-9,34	8,83
	7	-1,862	2,175	,978	-8,33	4,60
4 Having a profession	1	-,325	3,841	1,000	-11,74	11,09
	2	10,501	4,316	,189	-2,33	23,33
	3	2,096	2,023	,945	-3,92	8,11
	5	,453	4,641	1,000	-13,34	14,25
	6	1,839	2,759	,994	-6,36	10,04
	7	,234	1,734	1,000	-4,92	5,39
5 Beginning a business	1	-,778	5,824	1,000	-18,09	16,54
	2	10,048	6,148	,660	-8,23	28,32
	3	1,643	4,823	1,000	-12,69	15,98
	4	-,453	4,641	1,000	-14,25	13,34
	6	1,386	5,175	1,000	-14,00	16,77
	7	-,219	4,709	1,000	-14,22	13,78
6 Only to study at a university	1	-2,164	4,471	,999	-15,46	11,13
	2	8,662	4,886	,568	-5,86	23,19
	3	,257	3,055	1,000	-8,83	9,34
	4	-1,839	2,759	,994	-10,04	6,36
	5	-1,386	5,175	1,000	-16,77	14,00
	7	-1,605	2,872	,998	-10,14	6,93
7 Other …..	1	-,559	3,923	1,000	-12,22	11,10
	2	10,267	4,389	,230	-2,78	23,32
	3	1,862	2,175	,978	-4,60	8,33
	4	-,234	1,734	1,000	-5,39	4,92
	5	,219	4,709	1,000	-13,78	14,22
	6	1,605	2,872	,998	-6,93	10,14

As can be seen from the table, those, who chose the departments they were studying for the reasons of continuing the family profession (*n* = 7; *M* = 101,29), their scores were only sufficient for this field (*n* = 42; *M* = 109) and only wishing to study at a university (*n* = 19; *M* = 109), expressed attitudes with lower frequencies compared to the members of other group, thus it was seen that the difference for these groups were in negative direction and the assessments resulted against these three groups. While teacher candidates, stating their perceptions of the ability to undertake roles in connection with the choice of taking an early step in life, were seen to have completely positive effect on the change of perception, whereas in the comparison of the candidates, who showed justification of having a career (*n* = 103; *M* = 111) and other preferences, with other groups, it was observed that the perceptions of the ability to undertake teaching roles generally had an effect of change in positive direction.

The Perception of the Ability to Undertake Roles According to Compatibility Perception Between Profession and Identity

Teacher candidates were asked to comment on whether the field they chose to study were consistent with the characteristics of their personality. Almost half of the group (*n* = 107) were seen to perceive their personalities enough to go with their professions. It was noteworthy that there was not a very big difference between the numbers of those who did not consider their personalities consistent with their professions (*n* = 52) and the numbers of those who considered consistent (*n* = 88). In the analysis of variance, since *p* = 0,51 > 0,05 was obtained, it was concluded that there was no difference between the variances. As a result of ANOVA test, it was seen that the differences of opinions regarding the compatibility of the department and personality did not affect the perception scores of the ability to undertake teacher roles (*F* = 2,18; *p* = 0,091 > 0,05). According to the results of Tukey test conducted in order to determine between which groups this difference took place, it was remarkable that when teacher candidates, who considered their professions consistent with their personalities (*n* = 88; *M* = 12,51 were compared with other candidates, their perceptions of the ability to undertake roles were significantly in positive direction, whereas when those who studied at other departments were in multiple comparisons, their perceptions of the ability to undertake roles that they developed generally were lower difference in negative direction. In the comparison of candidates, who considered that their personalities were not consistent with their professions, with other groups, the results were against the group. In other words, those who answered this question as "no" (*n* = 52; *M* = 107,85) expressed an attitude towards their inability to undertake teacher roles in comparison with those in other groups.

The Perception of the Ability to Undertake Roles According to the Perception of Efficiency in Terms of Professional Knowledge and Skill

While a large part of the group (*n* = 118; *M* = 110,98) stated that their knowledge and skills were fairly well, a large part (*n* = 91; *M* = 112,22) stated that they saw themselves adequate. However, a substantial number of teacher candidates (*n* = 39; *M* = 107,74) said they considered themselves inadequate in terms of knowledge and skills.

Table 8: *Data of Professional Knowledge and Skill Adequacy Factor.*

	n	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1 Yes	91	112,22	10,380	1,088	110,06	114,38	85	130
2 No	39	107,74	11,612	1,859	103,98	111,51	80	125
3 Fair	118	110,98	11,305	1,041	108,92	113,04	71	130
4 No idea	5	112,00	11,832	5,292	97,31	126,69	98	130
Total	253	110,95	11,071	,696	109,58	112,32	71	130

In the homogeneity of variance test about the adequacy factor in terms of professional knowledge and skills required by the department, since *p* = 0,90 > 0,05 was obtained, it was concluded that there was no difference between variances. As a result of ANOVA test, it was seen that the differences of opinions in the adequacy of professional knowledge and skills did not have any effect on the perception scores of the ability to undertake teacher roles (*F* = 1,51; *p* = 0,21 > 0,05). In the comparison of teacher candidates who considered their knowledge and skills to be sufficient (*n* = 91; *M* =112,22) with other candidates, their perceptions of the ability to undertake roles were significantly seen to be higher, whereas the perceptions of those, who considered their knowledge and skills to be inadequate (*n* = 39; *M* = 107,74), were seen to have a negative difference in comparison with those expressing different opinions.

The Perception of the Ability to Undertake Roles According to the Desire of Changing the Department if Given a Chance

When the data were examined, the number of those who wished to change department constituted almost all of the sample ($n = 219$; $M = 110,81$). However, those who wished to continue their departments posed a smaller number.

Table 9: *Data of the Factor of the Satisfaction from the Department.*

	n	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1 Yes	219	110,81	11,220	,758	109,32	112,31	71	130
2 No	27	111,78	10,537	2,028	107,61	115,95	86	130
3 No idea	7	112,00	9,363	3,539	103,34	120,66	98	123
Total	253	110,95	11,071	,696	109,58	112,32	71	130

The homogeneity of variance test on the factor of desire to study at another department was applied, it was concluded that there was no difference between variances since $p = 0,74 > 0,05$ was obtained. As a result of ANOVA test, it was observed that the differences of attitude regarding the desire to study at another department did not affect the perception scores of the ability to undertake teacher roles ($F = 0,12$; $p = 0,88 > 0,05$).

Table 10: *Tukey Test Results of Department Selection Factor.*

(I) Department Alternative	(J) Department Alternative	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1 Yes	2	-,965	2,266	,905	-6,31	4,38
	3	-1,187	4,266	,958	-11,24	8,87
2 No	1	,965	2,266	,905	-4,38	6,31
	3	-,222	4,712	,999	-11,33	10,89
3 No idea	1	1,187	4,266	,958	-8,87	11,24
	2	,222	4,712	,999	-10,89	11,33

As it can be seen from the table, in the comparison of those who wished to change their departments ($n = 219$; $M = 110,81$) with other candidates, it was noteworthy that their perceptions of the ability to undertakes roles were significantly lower. In addition to this, when those who were indecisive about changing their departments ($n = 7$; $M = 112$), even though their numbers were less, were compared with those in other groups, their perceptions of the ability to undertake roles generally were higher.

CONCLUSION AND EVALUATION

1st, 2nd, 3rd and 4th year students, studying at different departments of Technical Education Faculty at a state university located in Istanbul, who were chosen as samples in this research, were asked about their attitudes regarding what extent of ability they possess to undertake the behaviors of teaching roles. The candidates indicated their attitudes, with 4,35 and in the level of "Definitely I can" (5,00 – 4,21), on whether they would undertake a total of 26 different roles grouped as social roles, communication skills roles, professional and teaching roles and managerial roles. In the research conducted by Erişen and Çeliköz (2003) in which they included the teacher candidates studying at Technical Education Faculty of Marmara University, it was seen that this level was found to be even lower and the candidates considered themselves "partially adequate" in terms of general teaching roles. This research also determined the demographical characteristics of the vocational teacher candidates participating in this research through independent variables. It was seen that males constituted a large majority of the candidates; the majority of parents were primary school graduates; the numbers of those who came from families of master graduates and higher were almost non-existent. A large majority of the candidates stated that they chose the department they currently study in order to have a career. In the research, candidates considered their personalities with the departments they study to be on consistent level of "all right." What should not be ignored was that a large number of candidates did not see their personalities consistent with the department they study. Another variable that might help in terms of making sense of this category was whether the candidates found themselves adequate in professional knowledge and skills. In this category, too, while a

significant number of candidates considered themselves on the level of "fairly well" adequacy, a substantial amount of candidates did not consider themselves adequate. This result is consistent with the data obtained by Erişen and Çeliköz (2003). Another independent variable, which questioned technical education, was the variable in which candidates were asked about whether they were satisfied with the department they currently study. While almost all of the candidates stated an attitude of "I will change the department I am studying if a chance is given" ($N = 498$), only 58 candidate declared that they did not agree with this idea. This result failed to prove the expectations. However, Sağlam (2008) found a positive correlation between prospective music teachers' sympathy for their profession and their attitudes towards teaching.

No significant difference was seen in the comparison of the candidates especially with 1st and 2nd year classes and 3rd and 4th year classes. A similar result was obtained by Bulut (2008). He did not observe significant change in the attitudes of the students expected as class levels ascended. But, Sağlam (2008) had found such a significant change.

Vocational teacher candidates perceived themselves to be more sufficient in the roles regarding their communication skills in terms of role groups compared to other roles. In the lowest level, they considered themselves adequate in terms of social roles. However, Yeşilyurt (2010) received positive results from his study carried out on the dispositions of prospective teachers of Technical Education regarding their collaboration roles which also include their social skills. The participants expressed that they perceived themselves competent in terms of both social and personal skills.

Both in the research of Erişen and Çeliköz (2003) and in this research, gender was seen to affect the perception of the ability to undertake professional behaviors and teaching roles. Female candidates considered themselves to be more apt for teacher roles in comparison with males. The data obtained also overlapped with the outcome put forward by Akbaş and Çelikkaleli (2006) in their research that female children developed a more positive attitude towards performing behaviors required by teaching profession.

Çelenk (1988) and Oral (2004), in the research they conducted, showed that the attitudes of female teacher candidates regarding teaching profession were more optimistic in comparison with males. Çapri and Çelikkaleli (2008) and Sağlam (2008) put forward that there was no change in the attitudes of the teacher candidates on this issue despite the passing years. In spite of the passing time, in this research too, resulting outcome in favor of females could be thought to emerge from the social perception that the teaching profession was a more suitable profession especially for women.

In the research of Erişen and Çeliköz (2003), it was seen that differences in the departments did not affect the perception of competence regarding the teacher conducts. In some areas, students of Electrical and Metallurgy Education departments perceived themselves to be more competent compared to the students of Printing and Construction departments. However, it was seen in our research that departments that candidates study at affected their perceptions of competence of the teaching roles. It was understood that while from the departments, teacher candidates, especially studying at Textile Education department, considered themselves to be more competent in terms of the adequacy of teaching roles compared to the departments, whereas department of Electrical education regarded itself to be the least competent department among the departments participating in the research. The findings showed parallelism with the results acquired by Erişen and Çeliköz (2003), Oral (2004), Şeker, Deniz and Görgen (2005), Bulut and Doğar (2006) and Çapri and Çelikkaleli (2008). It was observed in the research that attitudes towards teaching profession varied according to the branches.

When gender and department factors, which were discovered to have effect on the differentiation of the attitudes, were considered, males need to be improved in terms of teaching roles. Although candidates' roles of professional field were at the expected level, it was necessary to review programs in this respect since "social roles" and "managerial roles" were not at the desired level. In addition, this difference was expected to result favorably in the 3rd and 4th years in which the skills of teaching roles were acquired, but it was seen that this factor did not have much effect. Low educational level of the parents of a large part of candidates and substantially less number of candidates, whose parents were graduates of masters and higher, showed the need to review the candidate selection.

Although "the result of candidates' dissatisfaction with the field they study at" had no effect on the perceptions of the ability to undertake roles, it once more presented the need to review the problem in technical education, to address the programs in this regard, to go over the conditions of employment again from this perspective. Even though half of the answers that candidates gave for the reasons to study at university were stated in the form of having a career, it was quite significant that the answers of the rest of the candidates were gathered upon having

only sufficient scores for this field and other options. It showed that these candidates, most of whom were from vocational high schools, wished to study at a technical education faculty and did not willingly make a choice. It made necessary to review employment at higher education, guidance at secondary school education in general and in particular, vocational training program, education, training and guidance.

Although educational programs were not well–designed, lower motivation, reluctance and the shift of interest could be seen in teacher candidates due to reasons such as program errors in vocational education, economic status of the country, and political policies and parental status. A good vocational teacher should go into the profession by knowing himself well, in peace both with himself and his environment, fully-equipped in terms of professional knowledge and skills and having an actionary personality in terms of teaching profession. From teaching courses that help to acquire these knowledge and skills, the contents of the courses like Classroom Management and Private Teaching Methods should not only be developed in a way to equip the candidates in terms of acquiring knowledge and skills, but at the same time, to prepare them in terms of skills of emotional field.

The results, put forward by the research, showed the need for the transition systems between secondary school and higher education, programs of higher education and the further expansion of the researches conducted on employment policies. Alternative programs need to be developed by concretizing especially candidates' reasons for choosing vocational education and investigating the usefulness of the training programs. The ways for more exact job satisfaction and alternative employment policies with higher social status should be investigated by researching the employment areas of the graduates of vocational education. The reasons for especially choosing vocational education by the lowly-educated sections of the society should be investigated thoroughly, selection and placement ways, which enable all sections of the society to make choices in this area, should be searched.

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CLUSTER ANALYSIS OF ADOLESCENT BLOGS

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ABSTRACT
Emerging web applications and networking systems such as blogs have become popular, and they offer unique opportunities and environments for learners, especially for adolescent learners. This study attempts to explore the writing styles and genres used by adolescents in their blogs by employing content, factor, and cluster analyses. Factor analysis was used to identify the factors that influence the genres of adolescents' blogs, and cluster analysis was used to divide the adolescents' blogs into the topic balanced group and the expression of feelings group. The findings revealed that the two groups of adolescents showed a difference in blog background, genres, and use of Internet language variables. Additionally, female adolescent bloggers tended to post more articles than male bloggers. Furthermore, the number of posted articles between female and male adolescents varied in some genres.
Keywords: blog, adolescent blogger, adolescent blogs, cluster analysis, Web 2.0

INTRODUCTION

Blogging has gained in popularity and has become a valuable part of the learning environment network in the Web 2.0 era, where learners are able to conveniently post articles with text, graphics, and other multimedia components on the Internet (Ellison & Wu, 2006; Liu & Chang, 2010; Liu, Ho, & Song, 2011; Lou, Wu, Shih, & Tseng, 2010; Mouhtouris, 2006; Schmidt, 2007; Tan, Ladyshewsky, & Gardner, 2010). In this respect, O'Reilly (2005) has highlighted several characteristics of Web 2.0, such as the web-based platform, which harnesses collective intelligence and enriches the experiences of its users. In other words, in the Web 2.0 era, greater attention is directed toward learners as their preferences are given greater consideration, and services are provided that meet the varying and diverse needs related to learning and instruction.

A blog can be broadly defined in two ways: its usage and its function. With respect to usage, a blog can be considered a type of diary that incorporates a rich corpus of multimedia information and is maintained on the web by its users so they can share their thoughts with other users (Blood, 2002; Herring & Paolillo, 2006; Herring, Scheidt, Wright, & Bonus, 2005; Kalelioglu & Gulbahar, 2010; Kiyici, 2010; Liu & Chang, 2010). Additionally, blogs offer an exciting new opportunity to deliver individual opinions, share ideas, interact, and communicate with others on the Internet. Blogs can also be used as a collaborative tool for student groups and instructors as a medium for tasks such as delivering news, messages, and resources as well as a means to encourage discussions and provide feedback and comments (Chen, Liu, Shih, Wu, & Yuan, 2011; Liu, Lin, & Chang, 2010; Shih, 2010; Tilfarlioglu, 2011; Wang, 2010; Weller, Pegler, & Mason, 2005). With respect to

function, a blog contains information regarding delivery functions. These include Really Simple Syndication (RSS), comments, trackback ping, blogroll, and archives (Winer, 2003). Furthermore, a blog is a network where the emphasis is on individuality and where the interface is easy to use so that learners can create their own space (Curling, 2001; Nardi, Schiano, Gumbrecht, & Swartz, 2004; Wells, 2006).

According to the literature, there are numerous ways to classify blogs. For example, a blog can be classified as personal or collaborative depending on the number of blog owners. A blog can also be classified by subject (such as knowledge, war, politics, companies, media, videos, etc.; Fievet & Turrettini, 2004). Blood (2002) identified three basic types of blogs: filter, personal diary, and notebook. These three types are defined as follows:

(1) Filter: The content of this blog is usually not related to the blogger. For instance, this type of blog records local, national, or international news and current affairs. This kind of blog article, therefore, is a filter in that it reflects the viewpoint of the blogger.

(2) Personal diary: This type of blog differs from the filter blog in that it records the immediate circumstances of the blogger. For example, the blogger may post personal thoughts regarding an event or post comments relating to some real-life situation.

(3) Notebook: This kind of blog consists of elements of both the filter blog and the personal diary blog. In this type of blog, articles usually contain more words, and each posting or article is generally topic specific.

The basic classification unit is the blog article; thus, the more filter type articles a blog has, the greater the possibility that the blog will be classified as a filter blog. In the early days of blogging, according to Blood's viewpoint, the filter type blogs were more common than the personal diary and notebook type blogs. However, as a result of increased blogging in recent times, the personal diary blogs have become much more common and popular.

In contrast to and in conjunction with Blood's definition, Krishnamurthy (2002) classified blogs into two dimensions: personal/topic and individual/community blogs. These were then further divided into four types. In Blood's classification, the emphasis was on the individual whereas Krishnamurthy also recognizes a community dimension (Figure 1). For instance, a group of people who blog for various reasons or seek advice (such as new mothers) belong to a blog type called the support group. According to Krishnamurthy (2002), personal journals fall into the online diary type, but Krishnamurthy (2002) further identifies those individuals who select and offer comments in response to the information that they gather on the web. This type of blogger is categorized as the personal comment type (also referred to as the filter type). Finally, those individuals who blog collaboratively with regard to a specific topic or purpose, such as an online game or a computer-related topic, are categorized under the discussion center type.
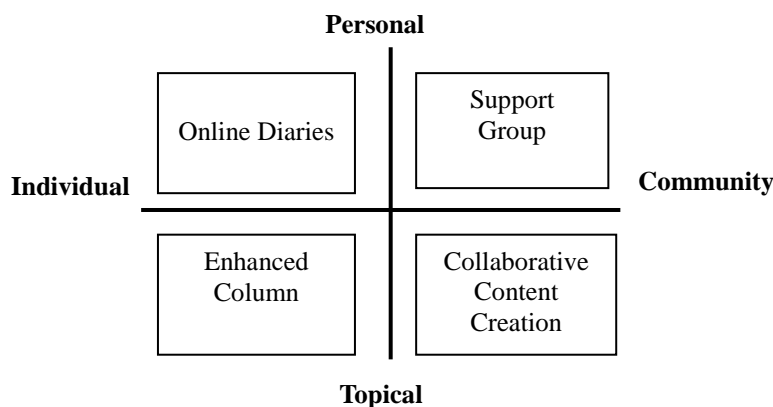
Figure 1: Four different blog types (adopted from Krishnamurthy, 2002)

Additionally, blogs can be classified into three types with respect to its purpose: personal journal, k-log, and filter type (Blood, 2000; Herring, Scheidt, Wright, & Bonus, 2005; Krishnamurthy, 2002). Personal journal refers to recording the blogger's thoughts, ideas, or things in everyday life, mainly for leaving records or expressing their feelings. A k-log blog implies that its primary content centers on information and knowledge or observations regarding some particular topic or project. Unlike the k-log, the filter type implies that its content consists of evaluations, comments, or ideas from bloggers. In the past, the classification of blogs was

based on the type of the article, the type of community, or the content of blog. However, there were cases where it was difficult to classify a blog with these three characteristics. For example, a student blogger would share their diary, their comments toward a specific hyperlink, or what they learn in the school. It's difficult to classify this student blog as k-log, personal diary, or filter blog. Therefore, it's a new issue to classify adolescents' blogs into different groups with automatic computer algorithm, and based on their respective distinctive characteristics, we gathered information from their blogs. However, few empirical studies have been carried out with respect to adolescent blogs for the purpose of classifying their blogs into groups according to blog genre (type of article) and even investigate the language use (networking writing styles).

RESEARCH METHOD

Participant

The participants of this study were adolescent bloggers between 12 and 18 years of age who were enrolled in either a junior or a senior high school. Initially, the seed blog of an adolescent was randomly selected from the blog service provider Wretch. Snowball sampling was used to randomly select two to three blogs that appeared as links on the originally selected blogs. The search was ended when there was no further hyperlink network could be tracked (Liu, Shih, & Tsai, 2011).

Finally, the chosen adolescent bloggers were required to meet the following criteria: the bloggers must be adolescent (between 12 and 18 years of age), they must have 50 or more articles posted on their blogs, and each article should contain around 300 words. The blog data were collected within three weeks to avoid the rapid change of the selected blogs. When a blogger posted an article within these three weeks, the research assistant must add the information into the database for further analyses.   A total of 48 blogs hosted by 24 male and 24 female adolescent bloggers were sampled (30 senior (62.5%) and 18 junior (37.5%) high students). There were 696 articles randomly selected for content analysis from the 48 blogs.

Procedure

Content analysis was used to identify the blog genre and language use of the sample articles. Through content analysis, 11 blog genres were obtained (Table 1), and 8 types of language use were found, e.g. phonetic symbols, homophones, Taiwanese dialect, letters, pictogram, digit symbols, text-based emoticon, and figure-based emoticon. The following analysis would use factor analysis to reduce the 11 blog genres and 8 types of language use to fewer factors, and use the factor score of those factors as the input of k-means clustering to find the type of blog automatically. The descriptive statistics was used to describe the basic characteristics of selected blogs. The MANOVA was used to compare the basic characteristics of different types of blogs.

Table 1: Classification and description of the blog genre

Category	Description
Feelings	Focuses life events; emotional expression; attitudes toward some events
Love	Focuses on love (the same gender or the opposite gender), including describing love stories, which may also involve recounting quarrels and amorous events.
Peer	Focuses on the description or record of friendships or arguments between friends.
Fans	Focuses on celebrities, including monitoring entertainment news, opinions on film stars (movies or albums). If the content of the article is simply copied from other places, the article is then categorized in the "paste" category, not in the "fans."
Interest	Focuses on the particular interests of the bloggers.
Call the roll	Focuses on this new popular game on the Internet. It is similar to a questionnaire, and urges bloggers or visitors to answer questions.
School	Focuses on the events taking place in school in addition to school life and examination related topics.
Creation	Focuses on the creative work of the blogger including music, texts, pictures, and photos, etc.
Sports	Focuses on field sports including feedback on sports events, and emotional responses regarding participation in sports clubs. If the content of the article is simply copied and pasted from other places, the article is categorized in the "copy and paste" category, not in the "fans."
Copy and paste	Articles were not originally written by the blogger, but originated from Internet, books, or other sources, and no adjustment was made to the original content.
Leisure	Focuses on leisure and entertainment including travel and play.

Data Analysis

Factor analysis was employed to analyze the types of articles and the language used in the blogs so as to explore the factors that influenced the subject matter in the blogs. According to the content analysis, there were approximately 19 "languages" used in the blogs, including the Na'vi language, phonetic symbols, homophones, Taiwanese dialect, pictograms, digit symbols, and symbols of emotions, such as text-based and figure-based emoticons. Table 2 shows the results of the factor analysis. Four factors were extracted. Factor 1: love, peers, and figure-based emoticons; Factor 2: letters, feelings, and Taiwanese; Factor 3: digit symbols, fans, and homophones; and Factor 4: sports, phonetic symbols, interest, and school. Each factor consisted of specific types of articles and Internet languages used in the blog. Thus, the researchers named the factors according to the article type. Factor 1 was named peer relationships; Factor 2 was named expression of feelings; Factor 3 was named fans; and Factor 4 was named entertainment and school.

Table 2: Factor loadings and eigen values for each factor

Items	Peer relationships	Expression of feelings	Fans	Entertainment and school
Love	**.88**	−.01	−.10	.00
Peer	**.77**	.26	.03	.25
Figure-based emoticon	**.69**	.11	.38	.05
Letters	−.06	**.85**	.14	.12
Taiwanese	.28	**.72**	.09	.07
Feelings	.12	**.71**	−.18	.24
Digit symbols	−.01	−.01	**.86**	−.08
Fans	.23	−.12	**.73**	−.03
Homophones	−.12	.41	**.71**	.13
Sports	−.27	−.04	−.06	**.75**
Phonetic symbols	.23	.16	.03	**.73**
Interest	.10	.10	−.04	**.63**
School	.17	.29	.09	**.56**
Eigen value	2.18	2.13	1.99	1.97
Cumulative percentage of variance	16.75	33.16	48.46	63.59
KMO sampling adequacy coefficient	.53***			
*** $p < .001$				

FINDINGS

Descriptive Statistics of the Adolescent Blogs

In this study, only the blogs with at least 50 posts were selected. It was found that 37.5 % of the blogs posted consisted of 101 to 150 articles and 29.2% consisted of 50 to 100 articles (Table 3). In total, there were 6912 articles posted by the bloggers, with an average of 114 articles per adolescent. Male bloggers posted an average of 117 articles, whereas females posted 171 articles. The articles written by male adolescent bloggers contained 349 words on average, whereas those written by females contained an average of 313 words. During the period of the study, male adolescent bloggers were actively engaged in their blogs for 21 months on average, whereas the operation period for female adolescent bloggers was 17 months.

Table 3: The total number of articles in the adolescent blogs

Total number of articles	Number of blogs	Percentage
50~100	14	29.2
101~150	18	37.5
151~200	7	14.6
201~250	4	8.3
251~300	3	6.2
301~	2	4.2
Total	48	100

With respect to article type (or blog genre), the results indicate that the topics were extremely diverse but focused primarily on feeling type and school type articles (Table 4). This may be because the adolescents' lives were primarily centered on their friends, schooling, and family. As a result, the events posted on the blogs tended to reflect such concerns. Further analysis on the content found that there was an emphasis on study pressure, peer interaction, love, and interactions or conflicts with their parents.

Table 4: Descriptive statistics of blog genres on the adolescent blogs

Type	#	%
Feelings	256	32.6
School	187	23.8
Peer	107	13.6
Love	79	10.1
Leisure	55	7.0
Copy and paste	46	5.8
Call the roll	20	2.5
Sports	16	2.0
Fans	10	1.3
Creation	7	0.9
Interest	3	0.4
Total	786	100

Due to an extensive immersion in networking, the new generation of adolescents has gradually resorted to a style of writing and language commonly found on the Internet or in blogs, for example, the Na'vi language. The Na'vi language differs substantially from everyday language in that the Na'vi language is creative and novel, thus allowing adolescents to demonstrate their uniqueness by using this language. As a result, the Na'vi language has gradually become a new form of sub-culture for adolescents.

According to the findings of this study, the Internet language most used by adolescents is the formal language used in their academics and personal lives. To appear endearing, the adolescents occasionally employ a form of Na'vi (Table 5). Table 5 shows that the adolescents' blogs used phonetic symbols (e.g., ㄅ means "no" in Chinese) the most and digital symbols (e.g., 5201314 means "I love you forever" in Chinese) the least. The possible reason why the phonetic symbols were used in blogs may be that adolescents prefer to chat or communicate as if involved in an online game. To save time, they preferred to use Chinese phonetic symbols to express ideas. When this misuse becomes a popular means of communication (Na'vi language), a subculture

is created. Thus, the Na'vi language and the Internet language used in the blogs are considered interchangeable.

Table 5: Descriptive statistics of the Na'vi language used in the adolescents' blogs

Forms of Na'vi language	#	%
Phonetic symbols	191	40.6
Homophones	141	30.0
Taiwanese dialect	88	18.7
Letters	37	7.9
Pictogram	10	2.1
Digit symbols	3	0.7
Total	470	100

The emoticon can be classified into a text-based emoticon (e.g., ^ . ^ means smile or happy) or a figure-based emoticon (e.g., 😊 also means smile or happy). The emoticon also represents a form of the Na'vi language (adolescent language used in a blog). The adolescent employs an emoticon for the purpose of expressing emotion and friendliness so as to create a closer relationship between the adolescent blogger and the readers. In analyzing the content of the blogs, we found that adolescents used text-based emoticons most often when engaged in blogging. A possible reason for using text-based emoticons is that they provide a short-hand way to express ideas, thus saving time.

Table 6: Descriptive statistics of emoticons used by the adolescents

Emoticon	#	%
Text-based emoticon	415	93.3
Figure-based emoticon	30	6.7
Total	445	100

Clustering Analysis of the Adolescent Blogs

The present study employed the K-means grouping method for the cluster analysis, in which the input data represented the factor scores that resulted from the factor analysis. By using the high and low values from the four factors identified above, sixteen possibilities were generated for each factor. Therefore, group sizes of two, three, four, and five were considered appropriate for the purpose of the cluster analysis. We found that when the sample was divided into three, four, or five groups, there were too many blogs in some of the groups; therefore, these categories were deemed inadequate for the purpose of explaining the sample characteristics. The best option was to classify the samples into two groups for further analysis. The group results are summarized in Tables 7 and 8.

The factor scores were standardized with the values ranging between -3 and 3. A scale for the factor scores was produced by dividing the factors into 11 equal parts. After converting the scores to the scale, the scale was then used to describe the characteristics for each group. Groups were, thereby, named according to their characteristics. Employing cluster analysis, the samples were divided into two groups, a topic balanced group and expression of feelings group. The topic balanced group (Group 1) consisted of 35 adolescent blogs (16 female bloggers and 19 male bloggers). This group is characterized by a scale of five with regard to peer relationships, fans, and entertainment and school (Table 7) and four points with respect to expression of feelings. In particular, the performance of this group is average, and the four ranking factors are moderate.

Table 7: Topic balanced group score scale table

Factor	Factor score	Scale
Peer relationships	− .25	5
Expression of feelings	−.42	4
Fans	.10	5
Entertainment and school	.03	5

The expression of feelings group (Group 2) received seven points for expression of feelings, six points for peer relationships, five points for fans, and five points for entertainment and school. Both expression of feelings and peer relationships obtained relatively high scores (Table 8). Thirteen adolescent blogs (eight female bloggers and five male bloggers) were also included in this group. With regard to the content analysis, the types of articles in such a blog focused on feelings, love, and peer relationships. Through reading the articles of this group, it was relatively easy to determine whether the adolescent blogger was happy or worried, the blogger's likes and dislikes, and whether the adolescent blogger was involved in interpersonal relationships that gave rise to any problems or concerns.

Table 8: Expression of feelings group score scale table

Factor	Factor score	Scale
Peer relationships	.69	6
Expression of feelings	1.14	7
Fans	− .27	5
Entertainment and school	− .09	5

Differences between the Two Groups in the Adolescent Blogs

Multivariate analysis of variance was used to test the differences between Groups 1 and 2 on the number of articles, the number of words, and the duration of blogging. The results indicate there was a significant difference between Groups 1 and 2 (Wilks' Λ = .68, p< .001) with respect to the three dependent variables. The post hoc comparison indicates that there was also a significant difference in the number of articles (p< .001). However, there was no significant difference between the two groups with respect to the number of words or duration of blogging (Table 9).

Table 9: Summary of the post-hoc comparison with number of articles, number of words, and the duration of blogging for the two groups

Dependent variable	Group	Mean difference	Standard error	95% Lower bound	95% Upper bound
Number of articles	G1−G2	−92.75***	20.04	−133.09	−52.41
	G2−G1	92.75***	20.04	52.41	133.09
Number of words	G1−G2	15.23	37.17	−59.59	90.05
	G2−G1	−15.23	37.17	−90.05	59.59
Duration of blogging	G1−G2	1.33	2.43	−3.55	6.22
	G2−G1	−1.33	2.43	−6.22	3.55

***p < .001

Multivariate analysis of variance was used to test the difference between Groups 1 and 2 in relation to the eleven blog genre posted by the bloggers. The results indicate there was a significant difference between Groups 1 and 2 (Wilks'Λ= .37, p< .001) with respect to the eleven dependent variables. The post hoc comparison indicates there were significant differences with regard to the four types of articles (p< .05): feelings, love, peer, and copy and paste. However, there was no significant difference between the two groups with respect to the other types of articles (Table 10).

Multivariate analysis of variance was used to test the differences between Groups 1 and 2 in relation to the Internet language used in the blogs. The results show that there was a significant difference between Groups 1 and 2 (Wilks'Λ= .37, p< .001) with regard to the eight dependent variables. The post hoc comparison also indicates that there was significant difference with regard to the three types of Internet language used in the blogs (p< .001), letters, Taiwanese, and text-based emoticon. There was no significant difference between the two groups with respect to the other types of Internet language used in the blogs (Table 11).

Table 10: Summary of the post-hoc comparison for the eleven types of articles in the blogs

Dependent variable	Group	Mean difference	Standard error	95% Lower bound	95% Upper bound
Feelings	G1－G2	–4.19*	.87	–5.94	–2.43
	G2－G1	4.19*	.87	2.43	5.94
Love	G1－G2	–2.20*	.70	–3.62	–.79
	G2－G1	2.20*	.70	.79	3.62
Peer	G1－G2	–3.17*	.77	–4.71	–1.63
	G2－G1	3.17*	.77	1.63	4.71
Fans	G1－G2	.08	.19	–.31	.46
	G2－G1	–.08	.19	–.46	.31
Interest	G1－G2	–.02	.08	–.18	.14
	G2－G1	.02	.08	–.14	.18
Call the roll	G1－G2	.02	.21	–.41	.44
	G2－G1	–.02	.21	–.44	.41
School	G1－G2	–1.17	.90	–2.99	.65
	G2－G1	1.17	.90	–.65	2.99
Creation	G1－G2	.10	.18	–.27	.45
	G2－G1	–.10	.18	–.45	.27
Sports	G1－G2	.25	.23	–.21	.70
	G2－G1	–.25	.23	–.70	.21
Copy and paste	G1－G2	–.80*	.35	–1.49	–.10
	G2－G1	.80*	.35	.10	1.49
Leisure	G1－G2	–.12	.45	–1.02	.79
	G2－G1	.12	.45	–.79	1.02

*p < .05

Table 11: Summary of the post-hoc comparison for the eight types of internet language used in the blogs

Dependent variable	Group	Mean difference	Standard error	95% Lower bound	95% Upper bound
Phonetic symbols	G1－G2	–2.24	1.48	–5.22	.73
	G2－G1	2.24	1.48	–.73	5.22
Digit symbols	G1－G2	.09	.08	–.07	.25
	G2－G1	–.09	.08	–.25	.07
Letters	G1－G2	–1.48***	.33	–2.14	–.81
	G2－G1	1.48***	.33	.81	2.14
Homophones	G1－G2	–1.25	1.47	–4.20	1.71
	G2－G1	1.25	1.47	–1.71	4.20
Taiwanese	G1－G2	–2.76***	.52	–3.81	–1.71
	G2－G1	2.76***	.52	1.71	3.81
Pictogram	G1－G2	–.03	.22	–.48	.42
	G2－G1	.03	.22	–.42	.48
Text-based emoticon	G1－G2	–7.55***	1.56	–10.69	–4.42
	G2－G1	7.55***	1.56	4.42	10.69
Figure-based emoticon	G1－G2	–.94	.64	–2.23	.35
	G2－G1	.94	.64	–.35	2.23

***p < .001

DISCUSSIONS

Adolescents often write various topics on blogs, and most are concerning their daily life and schooling because they are students and their life happens mainly at school and home. Thus, the content of their writings are affected by these two situations. Although they write articles about daily life and schooling, different bloggers focus on different perspectives. With the same topic of the articles, readers may read what happened at school or homework and test results in one blogger's article, while complaint about the teacher's threatening and discontent in the other. Additionally, some teenager bloggers write articles about interests, creativity writing, or sports. Therefore, we suggest that teenagers focus on writing a particular or specific topic in order to improve not only the quantity, but the quality of articles as well, and thus to distinguish the features of their blogs.

In this study, we found four factors, including peer relationship, expression of feelings, fans, and entertainment and school and used them as 4 genres to classify the adolescents' blogs effectively. Thus, the adolescents' blogs were classified into the "topic balanced group" and "expression of feelings group" according to the factor loadings of the four factors. Compared with "topic balanced group", we found the factor loadings are higher in "expression of feelings group" in terms of peer relationship and expression of feelings. That is, the content of the blogs of the expression of feelings group tend to have bloggers' personal expression of feelings involved, which concerns with interactions with peer and the opposite gender instead of just noting down things that happen daily. Furthermore, the statistics confirm that the expression of feelings group have more blog articles related to daily routine, romance, and peers than of the topic balanced group, which confirm the statistical results stated earlier. On the contrary, the topics of the articles vary and balanced and cover personal diary, peer relationship, creative writing, and entertainment. However, the diversity in genre could do negative impact to the quality and the quantity of the articles. Also, for easily managing the multiplicity of a blog, many bloggers would further classify their articles into more specific subtopics.

In general, adolescent bloggers hardly ever use a fixed theme, e.g. gourmet, traveling, or issues on gender, to share their articles. Instead, they always mixed all kinds of themes. Although four factors of adolescent bloggers were obtained and classified into two groups, we found little differentiation between these two groups. This reflects that the adolescents like to present themselves through writing various topics and some confusing net language, which may seem nonsense or meaningless to many of us, but meaningful to the adolescents. Readers from other generation should bear an open mind when reading their articles. In the past, Krishnamurthy (2002) use two dimensions: personal/topic and individual/community blogs to analyze the articles posted in teenagers' blogs, and four types of blogs were found. However, what kinds of topics would the teenagers write in the blogs did not stress clearly. This study further analyzed the content of the articles teenagers wrote in their blogs, and eleven kinds of blog were explored. The result indicated that students would share their feelings or daily life events in their blogs. This finding echoed the previous studies indicating that students would express their emotion and feeling through their blogs (Blood, 2002; Herring & Paolillo, 2006; Kalelioglu & Gulbahar, 2010; Kiyici, 2010; Liu & Chang, 2010). Gradually, blog has become a convenient media for teenagers to write some articles to express their emotion in their blogs. The result implied that teenagers' blogs could be viewed as another channel for teachers or parents to monitor or care the teenagers' daily life and emotion.

More interestingly, we found that teenagers did not only share their emotion, or record their daily life in the blogs. Actually, because blogs allow teenagers to use different kinds of materials, such as texts, photos, or videos to show their new ideas, to present their creative work, blogs provide more chance for teenagers to express their creativity in different forms. Additionally, the characteristics that information spread quickly in the internet world provide more opportunity for teenagers' creative works to be seen by others, and this will enhance teenagers' motivation to share and express their different creative ideas in their blogs. Blogs become another channel outside of the classroom for teenagers to express their creativity. We suggested that teachers could apply blogs into classroom to encourage students to express their creativity. However, we further noticed that students would copy and paste others' articles or works in their blogs to share the information. Obviously, teenagers would used blogs to be a channel for exchanging information, and "copy and paste" is a common behavior. Because students have more chance to use online information, internet ethics becomes an important issue. When teachers use blogs as an instructional or learning media, teachers should teach their students how to use this media, and how to use the information online appropriately.

Cyber environment is truly different from the real world. It is not necessary we take the subculture constructed by the Internet that serious. Most of practitioners and educators worry very much about the bad influence of t Na'vi language. They think the language use would lower students' language level. On the other hand, the use of Na'vi language can be treated as students' creativity. Also it may not have consequence between Na'vi

language and student's language competency, which means stopping students from using Na'vi language is no guarantee of good language level. To conclude, an instructor's teaching methods and content may also affect student's language learning, except student himself/ herself. Meanwhile, the findings of the study reveal that only a small amount of students use Na'vi language and some even dislike using it. As long as this language does not do too great impact to children, we should be more tolerant about this phenomenon for adolescents to present themselves. After all, mainstream culture and subculture can coexist in our society. Overtime, some cultures which do not evolve and fit the society may be extinct.

In this study, we analyzed the content of the articles the teenagers posted in their blogs, and explored different types of behaviors shown in the blogs. Blogs were viewed as a new media for adolescents to express their ideas or emotion. Moreover, blogs were a kind of open and interactive environment, and lots of interaction would happen between bloggers and their audiences through feedbacks or comments. In the future, in order to have deeper understanding about adolescents' behaviors in the blogs, it is essential for researchers to analyze the interaction between bloggers and their audiences, and to examine how the interactions between bloggers and their audiences affect adolescents' behaviors in the blogs.

CONCLUSIONS

The results indicate that adolescent blogs could be categorized into one of two groups based on significant differentiating factors. The two groups are the topic balanced group and the expression of feelings group. The distinguishing characteristics include the number of words, the length of time devoted to blogging, the types of articles, and the types of Internet language used in the blogs. With respect to the types of articles, the blogs relating to the expression of feelings group showed more emotions than the topic balanced group, and the articles dealt more with love and peer relationships. This group also included more copy and paste type articles. With respect to the Internet language used in the blogs, the expression of feelings group's blogs employed more letters, Taiwanese dialect, and text-based emoticon language than the topic balanced group. The mode of expression and manner of blogging in adolescent blogs appears, therefore, to be complex and subject diverse. The present study, however, employed cluster analysis to classify the adolescent blogs into two groups with their own distinctive characteristics.

Through the use of cluster analysis, one can clearly see that the groups of adolescents each possess distinct characteristics. In relation to the topic balanced group, the articles told superficial stories that involved a variety of themes and were all-encompassing, which could lead to the speculation that adolescents in this category were more lively, outgoing, and outspoken than those in the expression of feelings group. It may be assumed that blogs of the topic balanced group were less likely to be emotional, and that the bloggers were more concerned with recording main events in their lives.

The expression of feelings group's blogs were more concerned with peer relationships and emotions than the topic balanced group. The article content indicated that the adolescents appeared more sentimental and attentive than the other group. In this respect, articles focused on peer relationships and the bloggers were concerned with friendship and love. When reading articles posted by this group of adolescents, one can gain current information about the adolescents' social support systems.

Finally, because the adolescents were willing to express their thoughts and share their secrets on the blogs, the adolescents' blogs provided a window for teachers and parents to become more aware of the unusual attitudes and outlooks of the adolescents. Many adolescents, unable to cope with the pressures of the academic work have negative emotion. In fact, the messages posted in the blogs provide a means of monitoring and understanding the experiences of the adolescents as they communicate among themselves. Thus, in case parents or teachers have difficulty in communicating with adolescents, teachers and parents now have the option of browsing the personal blogs of their adolescents to understand their inner thoughts.

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EFFECTIVENESS OF AUTOMATED CHINESE SENTENCE SCORING WITH LATENT SEMANTIC ANALYSIS

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ABSTRACT
Automated scoring by means of Latent Semantic Analysis (LSA) has been introduced lately to improve the traditional human scoring system. The purposes of the present study were to develop a LSA-based assessment system to evaluate children's Chinese sentence construction skills and to examine the effectiveness of LSA-based automated scoring function by comparing it with traditional human scoring. Twenty-seven fourth graders and thirty-one six graders were assessed on single-character sentence making test (subtest 1) and two-character words sentence making test (subtest 2). The outcomes of LSA-based automated scoring methods in three Chinese semantic spaces generated from three type weighting functions were compared to the traditional human scoring. The results showed that LSA-based automated scoring in three different Chinese semantic spaces and traditional human scoring were highly correlated in single-character sentence making test and moderately correlated in two-character words sentence making test. The Chinese semantic space generated from Log-IDF outperformed the other two types of weighting function in the present study.

INTRODUCTION
Writing skills are important for children's overall attainment. It is probably one of the few skills we learned in school that will be used often later in life. Writing is an essential element of children's education which has an impact on the progress of children achievement across the whole curriculum. Writing is also a means of communication; it allows children to participate actively in learning by sharing ideas, experience, thoughts, and feelings (Huang, Liu, & Hsiao, 2008). Effective writing, which requires writing with clarity, coherence, organization, and accurate grammar, is difficult to achieve, since it involves complex physical and mental processes. One important aspect that is fundamental in learning to write is constructing complete and grammatically correct sentences (Chik, Ho, Yeung, Wong, Chan, Chung, & Lo, 2010; Chik, Ho, Yenng, Chan, & Luan, 2011; Saddler, 2005).

Sentence construction can be as difficult a skill to assess as it is to learn. Reliable assessment requires a set of well-developed criteria and a significant amount of time devoted to the scoring procedure. In the present study, an automated scoring system with Latent Semantic Analysis (LSA) was developed to assess children's Chinese sentence construction skills. The system was designed as a pedagogical tool to provide instant computer-generated scores for sentence construction and to reduce the heavy load in the scoring process.

Latent Semantic Analysis (LSA) is a theory and method for extracting and representing the contextual-usage meaning of words by statistical computations applied to a large corpus of text (Landauer & Dumais, 1997; Landauer, McNamara, Dennis, & Kintsch, 2007). It is closely related to neural net models, but is based on singular value decomposition (SVD) and LSA used singular value decomposition to condense a large corpus of texts to 100-500 dimensions (Landauer, Foltz, and Laham, 1998; Landauer et al., 2007). The applications of LSA in educational settings were found in few studies. For example, Millis, Magliano, Wiemer-Hastings, Todaro, and McNamara (2007) assessed reading comprehension skills with LSA and found that LSA predicted reading comprehension skills and identified readers overall reading strategies. LSA was also involved in developing computer tutors, which provide instant feedbacks and teach conceptual knowledge to learners in Newtonian physics (VanLehn, Graesser, Jackson, Jordan, Olney, & Rosé, 2007) and computer literacy (Graesser, Lu, Jackson, Mitchell, Ventura, Olney, & Louwerse, 2004). Moreover, Graesser and his colleagues (Graesser,

McNamara, Louwerse, & Cai, 2004; Graesser & McNamara, 2011; Graesser, McNamara, Kulikowich, 2011) developed a Coh-Metrix system with LSA to select appropriate texts for different levels of readers by providing multilevel analyses of text characteristics.

Past studies have shown that LSA has an enormous practical value in education; however, so far, LSA is not yet in the replacement of traditional human scorning. Therefore, the present study aimed at developing an automated scorning system of Chinese sentence construction skills with LSA by comparing the effects of three semantic spaces that were established by different types of weighting function (Log-Entropy, Log-IDF, TF-IDF). Few studies discussed the utility of applying different types of weighting function in LSA and found that Log-Entropy gave better results than the other proposed methods (Dumais, 1991; Lintean, Moldovan, Rus, & McNamara, 2010; Nakov, Popova, & Mateev 2001). Thus, generally in application, Log-Entropy was used to develop the semantic space of LSA (Chen, Wang, & Ko, 2009; Quesada, 2006). Nevertheless, empirical evidence supporting the application of various types of weighting function in LSA is still scarce. In this study, three semantic spaces were developed by adopting three types of weighting function and the performance was examined. Finally, the effectiveness of LSA-based automated scoring system was examined by comparing the correlations between human scoring and LSA-based automated scoring.

Latent Semantic Analysis
To make use of LSA, establishing a semantic space to represent the type-by-document matrix in a given corpus in which each row stands for unique type and each column stands for a document is required. Each element of the type-by-document matrix contains the frequency with which the type of its row appeared in the passage denoted by its column. The type-by-document matrix is often transformed to weight them by their estimated importance in order to better mimic human comprehension process (Landauer et al., 1998; Martin & Berry, 2007; He, Hui, & Quan, 2009; Olmos, León, Escudero, & Jorge-Botana, 2011).

Next, SVD (singular value decomposition) and dimension reduction to the type-by-document matrix is applied. SVD is the method used by LSA to decompose the type-by-document input matrix $\mathbf{A}$. The SVD for $m \times n$ type-by document input matrix $\mathbf{A}$ with the rank of $\mathbf{A}=r$ is defined as follows:

$$A = U \sum V^{T}$$

<div align="right">Equation 1</div>

Where U is an orthogonal matrix, V is an orthogonal matrix, and Σ is a diagonal matrix with the remaining matrix cells all zeros (Berry & Browne, 2005; Golub & van Loan, 1989). Dimension reduction is used to remove the extraneous information and variability in type and document vectors which referred to as "noise". A pictorial representation of the SVD of input matrix $\mathbf{A}$ and the best rank-k approximation to $\mathbf{A}$ is shown in Figure 1 (Berry, Dumais, & O'Brien, 1995; Martin & Berry, 2007; Witter & Berry, 1998).
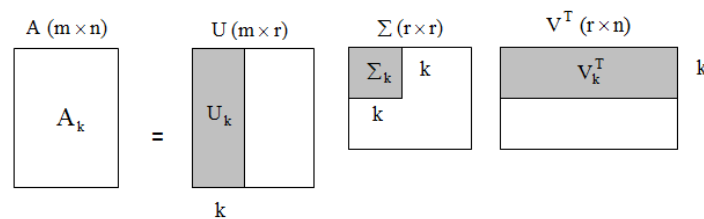
Figure 1. Diagram of the truncated SVD

After SVD and dimension reduction, A_k is the k-dimensional vector space which is called "semantic space".

Objectives of the study
1. To develop a LSA-based assessment system to evaluate children's Chinese sentence construction skills. To develop a LSA-based assessment system to assess sentence construction skills, single-character sentence construction test (subtest 1) and two-character words sentence construction test (subtest 2) were constructed by two instructors of language and literacy education department.

2. To examine the effectiveness of LSA-based automated scoring function by comparing it with traditional human scoring. To develop the automated scoring system, LSA was employed and the effectiveness of the automated scorning system was examined by the results obtained by human

raters and the system. In addition, the effects of three semantic spaces that were established by different types of weighting function (Log-Entropy, Log-IDF, TF-IDF) were also examined.

Research Questions

1. Does LSA-based automated scoring system score children's performance on sentence construction tests as well as human raters?

2. Does the Chinese semantic space generated from Log-Entropy outperform the Chinese semantic spaces generated from Log-IDF and TF-IDF?

METHOD

Participants

There was a total of 58 participants (27 fourth graders and 31 six graders) at Sin-Yi elementary school in Taichung, Taiwan. The mean age of the participants was 10.8 years (range 9.3 to 12.2, SD =1.03). None of the children was previously diagnosed with any emotional, behavioural or sensory difficulties.

Sentence Construction Tests

Sentence construction skills were assessed by two subtests: single-character sentence construction test (subtest 1) and two-character words sentence construction test (subtest 2). The subtests took approximately 40 minutes to finish. All the tests were computerized.

Single-character sentence construction test (subtest 1)

There were two practice trials and 10 test trials. In each trial, Chinese single characters were distributed in a raw in random order. Participants were asked to rearrange all the given characters to construct a complete and grammatically correct sentence (an item example is shown in Table 1). The number of characters in each test item ranged from 8 to 16 characters. The interface and instruction of single-character sentence construction is illustrated in Figure 2.

Table 1. An example of single-character sentence construction test

Item	裡、在、遊、院、玩、戲、我、子
Answer	我在院子裡玩遊戲 I play games in the yard
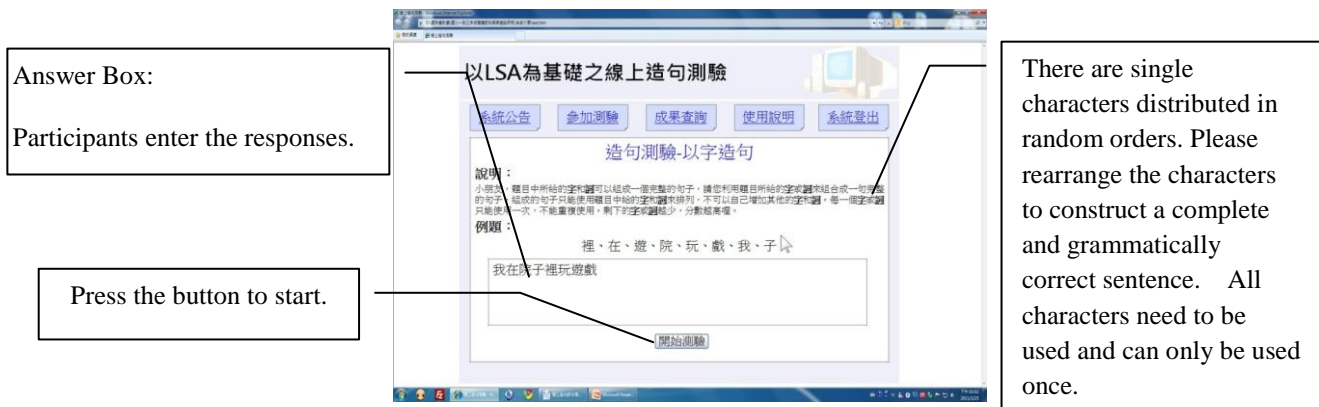
Figure 2. Interface of the single-character sentence construction test

Two-character words sentence construction test (subtest 2)

There were two practice trials and 10 test trials. In each trial, Chinese two-character words were distributed in a raw in random orders. Participants were asked to rearrange all the words provided to construct a complete and grammatically correct sentence (an item example is shown in Table 2). The number of words in each test item ranged from 5 to 8 words. The interface and instruction of two-character words sentence construction test is illustrated in Figure 3.

Table 2. An example of two-character words sentence construction test

Item	長大、在、我們、中、歡笑
Answer	我們在歡笑中長大 We grew up with laughter and joy.

Answer Box:

Participants enter the responses.

Press the button to start.

There are two-character words distributed in random orders. Please rearrange the words to construct a complete and grammatically correct sentence.   All words need to be used and can only be used once.
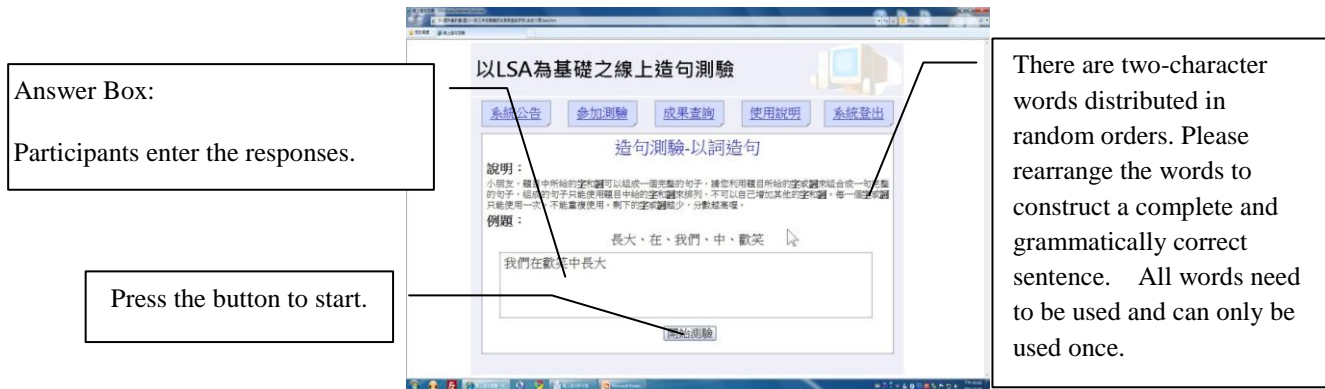
Figure 3. Interface of the two-character words sentence construction test

Human Scorring
Two Chinese literacy teachers played the role as human raters. The scores of test items were given based on the number of characters/words used and the grammatical correctness of the sentence. Taking the test item in Table 1 as an example, if a participant constructed a grammatically correct sentence with all the eight given characters, he /she would get a full score which is 8, for this particular item. However, if the participant only used six out of the eight words to construct a grammatically correct sentence, he/she would get 6 for the item.

Chinese corpus
The present study used Academia Sinica Balanced Corpus of Modern Chinese (3.1) from Academia Sinica in Taiwan to establish Chinese semantic spaces of LSA. The corpus contained 5 million words and 9227 documents.

Types of weighting function
A weighting function is generally applied to each nonzero (type frequency for type *i* in document *j*) element, a_{ij}, of the matrix **A** to improve retrieval performance (Berry & Browne, 2005; Dumais, 1991). LSA applies both a local and global weighting function to each nonzero element, a_{ij}, in order to increase or decrease the importance of types within documents (local) and across the entire document collection (global). So a_{ij} = local(*i, j*)*global(*i*), where local(*i, j*) is the local weighting for type *i* in document *j*, and global (*i*) is the type's global weighting (Dumais, 1991; Letsche & Berry, 1997). The study used three different types of weighting function: Log-Entropy, Log-IDF, TF-IDF, and the equations are as follow:

$$
\begin{cases}
L(i, j) = \log(tf_{ij} + 1) \\
G(i) = 1 + \sum_{j} \dfrac{p_{ij} \log_2(p_{ij})}{\log_2 n}, \, p_{ij} = \dfrac{tf_{ij}}{gf_i}
\end{cases}
\qquad \text{Equation 2}
$$

Equation 2 is the type weighting function of Log-Entropy, where $L(i, j)$ represents local weighting. tf_{ij} represents type frequency of type *i* in document *j*. $G(i)$ represents global weighting, and gf_i represents the total number of times that type *i* appears in the entire collection of *n* documents.

$$
\begin{cases}
L(i, j) = \log(tf_{ij} + 1) \\
G(i) = \log(m / df(i))
\end{cases}
\qquad \text{Equation 3}
$$

Equation 3 is the type weighting function of Log-IDF, where *m* is the total number of documents and *df*(*i*) is used the document frequency.

$$\begin{cases} L(i, j) = \dfrac{n_{i,j}}{\displaystyle\sum_{k}^{N} n_{k,j}} \\ G(i) = \log(m / df(i)) \end{cases}$$

<div align="right">Equation 4</div>

Equation 4 is the type weighting function of TF-IDF, where $n_{i,j}$ is the number of times the type i occurs in the given document j, $n_{k,j}$ is the total number of types in the document.

LSA-based automated scoring
The ability to add new types and documents to reduce rank type-document vector space is important because the original information in the document collection often needs to be augmented for different contextual or conceptual usages (Martin & Berry, 2007). In the present study, a simple method of handling the addition of sentences was used by applying the fold-in procedure (Equation 5). Here, following the fold-in procedure, a new sentence folds into the existing k-dimensional vector space (Berry, Dumais, & O'Brien, 1995). As well, based on the existing type-document vector space, the fold-in procedure was applied to measure the similarity between the best answer and each participant's answer (Equation 6). A best answer was defined as the response that matches the correct answer in the system. :

$$d_{new} = d^T U_k \Sigma_k^{-1}$$

<div align="right">Equation 5</div>

In Equation 5, the vector d, represents the best answer or participants' answer, which contains zero and nonzero elements; where the nonzero elements correspond to the type frequencies contained in the sentence adjusted by term weighting function.

$$sim(S_1, S_2) = \frac{d_1 d_2^T}{\|d_1\| \|d_2\|}$$

<div align="right">Equation 6</div>

In Equation 6, the similarity is computed as the cosine of the vector representation of the sentences. d_1 represents the vector representation of the best answer, S_1, represents the best answer, and d_2 represents the vector representation of the participant's answer, and S_2, represents the participant answer.
Finally, LSA-based automated scoring equation (Equation 7) is presented as follows:

$$score_{item} = sim(S_1, S_2) * s_{item}$$

<div align="right">Equation 7</div>

s_{item} represents the maximum score in each item, $sim(S_1, S_2)$ represents the semantic similarity between the correct answer and the participant's answer. And $score_{item}$ represents the participant's sentence construction score in each item.

RESULTS
Pearson correlations between human scoring and LSA-based automated scoring were calculated to examine the effectiveness of LSA-based automated scoring. The study used three types of weighting function and the results were presented in Table. 3, Table. 4, and Table. 5.

Table 3. Correlations between human scoring and LSA-based automated scoring (Log-Entropy)

Variable	1	2	3	4
1 human scoring (subtest 1)	1	—	—	—
2 LSA-based automated scoring (subtest 1)	0.912**	1	—	—
3 human scoring (subset 2)	0.710**	0.611**	1	—
4 LSA-based automated scoring (subtest 2)	0.511**	0.522**	0.531**	1

*p<0.05; **p<0.01

Table 4. Correlations between human scoring and LSA-based automated scoring (Log-IDF)

Variable	1	2	3	4
1 human scoring (subtest 1)	1	—	—	—
2 LSA-based automated scoring (subtest 1)	0.916**	1	—	—
3 human scoring (subset 2)	0.710**	0.617**	1	—
4 LSA-based automated scoring (subtest 2)	0.508**	0.524**	0.543**	1

*$p<0.05$; **$p<0.01$

Table 5. Correlations between human scoring and LSA-based automated scoring (TF-IDF)

Variable	1	2	3	4
1 human scoring (subtest 1)	1	—	—	—
2 LSA-based automated scoring (subtest 1)	0.901**	1	—	—
3 human scoring (subest2)	0.710**	0.594**	1	—
4 LSA-based automated scoring (subtest 2)	0.489**	0.487**	0.467**	1

*$p<0.05$; **$p<0.01$

The results showed in subtest 1, human scoring and LSA-based automated scoring were strongly correlated ($rs = 0.912, 0.916, 0.901$).   In subtest 2, however, human scoring and LSA-based automated scoring were moderately correlated ($rs = 0.531, 0.543, 0.467$).   Moreover, the relations between LSA-based automated scoring and human scoring were more consistent in subtest 1 than in subtest 2. Moreover, contrary to what were found in previous studies (e.g., Dumais, 1991; Lintean, Moldovan, Rus, & McNamara, 2010), our results showed that the automated scorning system established by semantic space of Log-IDF worked slightly better than the two other methods (Log-Entropy and TF-IDF) in subtest 1 ($rs = 0.916, 0.912, 0.901$) and subtest 2 ($rs = 0.543, 0.531, 0.467$). The outcomes of the three types of weighting function showed that the Chinese semantic space generated from Log-IDF outperformed the other two types of weighting function (Log-Entropy and TF-IDF).

CONCLUSION
The present study developed LSA-based assessment system and examined the effectiveness of LSA-based automated scoring function by comparing it with traditional human scoring. The results showed that, in subtest 1(single-character sentence construction test), LSA-based automated scoring and human scoring were highly correlated in three types of weighting function, which implies that LSA-based automated scoring was comparable to human scoring. In subtest 2 (two-character words sentence construction test), LSA-based automated scoring and human scoring were only moderately correlated, which implies that human raters and LSA did not score children's sentence construction skills equivalently. It was interesting to discover that LSA-based automated scoring system acted similar to human raters in single-character sentence construction test (subtest 1) but less well to two-character words sentence construction test (subtest 2). LSA automated scoring system rated children's answers by comparing them with the pre-set best answers. However, one of the well-known limitations of LSA is that it made no use of word order, syntactic relations or logic, and morphology (Landauer et al., 1998).   In subtest 2 (two-character words sentence construction test), the rearrangement of the two-character words produced high similarities between grammatically incorrect sentences and the best answers provided by the automated scoring system.   In Chinese, each character is a morpheme, and morphemes are combined into words. Most of Chinese words involve multiple morphemes, for example, 天空 *sky*, 美麗 *beautiful,* 我們 *we*, are two-character (morpheme) words.   Therefore, the ability to manipulate and to be aware of morphemes (characters) is important for Chinese literacy acquisition.   In LSA Chinese scoring system, when a sentence (or a row of characters) is given, the system automatically segments the row of characters into words that match the corpus (e.g. 藍藍的/天空/很/美麗, *The blue sky is beautiful*).   However, in subtest 2, the "two-character words" were provided in the test items and therefore, as long as the participant used all the given two-character words, the answers would automatically match the " pre-set answers" in the system.   Hence, even the sentence was grammatically and syntactically incorrect, a high score would still be given by the system due to the great resemblance between the responses and the pre-set best answers.   Therefore, the equivalency of scoring was not met between human raters and the system. On contrary, in subtest 1, only single characters were given, thus, the participants were required to recognize every character, to combine all the given characters into meaningful words, and to construct grammatically and syntactically correct sentences with these words. The skills and behaviors require in subtest 1 actually bear a resemblance to the actually writing activity. Consequently, human raters and the system scored children's performance on single-character sentence construction test similarly. Moreover, in subtest 1 (single-character sentence construction test), the present

automated scoring system captured both children's morphological processing skills and sentence construction skills. In addition, the results of the present study did not support that Log-Entropy is more appropriate in developing the Chinese LSA-based automated scoring. One possible explanation is that previous studies were conducted in English. The characteristics of Chinese may require a different method of weighting function to reflect the nature of the language. In conclusion, LSA-based automated scoring system is effective in assessing children's sentence construction skills and Chinese semantic space generated from Log-IDF is better compare to the other two types of weighting function for the automated scoring mechanism.

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EFFECTS OF REFLECTIVE THINKING IN THE PROCESS OF DESIGNING SOFTWARE ON STUDENTS' LEARNING PERFORMANCES

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ABSTRACT
The purpose of this study is to examine the effects of reflective thinking effects in the process of designing software on students' learning performances. The study contends that reflective thinking is a useful teaching strategy to improve learning performance among lower achieving students. Participants were students from two groups: Higher achieving students were the control group, and lower achieving students were the experimental group. The experimental group students wrote weekly diaries demonstrating reflective thinking in the processes of designing software. The study's results show the evaluation scores of the two groups of students' software designs were comparable. The abilities of the experimental group to comment on a design improved. This shows that a reflective thinking strategy did have positive effect on improving lower achieving students' learning performances, especially in the process of software design. Discussion of the results and suggestions for future study appear at the end of this study.

INTRODUCTION
Currently, numerous software design tools are helpful for rapidly constructing an environment of digital learning, which contributes to achieving expected learning goals and efficacy. However, when considering learners' backgrounds, software developers should ponder principles of accessibility and usability, to integrate learning theories into designs (Hackett & Parmanto, 2006; Hsieh, 2008; Kidney, Cummings & Boehm, 2007; Lam, Lam, Lam & McNaught, 2009; Powell & Murphy, 2009; Zhang, Zhang, Duan, Fu & Wang, 2010). For example, when a web designer develops a search engine, an invitation to users allows participation and exploration of behavior and cognition simultaneously, and application of a learning theory should be used to clarify issues of usability and accessibility in web design. Subsequently, the web designer can revise the original design's concepts and finalize the search engine's design.

According to Dewey (1933) reflective thinking is, "the kind of thinking that consists of turning a subject over in the mind and giving it serious and consecutive consideration" (p. 3). The software design process requires reflective thinking, in addition to ordinary thinking; namely, previous thoughts and conduct should be reviewed through "reflective thinking," prepared for deep learning (Dewey, 1933). If time for reflective thinking is available during the process of software design, capitalizing on opportunities for undertaking reflective thinking involves acquiring descriptive content (or facts), procedural knowledge (conceptual or induced from formulas), and high-level learning (i.e., deep learning). An example of reflective thinking process is: Teachers encourage students demonstrating low learning performance to access previous learning, revisit techniques employed to gain the learning, and estimate knowledge deficits requiring fulfillment. This reflective thinking process has the potential to improve performance and unique personal creativity of low learning students (Schunk, 2004).

According to Social Cognitive Theory, social environments and personal beliefs or cognition affect the ways humans thinking. In other words, "self-efficacy" (i.e., an individual's self-confidence level for completing a special task) will be different, depending on different situations (Bandura, 2002). Some studies' empirical results indicated that students having higher levels of self-efficacy achieved higher learning performance, and vice versa. Since students gained confidence from positive experiences of achieving high learning performance, their high levels of self-efficacy further advance (McMurray & Sanft, 2005; Phan, 2007, 2008). In addition, a few studies examined whether or not students involved in reflective learning processes attained significant benefit in learning performance, and their reflective learning outcomes influenced their levels of self-efficacy. Therefore, the current research designs an experimental study to verify whether or not reflective thinking effects exist for students in a software design course, especially those demonstrating lower achievement. Overall, this study's three core questions are: Do lower achieving students' learning performances improve from reflective thinking processes? Do lower achieving students' self-efficacies for computer use enhance due to the effects of reflective thinking? Finally, through exploration what reflective thoughts are produced and then discovered from lower achieving students' perspectives for a commenting task?

LITERATURE REVIEW

Clarification of this study's purpose requires discussion of the meaning of learning through reflective thinking and the causal relationship between reflective thinking outcomes and individuals' levels of self-efficacy. The literature review also includes the design principles and the multi-dimensional assessment criteria adopted in the software design course for implementing learning through reflective thinking.

Learning through Reflective Thinking

The conceptual definition of the term, reflective thinking, originates with a proposal from the scholar John Lock in 1690, and subsequently the scholar John Dewey transformed this concept into an operational principle, which asserts that reflective thinking can result in true, purposeful, and meaningful learning (Dewey, 1933). The definition of reflective thinking suggests that the process can result in great value, despite the effort required. The process of reflective thinking affords personal creativity, meaning, and criticism from learning activities.

In terms of exploration of reflective learning, the process of learning encompasses deep or high-level learning, which means engaging in critical thinking, obtaining cognitive and metacognitive awarenesses, operating with sophisticated conceptual thinking, and originating creative ideas to solve problems (Chang & Chou, 2011; Hatton & Smith, 1995; McCrindle & Christensen, 1995; Thorpe, 2004). In other words, reflective learning transforms and re-digests acquired knowledge to solve problems and demonstrate personal creativity – perhaps, highlighting personal values during knowledge acquisition and integration.

Prior study results indicated the positive impact of reflective thinking on learning achievement (Ersozlu & Arslan, 2009; McCrindle & Christensen, 1995; Sheorey & Mokhtari, 2001). Those results showed either significantly improved scores obtained by experimental groups or obviously comparable learning performance in the assigned learning tasks when compared other students in control groups. In addition, as an individual learner proceeds through a reflective thinking process, awareness of strategies for learning may simultaneously enhance. The learner's perception of level of ability to learn (i.e., self-efficacy) increases as well. The McMurray and Sanft (2005) study also indicated a strong correlation between reflective thinking and self-efficacy. The Phan (2007) study empirically verified the causal effects of reflective thinking and self-efficacy on academic performance. The importance is the necessity of encouraging students to think reflectively during learning processes.

At present, one of the most commonly seen avenues for learning through reflective thinking in classrooms is practice through projects. Students, individually or in groups, can learn from solving case problems, learn from doing, and do from learning. Also, students can actively participate in other activities before, during and after the class (e.g., preview, review, and discuss learning content), to enhance the content quality of reflective thinking and then achieve the expected learning results (Thomas, 2000). As for other ways of learning through reflective thinking, the literature suggests that teachers adopt different teaching strategies: completing reflection sheets, writing a reflections diary, storytelling, or debating openly (Chen, Kinshuk, Wei & Liu, 2011; Hatton & Smith, 1995; McKillop, 2005). The current study asks students to write reflection diaries, and in deference to today's high technology, pen and paper are not necessarily the only technique for recording. Instead, student wrote personal reflections of learning on blogs (Efimova & Fiedler, 2004) and had the freedom to add representative images and pictures to supplement their reflections.

Self-Efficacy

Based on the perspective of Social Cognitive Theory, "self-efficacy," proposed by Bandura is a learner's cognition of self-confidence and the capability to achieve a degree of competence in a specialty (Bandura, 2008). It is an individual's evaluation of self-confidence and belief in ability to accomplish a mission (Schunk, 2004). Self-efficacy is different from ability. With expected outcomes, self-efficacy is a person's cognition of ability when taking action. Cognition changes, as exposure and retention of information expand (Bandura, 1986). For example factors, such as personal emotional change, anticipation for results, awareness of others' expectations, previous experience, environmental conditions, and so on, can affect an individual's self-evaluation of ability. Among the factors, arguably, previous experience is a strong predictor of self-efficacy, because previous positive or negative learning experience influences the extent of a learner's evaluation of self-efficacy. Those who had positive learning experiences gain enhanced self-efficacy more easily than those who had negative learning experiences. In addition, a learner's self-efficacy will likely change during different times, and situations, and build inner value for cognition for self-ability (Bandura, 2002; İşman & Çelikli, 2009; Topkaya, 2010).

For more than 20 years after 1977, much research of self-efficacy appeared, including correlations, pre-test and post-test comparisons, and experimental studies. These studies mainly explore the influence of self-efficacy on learning achievement, including: solving conceptual math problems, writing, and reading abilities, learning

motivation (Bong & Clark, 1999; Schunk, 1991; Zimmerman & Bandura, 1994; Zimmerman, Bandura & Martinez-Pons, 1992), occupation choice or career decision, etc. (Betz & Hackett, 1981; Chaney, Hamoond, Betz & Multon, 2007; Hartman & Betz, 2007). The literatures, suggests that self-efficacy development encompasses many patterns. Self-efficacy mentioned in various studies circumscribes the same concept, but within differing contexts (Multon, Brown & Lent, 1991; Pajares & Miller, 1994; Schunk, 1991; Zimmerman, 1995; Zimmerman & Bandura, 1994; Zimmerman, Bandura & Martinez-Pons, 1992). For example, self-efficacy in schoolwork is the student's cognition of ability for achieving goals in learning. Self-efficacy in teaching is a teacher's cognition of an ability to help students learn, and consequently influences motivation and willingness to prepare instructional materials and activities. Self-efficacy in computer technology is a self-rating ability to apply computers to diverse situations, such as searching information via the Internet and using multi-media software. Consequently, questionnaires developed for different studies for measuring self-efficacy in various contexts are unique (Hsieh, 2009).

For measuring self-efficacy of computer use, the General Self-Efficacy Scale (GSE), developed by Schwarzer and Jerusalen, is the most common questionnaire, which is able to predict a student's performance with computers in daily life, under pressure, and so on (Schwarzer & Jerusalem, 1995). However, according to studies conducted by Joo, Bong and Choi, a questionnaire's design, which has high credibility for measuring self-efficacy for Internet use merely measures a student's ability to search web pages effectively, not a more general ability for learning (Joo, Bong & Choi, 2000). Thus, instead of utilizing GSE, the Thatcher and Perrewe (2002) Computer Self-Efficacy Questionnaire is an alternative for determining students' abilities to search web pages. However, to measure students' abilities of packaged software using, this questionnaire maybe not an appropriate one.

This study adopts the Compeau and Higgins (1995) Computer Self-Efficacy Questionnaire, researched and designed by Compeau and Higgins (1995). The questionnaire contains ten Yes/No questions and measures both the magnitude of self-efficacy, so it can provide data of students' abilities to use packaged software. Compeau and Higgins established the reliability and validity of analyses obtained from this questionnaire after using Partial Least Squares to test a research model. The results of their analyses showed the questionnaire's high internal consistency (reliability coefficient greater than 0.8), and strong construct validity (higher than 0.7). Thus, to examine whether or not lower achieving students, who had undertaken learning through reflective thinking, would demonstrate significant change in self-efficacy, after completing an animation software design assignment, adoption of this questionnaire is more useful and appropriate than others.

Design Principles and Multi-Dimensional Assessment Criteria
Arguably, design principles, such as accessibility and usability, are fundamental skills for novice designers. Other design principles, such as aesthetics, attention-getting, friendly, responsiveness, simplicity, error tolerance and reliability, are also software designers' considerations. Also, design principle may have application in some, but not all, design projects. For example, novice web designers must execute several accessibility checks, including HTML elements, multimedia elements, web tools, and advanced scripting (Institute for Interactive Technology, 2006), to ensure the accuracy of the information presented on each web page; usability checks are likely necessary as well. For novice software designers, prior to the processes of software design, all usability checks are important considerations, including: compatibility, consistency or coherence, directness (WYSIWYG-what you see is what you get), interactivity, and user-in-control (Nielsen, 1994).

Expert software designers intuitively consider most design principles in their software development processes, without consciously applying design principles, they are aware of most users' preferences and update designs to comply with the latest trends. The most effective way to achieve most design principles' requirements is to invite software users entering the processes of software design to test software beta versions, even though such testing is sometimes very time consuming (Ropinski, Meyer-Spradow, Steinicke & Hinrichs, 2006). Then software designers and users have chance to communicate with each other during development before releasing the software to the market. This approach, called user-oriented design, is increasingly popular among both novice and expert software designers. Overall, by taking design principles into consideration or taking user-oriented design approach, designers have gone through a reflective thinking process during the process of design.

In order to objectively assess students' performances for designing animation software, this study adopts multi-dimensional assessment criteria provided by the Association to Advance Collegiate Schools of Business (AACSB, http://www.aacsb.edu/). In recent years, AACSB has supervised many educational institutions to establish multi-dimensional assessment criteria to ensure quality of global business education not only in the United States, but also around the world. The academies achieving the criteria's quality standards gain certification from AACSB (http://www.aacsb.edu/accreditation/). This study evaluates students' learning

performances according the AACSB's five criteria developed for a software design course: Information Technology (IT), Oral Communication (OC), Problem Solving (PS), Value and Professionalism (VP), and Creativity and Innovation (CI). The contents of each assessment criterion are:

IT—including four sub-criteria: A student is proficient in instructions and functions of the animation design software, "Adobe® Flash CS3," is able to integrate other Adobe® software that allows editing web pages, pictures, videos, and so on, can configure a design to appear in its entirety on a personal website, accepts the Internet as an important tool for accessing information pertinent to design.

OC—including two sub-criteria: A student is comfortable using any mode or media of communication for delineating software design ideas, especially, demonstrating skill with technology for effective communication.

PS—including three sub-criteria: A student can correctly debug the software from error codes that appear during the process of software design (the most important one), is able to conduct immediate tests on the results of different animation software designs, can revise developed software according to principles of design.

VP—including two sub-criteria: A student can attend class on time as well as demonstrate an active attitude toward the process of learning (i.e., maintain an interest in software design), and is willingly undertakes software development according to the principles of design.

CI—including two sub-criteria: A student can use different methods to solve problems arising in the process of software design, complete a design that is instinctively interesting to users.

RESEARCH METHODS

The research methods implemented in this study include: Study's framework, experimental design, including study procedures, participants, and data collection, and analysis methods.

Study Framework

Reflective thinking is an important strategy in students' learning processes. According to the literature, for enhancing problem-solving abilities as well as increasing creativity, students should receive frequent encouragement to think reflectively when engaging in the process of learning or designing software. Thus, this study examines the effects of reflective thinking on students' learning performances during software design processes. The assumption is that for software design assignments, lower achieving students will demonstrate learning-process improvement after thinking reflectively and achieve performance comparable to higher achieving students.

A further assumption is that all students' computer self-efficacy significantly improves after acquiring skills in a software design course. After practicing reflective thinking in the process of design, especially, among those deemed to have lower achieving learning performances at the beginning of the software design course, self-efficacy for computer use should be equivalent to those students demonstrating higher achievement. This study adopts the Compeau and Higgins (1995) questionnaire, which has 10 questions answerable by "YES" or "NO." If the answer is the former, the students can make a personal self-assessment of strength of self-confidence on a 1 to 10 scale. All the students completed the questionnaire twice, one before the beginning of the course and again at the course's completion. The operational assumption is that students demonstrating low performance in the software design course could acquire abilities for software design and increased their levels of self-efficacy for computers by thinking reflectively. Figure 1 illustrates this study's framework. Two proposals for null hypotheses are:

Null Hypothesis 1 – A reflective thinking strategy cannot aid lower achieving students to reach learning performance comparable with higher achieving students in a software design course.

Null Hypothesis 2 - The level of computer self-efficacy after the course has no significant incensement compared with that before the course for students in the lower achieving group.
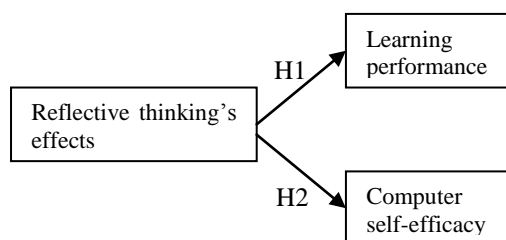
Figure 1: Study framework.

Experimental Design and Study Procedures

In this study, all students had the same educational background and the same starting-point of skill level and familiarity for the "Windows Software Design" course in spring 2008. After learning and practicing the windows software design about four weeks, grouping the students produced to categories (Figure 2), control and experiment groups based on their average scores from mid-semester quizzes. The quizzes evaluated graphic design, video clipping, program design, and schedule arrangement. Five multi-dimensional assessment criteria, information technology (IT), oral communication (OC), problem solving (PS), value and professionalism (VP), and creativity and innovation (CI), with different percentage weights evaluated students' performances (Table 1).
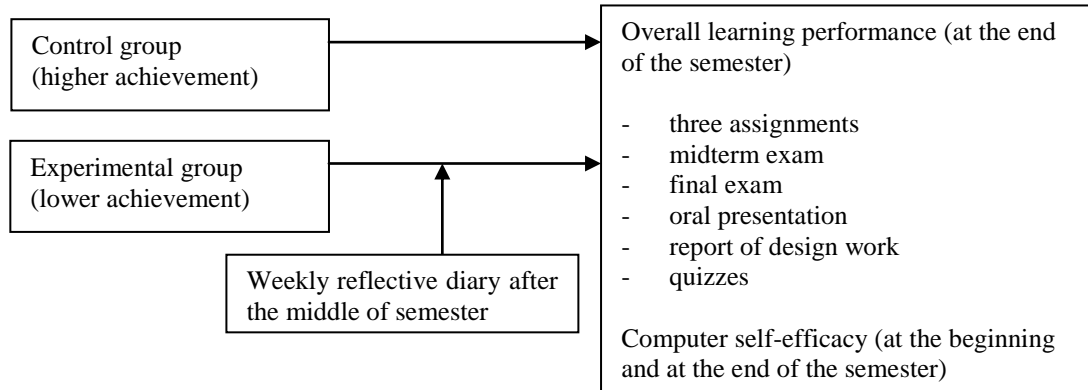
Figure 2: Experimental design.

Table 1: Weight for each criteria

Criteria	Quiz	Overall Scores
IT	75%	45%
OC	-	16%
PS	12%	13%
VP	-	19%
CI	13%	7%
Total	100%	100%

The experimental group consisted of students whose quiz scores were lower than the average score of all the students. These lower achieving students received an additional assignment, in the processes of their learning, of writing a weekly reflection diary of their weblogs and their animated software designs until they completed their projects. The control group's requirement was merely to finish the assigned software design assignment before the end of the course. Evaluations of two groups of students' overall learning performances included scores for three kinds of design scores from quizzes, homework, one midterm exam, one final exam, a design work, and oral and written presentations for the design work. All the evaluative components received different weights in percentage by using the same criteria as used in the quizzes. All the students (i.e., study's participants) completed the Compeau and Higgins (1995) Computer Self-efficacy Questionnaire before and after the course to determine if their levels of self-efficacy for computers had increased. Specifically, the self-efficacy levels of those who were originally regarded as lower achieving students could be observed as well after the practices of reflective thinking during their windows software design.

In addition, this study includes a qualitative research approach component. The participants analyzed the designated dynamic website (http://www.acmcf.org.tw/model/) before and after the course through computer generated, written documents, submitted the course instructor. This website contains many animated effects similar to the software design assignments completed for the design course. An analysis of the participants' perspectives of the dynamic website, before and after the course explored whether or not the students attended to design principles and/or considered the design concepts.

Participants

Among the sophomores in the college who studied the course, "Windows Software Design," 13 students were willing to participate in this study. Each participant had basic ability to create web page, understood object-oriented concepts of program design, and showed interest for learning animation software design. At the beginning of the course, all participants completed the Computer Self-Efficacy Questionnaire and received four

weeks of instruction for designing animation. The content covered an introduction to Adobe® Flash CS3 design tools, animated text and graphic design techniques, animated button and movie-clip design techniques, commonly used Adobe® Flash CS3 action scripts, and an introduction to usability and accessibility considerations in design. Based on their performances from quizzes related to animation design during the first four weeks, two groups categorized the students. The experimental group consisted of seven students whose total scores on the quizzes were lower than the average score of all the students. These students comprised the lower achieving group for this study, since their quizzes indicated difficulty comprehending design principles or spending less time on animation design practice. Oppositely, the other six students comprised the control group. These higher achieving students often attended the computer lab to practice animated design, resulting in more facility for completing quizzes competently.

Data Collection and Analysis Methods
Two evaluative criteria from students' scores were the bases for dividing students into groups for this study experimental design: One criteria was the average quiz score; the other was the students' overall score for the semester, including quizzes, homework, midterm exam, final exam, design work, and oral and written presentations for the design work. Each score ranged from 0 to 100, according to the five multi-dimensional, assessment criteria: IT, OC, PS, VP and CI. Based on the goals established according to the course syllabus, each criterion score had a specific weight, as shown in Table 1.

As a result, the control group students all scored higher than the average quiz scores obtained by all participant students. The quizzes primarily measured students' IT, PS and CI abilities. Contrarily, the experimental group's students scored lower than the overall average of quiz scores. Consequently, these lower achieving students received encouragement to write reflective diaries of their weblog activities during the design processes. Students in the experimental group wrote reflective diaries, and knew that the activity entailed no extra-credit points.

Calculation of students' overall scores was according to the weight of each score of the five multi-dimensional assessment criteria. An assessment of the scores of the two groups of students for each criterion ensued, and descriptive statistics analysis of the two groups of students produced average overall scores and the standard deviation. An Independent-Sample T-Test compared the two groups of students' overall scores and the scores in each multi-dimensional assessment criterion to determine the presence of a significant difference. In addition,, before and after the course, the two groups of students completed a pre-test and post-test Computer Self-Efficacy Questionnaire. Establishing the questionnaire's content validity employed the Compeau & Higgins (1995) Computer Self-efficacy Questionnaire instead of the GSE or other self-efficacy scales,   not specifically for predicting students' computing behaviors. Reliability analysis, followed by a Paired-Samples T-Test, explored the presence of significant differences between pre-test and post-test average scores.

In addition to analyzing quantitative data, such as students' quiz results, overall learning performance scores, and scores for computer self-efficacy, students' comments of the designated dynamic website underwent two types of qualitative analyses: The first, literal data from students' evaluations of the designated dynamic website, before and after the course, consisted of written files of the analyzed contents. A calculation of the number of words written by each student, analyzed via T-Test, determined if the numbers of words significantly increased from the initial evaluation to the second evaluation. The other qualitative analysis used software (Nvivo 7) to evaluate the written contents, to determine if the students' assessments had a basis in principles of design, or if any design concepts had considered when they gave comments on the designated dynamic website.

RESEARCH RESULTS
The average score of all the participating students' scores (M) on quizzes was 77.37 (standard deviation, SD=11.60). The experimental group's students scored lower than the control group students (experimental group: M=70.64; SD=11.82; control group: M=85.20; SD=4.37). Also, the difference between the two groups reached a significant level (T=2.84; p= .02). The bases for study's results are: First, the descriptive analysis results of the two groups of students' learning performances including the overall scores the students received in the software design course and their scores evaluated by five multi-dimensional assessment criteria, in percentage, with different weights; second a comparative analysis of the students' pre- and post-test scores for computer self-efficacy, and third, the results of students' written evaluations of the contents of the designated dynamic website from before and after the course.

Students' Learning Performances
Immediately subsequent to the quizzes, the experimental group's students adopted a method of learning through reflective thinking of the whole process of software design. Table 2 shows the descriptive analysis results of the

two groups of students' scores for each score item and the overall scores. As a result, after verification through Paired-Sample T-Test, the difference in each score item or overall score between them appears insignificant at a significance level of 0.05 (Table 3).

In addition, based on multi-dimensional assessment criteria, the performance of experimental group's students underwent further analysis. Table 4 reports the descriptive analysis results of the scores of the two groups of students for the five multi-dimensional assessment criteria. By conducting Paired-Sample T-Test, no significant difference exists for any criterion at a significance level of 0.05 (Table 5). Notably, the scores of experimental group's students for OC and VP were close to the scores of control group's students. In other words, the oral abilities (OC scores) for presenting software design ideas from students in the experimental group may have improved along with their value and professionalism (VP scores) in software design.

Table 2: Descriptive analysis results of the students' overall and each item scores

Score Item/Group	Experimental group		Control group	
	M	SD	M	SD
Homework	68.38	7.76	77.56	10.85
Midterm exam	69.57	10.96	78.25	9.03
Final exam	76.07	7.87	79.58	15.59
Design work	80.86	4.10	80.33	4.23
Oral presentation for the design work	73.57	32.75	85.00	4.47
Written presentation for the design work	84.29	6.65	85.00	6.99
Overall Score	75.58	5.72	80.86	3.62

Table 3: T-Test results of the students' learning performances

Item/ Test	T value	Degrees of freedom	Significance
Homework	1.40	5	0.22
Midterm exam	1.08	5	0.33
Final exam	0.62	5	0.56
Design work	0.16	5	0.88
Oral presentation for the design work	0.85	5	0.44
Written presentation for the design work	0.56	5	0.60
Overall Score	1.95	11	0.08

Table 4: Descriptive analysis results of the students' scores in each criterion

Item/Group	Experimental group		Control group	
	M	SD	M	SD
IT	73.98	6.53	79.86	4.07
OC	80.15	8.94	84.18	4.79
PS	74.94	5.29	80.65	5.93
VP	83.75	4.82	85.66	8.39
CI	74.23	4.90	79.57	4.25

Table 5: T-Test results of the students' learning performance in each criterion

Item/ Test	T value	Degrees of freedom	Significance
IT	1.91	11	0.08
OC	0.99	11	0.35
PS	1.84	11	0.09
VP	0.51	11	0.62
CI	2.08	11	0.06

The study's results do not support Null Hypothesis H1. The students in the experimental group, those having lower achievement in the first four weeks of the course, received encouragement thinking reflectively in the

process of software design to achieve comparable scores to those in the control group for each item and for overall scores. The experimental groups performance for each multi-dimensional assessment criterion, especially CI (creativity and innovation), appears to be competent in comparison to the students in the control group.

Students' Computer Self-Efficacy Test Scores
This study also explores the participating students' changes in their self-efficacy for computers, especially those students in the lower achieving group. All students completed the same questionnaire before and after the course. Comparisons of responses determined the existence of any significant differences. Then, a comparison of the two groups of students' pre-test or post-test of self-efficacy for computers determined whether or not they attained the same levels of self-efficacy at the end of the software design course. One student in the control group did not answer all the questions completely, causing exclusion of this particular data. Overall, the reliability analysis results of the questionnaire before and after the course reached 0.70 and 0.92 respectively (Note: the content validity had been established). Table 6 shows the pre-test and post-test average scores and the standard deviation (M and SD) of the two groups of students' self-efficacy for computers (total: 12 persons,7 in the experimental group and 5 in the control group) as well as the differences in the students' pre-test and post-test scores, as analyzed by T-Test.

As a result, the control group students' self-efficacy for computers pre- and post-test scores was higher than the scores from the experimental group's students. However, no significant difference appeared between the two groups of students for either of test scores. To be specific, the experimental group students' self-efficacy for computers, for either the pre-test or post-test, neither demonstrated a significant difference at a significance level of 0.05. Hence, Null Hypothesis (H2) gains support. Notably, the students in both the control and the experimental groups scored lower for the post-test than for the pre-test, This result shows that the students' degree of self-confidence for using packaged software declined by the end of the course. In terms of using Adobe® and Flash CS3 as well as other series of Adobe® software for editing pictures, videos, web pages, and so on, the students had lower self-confidence than before the course began. Even the experimental group's students who adopted learning through reflective thinking demonstrated a lower degree of self-confidence for using packaged software. Further discussion of this aspect appears later.

Table 6: Students' self-efficacy with computers

Group/ Pre-test and post-test	Pre-test M SD	Post-test M SD	T-Test (pre- and post-)
Experimental group	6.70 .74	6.63 1.11	Not significant
Control group	7.34 .64	7.24 1.08	Not significant
All the students	7.14 .69	6.89 1.09	Not significant
T-Test (group comparison)	Not significant	Not significant	—

Students' Analytical Contents of the Designated Dynamic Website
Table 7 shows the pre-test and post-test average numbers of words written by all participating students— 181 words and 230 words for each group respectively. However, the experimental group students wrote more than the control group students did, irrespective of pre-test or post-test timing, but none reached a significance level. Therefore, further analyses of the two groups of students' written contents may be worthwhile.

Table 7: Comparison of the average number of words for the analyses of the website

Group/ Pre-test and post-test	Number of words in pre-test	Number of words in post-test	T-Test
Experimental group	197	231	Not significant
Control group	176	230	Not significant
All the students	181	230	Not significant
T-Test	Not significant	Not significant	—

As for the pre-test analytic words provided by the two groups of students, all expressed personal assessments of the contents of the dynamic website but no concrete suggestions for changes. However, most of the students were able to list the dynamic website's advantages and disadvantages in their post-test analyses, and their awareness of layout designs, word types, colors, etc. For example, in the pre-test, one student in the experimental group said:

> From the animation on the website, we are able to grasp the general content from the very beginning, no need to click every button. It also has much stuff, providing many links for us to click and browse, unlike the general web pages that show the contents directly and make the layouts so chaotic.

In the post-test, the same student wrote:

> The blank space at the side seems to be wasted. It should have more animated effects added. I have no comments about the change of photo on the main page, but a part of something there seems to be cut off. If we click the button "simulation," we can see the word "simulation" written there. Some of the clicked pages are divided into two areas. It will be more convenient for us to know what the location address is, and we will not feel like turning it off upon seeing it.

However, by reading the pre-test words written by the control group students, apparently the principles of design had more frequent mention in their written contents, and the control group seemed more capable of pondering the kinds of designs that tend to cause users to learn the contents of the website more easily. Two comments are particularly telling:

> The contents of all the displayed stuff are shown on the left side, which is very convenient for users to click and see what they want to browse. If a user has to read English contents on the main page, the following contents should be written in English, too. But, I think that it may be a better way to have both English and Chinese versions for users to choose on any page.

> The main page on this website is not as complicated as those of other websites… But, as for the introduction, if the language version we have chosen is in both English and Chinese, the typeface should not be too small. If only English, the size of the typeface will be a little small. The website has an advantage—it has not only the literal introduction regarding collections, but also provides animation-simulated videos, so that the viewers can understand its operation through another way.

The post-test words written by the student of the control groups were of greater value for reference:

> The page design of this website is useful and direct. We can quickly link to the contents we intend to see. As for its design of the arts, no outstanding performance was shown. The literal and graphic introduction plus the impressive video files will enable users to obtain rich content right here on this website.

> In terms of color, I've discovered that this website has applied many gray colors to its backgrounds and buttons, so that the entire page seems to be somewhat dark. As for its layout and writing, the typeface used in this website seems to be PMingLiU, but the effect is not good. Maybe it will be better if it is changed to be BiauKai. As for animation, I think that the website did a great job. Many pictures are hard to draw. It is so incredible to make the animation well.

As a whole, even though the experimental group students wrote pre-test and post-test analyses of the dynamic website's design in greater volume than the control group students, the control group students were able to grasp the key points of design in the pre-test. To the contrary, the students in experimental group had to undergo the process of learning through reflective thinking, to enhance their abilities to design and analyze, and hence the post-test literal contents written by them shows an equivalent analysis to that written by the students in the control group.

CONCLUSIONS AND DISCUSSIONS

The purpose of this study is to examine the effects of reflective thinking, applied to software design processes, on students' learning performances. This study shows that learning through reflective thinking can result in great influence on lower achieving students who have learning obstacles for designing software, and reflective thinking has significance for their of software design processes. The effects not only showed in the performance in each scored item (e.g., final exam, design work), but also displayed changes in those students' learning performances from multi-dimensional assessment criteria, specifically OC and VP, and qualitative literal data. After the course, the lower achieving students' written analyses of the designated dynamic website also showed that they had obtained deeper understanding of the principles of a site's design. The evidence of their deep understanding arises drawn from the quality of their written analyses, in concert with the study's approach, adopted from Chang and Chou (2011) whom asserted a strong correlation between achievement and reflection

quality. In another words, due to learning through reflective thinking, the lower achieving students are likely to become aware of design principles, become able to design software by following them, complete the animation software design assignment and express personal design concepts in an orderly manner when orally presenting their designs. However, this study finds that, overall, students represent a low degree of self-confidence when using software to design animations after the end of the course. This finding is not surprising, since only the students having strong self-efficacy are willing to confront new challenges with optimism; whereas, the students having weak perceptions of self-efficacy are likely to be less confident in new, stressful situations (Schwarzer, 1997). Another caution arises from the scale used in this study to determine the students' levels of self-efficacy; the scale is sensitive to, and situation-dependent upon, students' current computer use status. Also, prior studies indicated that various internal and external factors, such as computer experience, gender, grade levels, task complexity and so on, can affect levels of perceptions of self-efficacy (İşman & Çelikli, 2009; Topkaya, 2010).

Finally, this study's results may provide instructors with an alternative approach of teaching: That is, reflective thinking, which can enhance students' creativity and other abilities. The evaluation method mentioned in this study may serve as a reference for teachers' lesson planning. In addition, in terms of the changes in students' perceptions of self-efficacy with computers, future studies might explore the necessity of re-designing the questionnaire to be more suitable for application to exploring students' use for designing animation software, instead of using the questionnaire for determining the degree of self-confidence in using common packaged software. Or, future studies may explore how reflective thinking can influence a student's perception of self-efficacy with computers and the influences from other internal and external factors, such as time for practicing designs in the computer classroom, personal computer equipment, and the frequency of browsing models of designs.

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ELEMENTARY EFL TEACHERS' COMPUTER PHOBIA AND COMPUTER SELF-EFFICACY IN TAIWAN

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ABSTRACT
The advent and application of computer and information technology has increased the overall success of EFL teaching; however, such success is hard to assess, and teachers prone to computer avoidance face negative consequences. Two major obstacles are high computer phobia and low computer self-efficacy. However, little research has been carried out in this area, especially from instructors' perspectives. This study aimed to determine the levels of computer anxiety and computer self-efficacy, and their correlations to classroom teaching among 300 elementary EFL teachers in Taiwan. Data were collected through survey method. Results indicated that teachers have moderate to high computer phobia and low computer self-efficacy. It is evidenced that computer phobia is negatively associated with computer self-efficacy. Also, it was found that teachers who frequently used computers showed lower computer phobia. Male teachers perceived themselves as having higher computer self-efficacy, and younger teachers tended to have a lower level of computer phobia and higher computer self-efficacy. High accessibility of computers at school for teachers would significantly lower computer anxiety and raise computer self-efficacy. In addition to investigating these two specific factors, evidence and implications for practice and directions for further research are also discussed.
Keywords: Computer phobia, Computer anxiety, Computer self-efficacy, elementary EFL teachers, Taiwan

INTRODUCTION

Computer assisted language learning (CALL) is increasingly being used for educational purposes throughout the world. Extensive research has supported the proposal that the effectiveness of their research results correlated with the use of CALL on ESL /EFL education (Rosen, Sears, & Weil, 1987; Tsou, Wang, & Li, 2002; Ybarra & Green, 2004). In Taiwan, in light of the government's imperative to integrate CALL into the teaching of English as a foreign language (EFL) to elementary school students, CALL has proved to be an essential aid for schools to facilitate teaching and learning (Chen, T. C., 2002). The integration of CALL has also been reported to provide a number of benefits for EFL teaching by educators in creating a learning environment, inspiring learning motivation, decreasing learning anxiety, minimizing individual learning differences, and increasing learning achievement (Ma, Andersson, & Streith, 2005).

Many scholars have focused their attention on the use of CALL and computer phobia on students, but rarely on the teachers themselves (Rosen & Macguire, 1990). Yet it is the teachers who serve as the agents of change for the students in the adoption and use of CALL by bringing the new concepts, ideas, and equipment into the classroom. These teachers, however, cannot serve in this role without the necessary skills, knowledge, and attitudes required to introduce and to integrate CALL successfully into the curriculum (Baylor & Ritchie, 2002). If teachers are unsure of their computer knowledge and skills, they can be cautious about implementing CALL in the classroom teaching for their respective students. One possible result of this caution is computer phobia, which is anxiety about interactions with computers that results in a negative attitude, such as fear and avoidance (Blank & White, 1984; Gunter, Gunter, & Wiens, 1998; Jay, 1981; Reznich, 1996; Yang, 1996). Ultimately, they might see themselves as victims of CALL and lose the opportunity to acquire and manipulate this useful resource.

Computer anxiety, which has often been linked computer phobia, refers to negative feelings associated with the use of computers (Cantrell, 1982; Chua, Chen, & Wong, 1999). Jay (1981) defined computer phobia as the negative attitude toward computers that results from computer anxiety. Rosen and Weil (1992) further defined computer phobia as anxiety and a negative attitude toward present and future interactions with computers. People suffering from computer phobia often hold a negative attitude toward computers, which in turn eventually causes avoidance of computers (Harrington, McElroy, & Morrow, 1990; Heinssen, Glass, & Knight, 1987; Rachman, 1998; Todman, 2000; Torkzadeh & Angula, 1992; Weil & Rosen, 1995). It is also associated with technophobia, which refers to a phobia toward technology, and cyberphobia, which refers to a phobia toward computers (Brosnan, 1998). In the present study, computer phobia is also referred to technophobia and cyberphobia.

The characteristics variables of computer phobia have also been widely researched over the last few decades. With regard to age, Laguna & Babcock (1997) indicated that younger people are less likely to suffer from computer phobia. Some studies have suggested that females have a higher level of computer phobia or negative

attitude toward computers than males (Levin & Gordon, 1989; McIlroy et al, 2001; Rosen, Sears & Weil, 1987). In addition, students are less likely to have a high level of computer phobia than those who are not students, although one study found that about one quarter of the students had computer phobia ((Pancer, George, & Gebotys, 1992; Weil & Rosen, 1995).

Among all the computer phobia scales, the computer anxiety rating scale (CARS-S) and computer thoughts survey (CTS) developed by Rosen and Weil (1992) are most widely used. The present study adopted this scale due to its widespread acceptance. Other commonly used instruments include the Computer Anxiety Index by Simonson, Matt, & Maurer (1987); the Computer Anxiety Rating Scale by Heinssen, Glass, & Knight (1987); the Computer Anxiety Rating Scale by Heller & Martin (1987); the Computer Anxiety Scale by Marcoulides (1989); the Computer Anxiety Scale by Kernan & Howard (1990); and the Computer Anxiety and Learning Measure by McInerney, McInerney, & Sinclair (1994).

Computer self-efficacy commonly refers to individuals' judgment of their knowledge and capabilities to use computers in diverse situations (Bandura, 1986; Compeau & Higgins, 1995; Murphy, Coover & Owen, 1989). People with high computer self-efficacy tend to believe that they are competent in operating computers and are eager to attend to computer related activities (Davis et al., 1989; Delcourt & Kinzie, 1993; Hill , Smith & Mann, 1987). In addition, Kinzie, Delcourt, and Powers (1994) stated that computer self-efficacy is associated with self confidence. The perceived computer self-efficacy of teachers will have an influence on their attitudes toward computers (Griffin, 1988; Zhang and Espinoza, 1998) and on CALL created for students (Ertmer at el, 1999). However, each teacher's belief in their own efficacy is related to teaching experience, and it is focused on their individual capabilities and time to perform tasks in the classroom. Furthermore, many research results have shown that males tend to have higher computer self-efficacy than females (Todman, 2000; Torkzadeh & Koufteros, 1994).

There are some commonly used computer self-efficacy scales (CSES) by researchers: Hill, Smith, and Mann (1987), Murphy, Coover, and Owen (1989), Delcourt and Kinzie (l993), Busch (1995), Compeau and Higgins (1995), and Durndell, Haag, and Laithwaite (2000). Among them, the CSES from Durndell, Haag, and Laithwaite (2000) used in the present study is the most up-to-date CSES, revised from versions of the CSES from Torkzadeh & Koufteros (1994) and Murphy, Coover, and Owen (1989). It has high validity and reliability.

Extensive research has supported the proposal that the two major obstacles to CALL implementation among teachers are computer phobia and computer self-efficacy (Gressard & Loyd, 1986; Harrison and Rainer, 1992; Woodrow, 1992). High computer phobia is strongly associated with low computer self-efficacy (Brosnan, 1998; Doyle et al, 2005; Joncour, Sinclair & Bailey, 1994). However, few studies to date have attempted to relate computer phobia measures to some index of computer self-efficacy (Szajna, 1994). Furthermore, to our knowledge, no studies have investigated elementary EFL teachers' computer phobia and computer self-efficacy in Taiwan, which lends support to the importance of and need for the present study. The present study is aimed to determine the level of Taiwanese elementary EFL teachers' computer phobia and computer self-efficacy, and the relationship between these two variables. Specifically, in this research, the following research questions are investigated:

1. What are the computer phobia levels of Taiwanese elementary EFL teachers?
2. What are the computer self-efficacy levels of Taiwanese elementary EFL teachers?
3. What are the relationships between computer phobia and computer self-efficacy of Taiwanese elementary EFL teachers?
4. Do the computer phobia levels and computer self-efficacy of Taiwanese elementary EFL teachers differ due to their background characteristics?

METHOD
Background Characteristics of Participants
Questionnaires were sent to 300 EFL teachers working in elementary schools located throughout Taiwan, and 215 (71.67%) valid responses were returned. Questions about teachers' background included gender, age, educational background, school information, computer usage, computer accessibility, etc. Computer usage and computer accessibility were included especially due to the fact that they have strong effects on teachers' attitudes toward computers (Gattiker & Hlavka, 1992; Harvey & Wilson, 1985).

According to the data analysis, the majority of the respondents were female (90.6%), with over 44% between the ages of 31 and 40 and just under about one-fifth (19.7%) between the ages of 41 and 50. The majority (61.3%) held undergraduate degrees, 37.7% had between 6 and 10 years of teaching experience, and 53.3% were working

in urban areas with 11-20 classes (39.2%) in the entire school. Most participants responded that they had more than 10 years of computer experience; most reported using computers every day at home (64.1%) and at work (74.5%). When asked whether schools provided them with sufficient computer related equipment, less than half (47.8%) replied in the affirmative about hardware, 45.9% about software, and 57.9% about the internet.

Instrument

The 85-item questionnaire had four sections: background characteristics, computer anxiety, computer thoughts, and computer self-efficacy. A questionnaire, the "EFL Teachers' Computer Phobia and Computer Self-Efficacy Questionnaire," was developed using the computer anxiety rating scale (CARS-S) and computer thoughts survey (CTS) by Rosen and Weil (1992), and the computer self-efficacy scale (CSES) by Durndell, Haag, & Laithwaite (2000). The CARS-S and the CTS are the most comprehensive research tools for identifying computer phobia. The CSES is used worldwide for classifying computer self-efficacy. This study used these three scales because they are widely recognized for their validity and reliability. Responses to items in these three sections were recorded along a five-point Likert scale. Background Characteristics are as described in the background characteristics of the participant section above. The scale results are explicated in the following.

Computer anxiety rating scale (CARS-S)

The CARS-S is a 20-item scale in a 5-point Likert format, and respondents are asked to express how they feel "at this point in time" about their anxiety levels toward computers: 1 = "not at all", 2 = "a little", 3 = "a fair amount", 4 = "much" and 5 = "very much". According to Rosen and Weil (1992), the issues addressed in this questionnaire are: (1) anxiety related to the machines themselves; (2) their role in society; (3) computer programming; (4) computer use; and (5) problems with computers and technology. They also reported that all alpha coefficients for this measure were in the range of 0.90–0.95, and the Cronbach's Alpha for this measure in the present study was 0.91. The CARS-S has been conducted with thousands of students and teachers from 22 countries all over the world. The norms established by Rosen and Weil for computer phobia are as follows: no computer phobia, 20–41; low computer phobia, 42–49; moderate to high computer phobia, 50–100.

Computer thoughts survey (CTS)

The CTS is also a 20-item scale in a 5-point Likert format with 11 items phrased in the negative direction and 9 items in the positive direction. Respondents are asked to express how often their thoughts are in accord with each statement. Responses are scored as follows: 1 = "not at all", 2 = "a little", 3 = "a fair amount", 4 = "often" and 5 = "very often". It contains three categories: Negative Computer Cognitions (11 items), Positive Computer Learning Cognitions (5 items) and Computer Enjoyment (4 items). Rosen and Weil (1992) reported reliabilities above 0.8 for the CTS, and the Cronbach's Alpha for the measure in the present study was 0.89. The CTS has been administered to more than 12,000 people from America and another 22 countries worldwide. The norms established by Rosen and Weil for computer phobia are as follows: no computer phobia, 69–100; low computer phobia, 61–68; moderate to high computer phobia, 20–60. These ranges are in contrast to the CARS, wherein high scores are indicative of computer phobia.

Computer Self-efficacy (CSES)

This instrument consists of 29 items and is scored in a 5-point Likert format (ranging from 1 = strongly agree to 5 = strongly disagree). The measure was originally used by Murphy, Coover, and Owen (1989), and was refined by Torkzadeh and Koufteros (1994). Durndell et al. (2000) made further slight modifications to allow for changes in computer-related practice and terminology. Reliability for the scale was reported to be 0.97, which was supported in the present study by a high Cronbach's Alpha of 0.94. All the reliabilities in the study were above the standard criterion of 0.7. These ranged from (a) 29 to 57, as not confident; (b) 58 to 86, as having little confidence; (c) 87 to 115, as confident; and (d) 116 to 145, as very confident.

Data Collection and Analysis

EFL Teachers' Computer Phobia and Computer Self-Efficacy Questionnaire was administered to the participants over a period of 8 weeks. Collected data were then compiled and analyzed using the SPSS statistical package (v.17). Descriptive data analysis, One-Way ANOVA, and the Pearson correlation coefficient were the primary statistical tests used in this study.

RESULTS

This section presents a statistical analysis of the data collected from the participants.   The data was analyzed to look at the factors both individually and in combination to answer the research questions that guided the study.

Computer Phobia Levels of Teachers

Outcomes from a descriptive data analysis of teachers' computer anxiety levels are shown in Table 1. About half

of the teachers (50.2%) reported no computer phobia, as evidenced by the CARS. Yet a substantial majority of teachers (89.9%) could be designated as low to highly computer phobic, as evidenced by the CTS. However, it is difficult to ascertain what percentage of computer activity is dedicated to personal use (e.g., through email and the internet), and how much is devoted to use associated with their teaching.

Table 1: Overall Computer Phobia Levels

Computer phobia levels	CARS	CTS
None	20–41 (50.2%)	69–100 (10.0%)
Low	42–49 (21.9%)	61–68 (42.1%)
Moderate/high	50-100(27.9%)	20-60 (47.8%)

Computer Self-Efficacy Levels of Teachers
Table 2 displays the levels of computer self-efficacy among teacher participants. Over 96% of the respondents showed that their levels of computer self-efficacy were in the confident or very confident categories. The overall mean score and standard deviation on computer self-efficacy were 116.73 and 18.09, respectively. Both the mean and median scores (118.50) were in the very confident category.

Table 2: Overall Computer Self-Efficacy Levels

Computer self-efficacy levels	N	Percentage (%)
Not confident	0	0
Little confidence	8	3.8
Confident	88	41.5
Very confident	116	54.7

The Relationships between Computer Phobia and Computer Self-Efficacy of Teachers
Pearson correlation analysis was used to assess the association between computer anxiety, computer thoughts, and computer self efficacy as measured by the CARS, CTS, and CSES. Table 3 displays the one way ANOVA results of the variables. The CSES correlates negatively with both CARS-S and CTS measures. The output also shows that there is moderately negative correlation between the CARS-S and CSES, with a coefficient of r = -0.618, which is also significant at p < 0.001. It can be concluded that teachers with high positive cognition and high anxiety may be likely to have low self-efficacy, which presents as a lower perceived ability to understand, use, and apply computer knowledge and skills.

Table 3: Pearson Correlation Analysis Results of the CARS-S, CAS, and CSES.

	CARS-S	CTS	CSES	Mean	SD
Computer Anxiety (CARS-S)	1	.184[*]	-.618[*]	2.0891	.65559
Computer Thoughts (CTS)	.184[*]	1	-.246[*]	3.0502	.29550
Computer Self Efficacy (CSES)	-.618[*]	-.246[*]	1	3.9263	.60337

* P<0.001.

Background Characteristics and Teachers' Computer Phobia
Table 4 shows that teachers' computer phobias differed significantly in terms of their age, PC usage, and computer accessibility at school. Teachers in the age group of 51-60, $F_{(3, 208)}$ =3.148, p=.026, had higher computer anxiety than did teachers in other age ranges. Teachers who used computer at home every day, $F_{(5, 203)}$ =11.38, p=.000, tended to perceived themselves as having lower computer anxiety. Teachers working at a school with medium to high accessibility of computer hardware, $F_{(5, 205)}$ =3.201, p=.024, tended to have lower computer anxiety. Finally, teachers with higher internet accessibility at school, $F_{(2, 206)}$ =9.603, p=.000, had significantly lower computer anxiety.

Table 4: One-way ANOVA Results for Comparison of Means, by Gender, Age, School location, PC Usage, and Computer accessibility at school

		SS	df	MS	F	Sig.
Gender	BG	510.401	1	510.401	2.961	.087
	WG	36197.467	210	172.369		
Age	BG	1594.225	3	531.408	3.148	.026*
	WG	35113.643	208	168.816		
PC usage (home)	BG	7629.088	5	1525.818	11.038	.000*
	WG	28060.530	203	138.229		

		SS	df	MS	F	Sig.
PC usage (school)	BG	1126.106	3	375.369	2.194	.090
	WG	35581.762	208	171.066		
Computer accessibility (Hardware)	BG	1638.620	3	546.207	3.201	.024*
	WG	34984.012	205	170.654		
Computer accessibility (Software)	BG	1240.923	3	413.641	2.397	.069
	WG	35381.709	205	172.594		
Computer accessibility (Internet)	BG	3123.242	2	1561.621	9.603	.000*
	WG	33499.389	206	162.618		

BG=between group; WG=within group
* P<0.05.

Table 5 shows that teachers' computer thoughts differed significantly only in terms of their PC usage. Teachers who used computers at home frequently (at least 2 to 3 times a week), $F_{(5, 197)} = 3.312$, $p = .010$, tended to perceive themselves as having higher computer thoughts. Teachers who used computers at school every day, $F_{(3, 202)} = 4.566$, $p = .004$, also tended to perceive themselves as having higher computer thoughts.

Table 5: One-way ANOVA Results for Comparison of Means, by Gender, Age, School location, PC Usage, and Computer accessibility at school

		SS	df	MS	F	Sig.
Gender	BG	11.820	1	11.820	.333	.565
	WG	7240.942	204	35.495		
Age	BG	49.215	3	16.405	.460	.711
	WG	7203.547	202	35.661		
PC usage (home)	BG	531.971	5	106.394	3.132	.010*
	WG	6692.768	197	33.973		
PC usage (school)	BG	460.588	3	153.529	4.566	.004*
	WG	6792.174	202	33.625		
Computer accessibility (Hardware)	BG	226.195	3	75.398	2.151	.095
	WG	6977.026	199	35.060		
Computer accessibility (Software)	BG	136.412	3	45.471	1.280	.282
	WG	7066.810	199	35.512		
Computer accessibility (Internet)	BG	211.056	2	105.528	3.018	.051
	WG	6992.166	200	34.961		

BG=between group; WG=within group
* P<0.05.

Background Characteristics and Teachers' Computer Self-Efficacy

Table 6 shows that teachers' computer self-efficacy differed significantly in terms of their gender, age, and PC usage. Male teachers, $F_{(1, 210)} = 4.583$, $p = .033$, perceived themselves as having higher computer self-efficacy. Teachers in the age group of 20-30, $F_{(3, 208)} = 5.253$, $p = .002$, had higher computer self-efficacy than did teachers in other age ranges. In addition, teachers who used computers at home every day, $F_{(5, 203)} = 21.557$, $p = .000$, tended to perceived themselves as having higher computer self-efficacy. Teachers who used computers at school every day, $F_{(3, 202)} = 3.204$, $p = .024$, also tended to perceive themselves as having higher computer self-efficacy.

Table 6: One-way ANOVA Results for Comparison of Means, by Gender, Age, School location, PC Usage, and Computer accessibility at school

		SS	df	MS	F	Sig.
Gender	BG	1475.332	1	1475.332	4.583	.033*
	WG	67598.800	210	321.899		
Age	BG	4864.829	3	1621.610	5.253	.002*
	WG	64209.303	208	308.699		

PC usage (home)	BG	23281.491	5	4656.298	21.557	.000*
	WG	43848.872	203	216.004		
PC usage (school)	BG	3051.038	3	1017.013	3.204	.024*
	WG	66023.094	208	317.419		
Computer accessibility (Hardware)	BG	1212.837	3	404.279	1.223	.302
	WG	67776.666	205	330.618		
Computer accessibility (Software)	BG	1860.327	3	620.109	1.894	.132
	WG	67129.175	205	327.459		
Computer accessibility (Internet)	BG	717.307	2	358.653	1.082	.341
	WG	68272.196	206	331.418		

BG=between group; WG=within group
* P<0.05.

CONCLUSION AND DISCUSSION

This study investigated whether elementary EFL teachers in Taiwan suffer from computer phobia and low self-efficacy. Some background characteristics of the teachers were also examined, since the literature in this field has indicated possible relationships between these factors. The study was conducted with elementary EFL teachers from all parts of Taiwan, and the findings confirmed that teachers suffer from the expected levels of computer phobia. Additionally, low self-efficacy levels are very common among the teachers. Based on the results, a negative relationship was observed between computer phobia and computer self-efficacy. The teachers' level of computer self-efficacy decreases as their computer phobia level increases.

As for the relationship of teachers' computer phobia, a statistically significant positive correlation was identified among computer anxiety and teachers' age, PC usage, and computer accessibility at school. It should be noted that the accessibility of computers apparently is highly associated with teachers' computer phobia and computer self-efficacy. This reveals the importance of providing teachers with sufficient computer equipment. It is also highly suggested that teachers be encouraged to use computers in order to decrease computer phobia and raise computer self-efficacy levels. Future researchers could expand this research by including more samples. Researchers may also be interested in comparing groups of teachers with different demographic backgrounds and from different countries.

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EMPLOYING DESIGN AND DEVELOPMENT RESEARCH (DDR) APPROACHES IN THE DESIGN AND DEVELOPMENT OF ONLINE ARABIC VOCABULARY LEARNING GAMES PROTOTYPE

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ABSTRACT
The design and development research, first proposed by Brown and Collins in the 1990s, is currently among the well-known methods in educational research to test theory and validate its practicality. The method is also known as developmental research, design research, design-based research, formative research and design-cased and possesses conceptual underpinning and practical aspects of the 'what' and 'how' of 'doing'. This paper describes the design and development of a web-based Arabic vocabulary learning games prototype incorporating the methods and approaches of DDR for elementary learners in Centre for Foundation Studies (CFS), International Islamic University Malaysia (IIUM). The effort in generating this learning prototype attempts to design, develop and integrate a game-based learning application in an online platform. It is meant to provide an interactive learning experience for learners who have been through traditional non-computer based Arabic teaching and learning methods. Their feedbacks and responses are then gathered and analysed as the formative evaluation for the design and development principles. The exploration of the potential of use for the game-based learning prototype in teaching and learning in real setting by various experts, learners and teachers was also among the steps taken to evaluate the usability and practicality of the prototype during the design and development phases.
Keywords: Design and development research, online games, Arabic vocabulary learning, formative evaluation, web-based games

INTRODUCTION

Nowadays, online digital educational games are described as the new model of e-learning (Squire, 2005) and have attracted researchers' attention from around the world and perceived as an integrated tool within the teaching and learning process (Prensky, 2001; Pivec, Koubek & Dondi, 2004; Whitton, 2010; Roslina et. al., 2011). The term 'game-based learning' or GBL describes the teaching and learning process via computer games similar to terms such as 'digital game-based learning' (Prensky, 2001), 'edutainment' and 'serious games' (Tsai F.H., et. al, 2008). 'Serious games', however, differ from edutainment games in terms of more advanced design consideration, latest hardware and software and rules of simulation (Michael & Chen, 2006). The differences between games and simulations are also viewed as fulfilling a particular psychological situation for the player in games and participants in simulations (Gredler, 1992). Simulations are also found potentially helpful in assisting the students to learn by construction in a simulated embodied experience and problem solving skills (Liu, Chen & Huang, 2011) and is also capable of evoking flow experiences and positive effects (Chiang, et. al., 2011).

The computer games characteristics are also among the main factors that differentiate them from any other instructional media and technology. Malone and Lepper (1987), for instance, identify motivational factors in games such as challenge, fantasy, curiosity and control. Other researchers have expanded the potential characteristics of games in designing game-based learning framework in terms of fun, entertainment, constraints,

goals achieving, acquiring knowledge and skills (Gredler, 1992), experiential learning and challenging (Gredler, 2004), competitiveness, enjoyable, creativity (Akilli, 2007), played on various platforms or game consoles (Roslina & Azizah, 2008), motivating (Tuzun, 2004; Alessi & Trollips, 2001) and experienced-based storyline (Zarina & Hanafizan, 2005).

Design and Development Methodology in Educational Games

The design and development of games proves to be a not so easy process requiring an extensive programming project from the development of game engine, middleware, interface programming and audio programming. Despite the difficulties, a number of tools such as functional authoring tools and drag and drop interface have been recently developed to ease the complexties (Roslina & Azizah, 2008). Several frameworks and models have been proposed by researchers in the field of game design such as The Design Framework for Edutainment Environment by Embi (2005), Adopted Interaction Cycle for Games by Barendregt and Bekker (2004), Game Object Model by Amory (2001) and The Engaging Multimedia Design Model for Children by Said (2004), as cited in Tan, Ling and Ting (2007).

The design and development principles of the online Arabic vocabulary games in study were based on the 5 level of games learning which Prensky (2001) refers to as: "**"How," "What,""Why," "Where," and "When/ Whether"** levels at which learning occurs in video and computer games (Pivec, Koubek & Dondi, 2004, p. 42). The design and development process of the Arabic vocabulary games prototype in this paper involves the integration of Arabic learning contents from the traditional text book and the Raptivity ® e-learning authoring software supplying many and various games templates. The selection of this software is due to reasons of its supportive features to the correct display of Arabic fonts and the right to left Arabic writing system. It is also a tool that can be easily navigated through by educators without requiring high level of computer skills, which is among the identified shortcomings of the Arabic language teachers (Mohd Feham & Isarji, 2006; Mohd Feham, 2006; Zawawi, 2008).

The online mode is selected as the games platform for this prototype because it allows learners, regardless of their geographic location, to independently participate in the learning environment (Connolly & Stansfield, 2006). It is played on a computer platform with the internet connection; the games are stored and played directly from the server (Roslina & Azizah, 2008). An online platform is also chosen for the games prototype to facilitate the usability and ensure easy-access to this application for the Arabic language learners.

Design and Development Research (DDR) Method as Employed Approaches

The employment of design and development research (DDR) methodology as the selected approach is justified in this study by its pragmatism in testing the theory and validating the practicality. Besides, it is described as a way to establish new procedures, techniques and tools based on specific needs analysis (Richey & Klein, 2007). This methodology is also formerly known as developmental research (Richey, Klein & Nelson, 2004), designed case (Reigeluth & Frick, 1999), design-based research (Reeves, 2006 & Herrington, et. al, 2007), formative research (Nieveen, 2007), and design research (Bannan-Ritland, 2003; Van der Akker, 2007).

Although many terms have been introduced to explain and describe this research method within its similarities and differences, it was first proposed by Brown and Collins in 1992 as an extension to other educational research methods (Wang & Hannafin, 2005, Markauskaite & Reimann, 2008) and to test theory and validate its practices (Richey & Klein, 2007). It is also employed to design and develop an intervention (such as programs, teaching-learning strategies and materials, products and systems) with the aim to solve a complex educational problem and to advance our knowledge on the characteristics of these interventions and the processes to design and develop them (Plomp, 2007, p.12). Wang and Hannafin (2005) define it "as a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (p. 6). Table 1.0 illustrates the pragmatic elements of a design and development research that have been adapted in this study:

Table 1.0 : Elements of a design and development research

Goals	Dual goals – theory and practice
Theory development	Multidisciplinary and interdisciplinary
Method	Mixed modes
Process	Cyclical, iterative, teamwork
Resources	Extensive literature, collaboration, partnership, various research technologies
Outcomes	Improved theory, product, design principles

Adapted from Nor Aziah (2007)

A Pragmatic Model of Design and Development of Online Arabic Vocabulary Learning Games Prototype
The employment of pragmatic elements of a design and development research (DDR) in this paper is described as the followings :

a) Multidisciplinary and interdisciplinary theory development: The design and development of the online Arabic vocabulary learning games involved various multidisciplinary and interdisciplinary analyses of needs for the design and development of games addressing numerous aspects of Arabic vocabulary learning problems among learners, teachers and experts. The design and development aspects from other fields of knowledge were also considered prior to the games' design and development process.

b) Mixed modes methods :
The mixed modes methods were implemented in the formative evaluation of the online Arabic games. The evaluation is meant to *judge the strengths and weaknesses of its instruction in its developing stages, for purposes of revising the instruction to improve its effectiveness and appeal* (Tessmer, 1993, p. 11). The evaluation was divided into 2 phases of game prototype 1 and game prototype 2 implementing both quantitative and qualitative mix-method instrumentations. The validation of the instruments for the formative evaluation was conducted by an expert in instructional design and game-based learning from the University of South Dakota, United States of America (USA).

The process of consultation, discussion and validation were communicated through the researcher's email at sabriqld2003@gmail.com. The formative evaluation for pre-prototype 1 went through several try-out sessions with a limited number of the user groups such as teachers and learners who will eventually use the materials and expert appraisal or review from a group of experts consisting of subject matter experts, instructional design experts, and teachers review of the materials (Nieveen, 2007). Prototype 1 and prototype 2 have been evaluated via four (4) types of formative evaluation which are expert review, one-to-one evaluation, small group test and field test which were adapted from Tessmer (1993, p. 15). The process of formative evaluations for the design and development principles were conducted in the following phases as shown in Table 2.0 below:

Table 2.0 : Phases of Formative Evaluations for the Games Prototype

GAMES PRE-PROTOTYPE (ANALYSIS, DESIGN AND DEVELOPMENT)	
Participants and Methods	**Instruments**
- 115 out of 133 learners in semester 3, 2008/2009 - 13 lecturers teaching in semester 3, 2008/2009 - 2 senior IT officers at CFSIIUM - (consultation in IT facilities) - 2 programmers from Raptivity ® - (consultation in using Raptivity's authoring tool) - 3 experts in digital game-based learning (DGBL) – consultation in survey design	• Needs analysis • Open-ended questionnaires • Interviews • Think-Aloud protocols • Content Analysis
GAMES PROTOTYPE 1 (DESIGN AND DEVELOPMENT)	
Participants and Methods	**Instruments**
- 2 programmers from Raptivity ® - (consultation in using Raptivity's authoring tool) - 1 subject matter expert in Arabic language - 3 experts in validating the survey design - 2 experts' review in instructional designs, English language and Arabic language.	• Open-ended questionnaires • Interviews • Think-Aloud protocols • Content Analysis
GAMES PROTOTYPE 2 (FORMATIVE EVALUATION)	
Participants and Methods	**Instruments**
a) Pre-Formative Evaluation - Peer reviews (2 lecturers) - SME in Arabic language (1 expert) **b) Formative Evaluation 1** - Experts' review (6 experts) - Learners' review (2 learners) - Evaluator's review (1 peer lecturer/asst. coordinator) **c) Formative Evaluation 2** - small group testing (16 learners) - field testing 1 (33 learners) - field testing 2 (49 learners)	• Survey • Open-ended questionnaires • Interviews • Think-Aloud Methods • Class observations • Testimonials

c) Cyclical, iterative, teamwork :
The iterative cycles of the five (5) phases of analysis, design, development, implementation and evaluation used in this project are in accordance to the ADDIE Model as shown in Figure 1.0 :
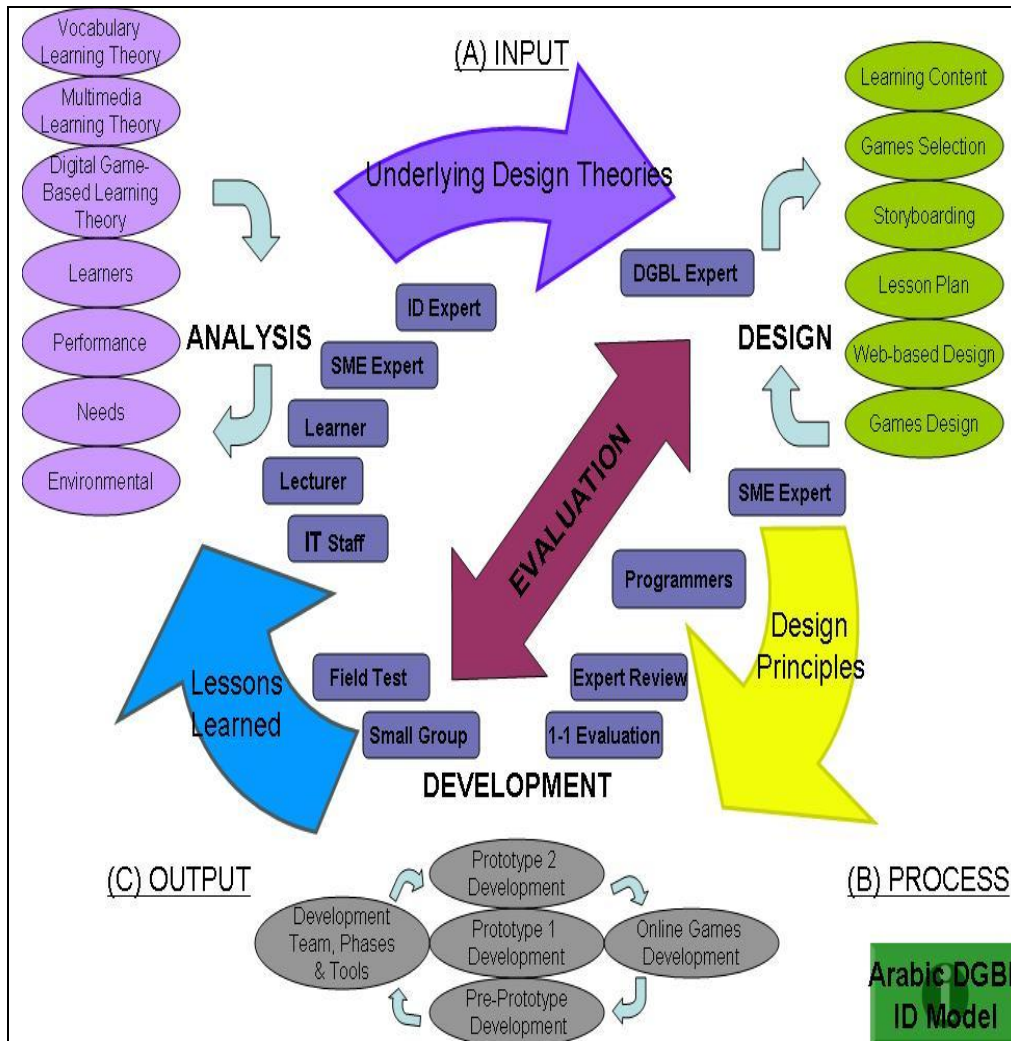
Figure 1.0 : Iterative cycles of adapted ADDIE's model

The front-end analysis for the learning needs of the prototype's design and development was then conducted based on the design and development of product and tool research (Richey & Klein, 2007) or previously known as Type 1 of developmental research (Richey, Klein, & Nelson, 2004). The differences between TYPE 1 and TYPE 2 developmental research are shown in Table 3.0 below :

Table 3.0 : A Summary of the 2 Types of Developmental Research

	Product and Tool Research Or Type 1 of DR	Model Research Or Type 2 of DR
Emphasis	Study of specific product or program design, development, &/or evaluation project	Study of design, development, or evaluation processes, tools, or models (can focus only on ONE phase)
Product	Lessons learned from developing specific products and analyzing the conditions that facilitate their use	New design, development, and evaluation procedures &/or models and conditions that facilitate their use
	CONTEXT-SPECIFIC CONCLUSION	*GENERALIZED CONCLUSIONS*

This research has embraced the product and tool research method (Richey & Klein, 2007) or previously known as Type 1 of developmental research (Richey, Klein, & Nelson, 2004). The product for this study is an online Arabic vocabulary learning games prototype, which was conceptualized, designed and developed based on both

theoretical and practical aspects. The development of the online Arabic vocabulary learning games prototype as a final educational product is a combination of the design and development principles with vocabulary games templates from Raptivity ® e-learning authoring tools in an online learning environment. The researcher is the main designer and developer of this learning prototype module. It is however, the nature of developmental research that the researcher collaborates with a development team. Relevant tools of development are employed and the development process is documented in work logs as illustrated in Table 4.0 :

Table 4.0 : Work Logs of Development Process and Stages

Stage	Work Log	Descriptions
Stage 1	Designing the online games storyboards.	Designing the storyboards based on 'Design Principles'.
Stage 2	Designing the webpage.	Designing the webpage for the online vocabulary games learning.
Stage 3	Developing the vocabulary games.	Developing the games by integrating the learning contents into the games design templates of Raptivity.
Stage 4	Uploading and publishing the games website.	Uploading and publishing the website in the internet server and testing the application.
Stage 5	Conducting pre-formative evaluation	Conducting pre-formative evaluation with subject-matter expert (SME) and lecturers as future users.
Stage 6	Revision of design and development	Revising and modifying the development process based on the feedbacks and responses.
Stage 7	Conducting formativeevaluation 1.	Conducting formative evaluation 1 of the online Arabic vocabulary games with expert reviewers, lecturers and learners as actual users.
Phase 8	Revision of design and development	Revising and modifying the development process based on the feedbacks and responses.
Stage 9	Conducting formative evaluation 2.	Conducting formative evaluation 2 of the online Arabic vocabulary games with students and teachers as the actual users.
Phase 10	Data analysis and report	Conducting the data analysis and report of the design and development process

d) Extensive literature, collaboration, partnership and various research technologies : The design and development of the online Arabic vocabulary learning games prototype have not been simply conducted as in designing and evaluating the games formatively or summatively. It has been scrutinized through the analysis of extensive literature, collaboration and partnership between different learners, lecturers, experts and instructional designers and integrated various research technologies and tools. In order to construct the framework for the online Arabic vocabulary learning games prototype, as shown in Figure 2.0, analyses of theories from literature such as of Nation's (2003), digital game-based learning (Prensky, 2001) and multimedia learning (Mayer, 2001) were conducted. The analyses of extensive literature were combined with a 9-year personal teaching experience of the researcher and the reasons for failures in Arabic subjects among learners in 4 consecutive semesters of 2005/2006 until 2008/2009 (TEMU Report, 2005-2009). Based on the researcher's initial analysis and observation, the lack of instructional technologies in current teaching and learning of Arabic has led to the problem of memorizing the content of Arabic lessons taught in the classroom, as echoed by Mohd Feham (2006) and Zawawi (2008). Concurrently, the reports on students' failures revealed that among the main and obvious factors were poor attendance in the classroom, weaknesses in memorizing Arabic vocabularies and their minimal effort to improve and pay attention in Arabic language learning. These factors are mainly related to students' learning attitude and motivation in learning Arabic.
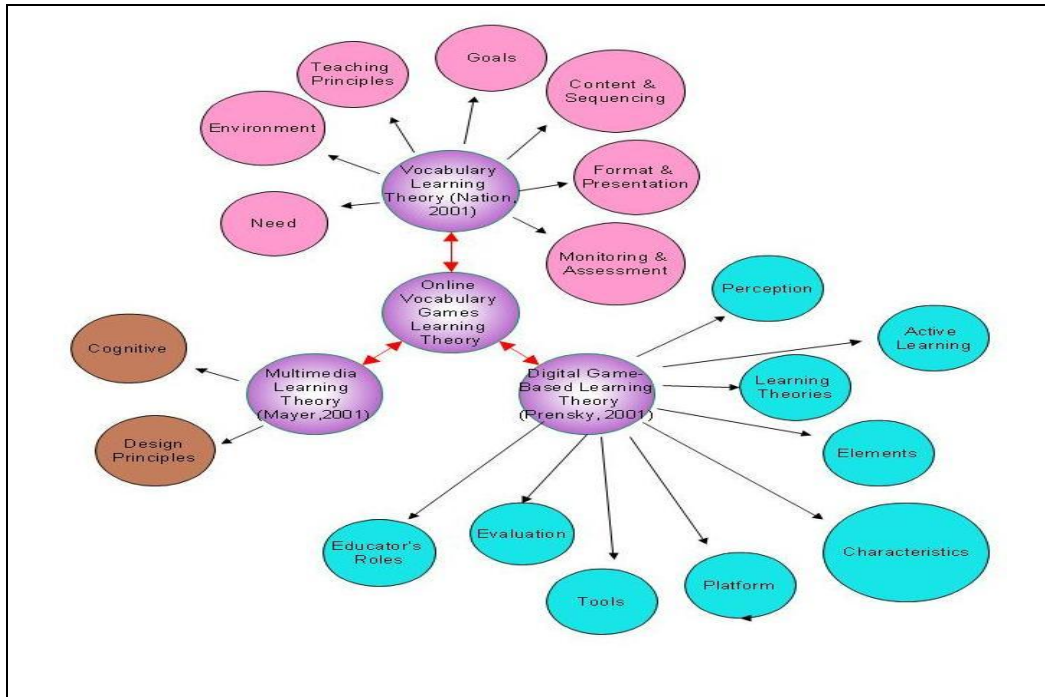
**Figure 2.0 : Design theories of online vocabulary
learning games from extensive review of related literature**

In addition, the ADDIE's adapted model is chosen as the instructional design model for the research as it fits the design and development methods, objectives and approaches to portray a complete picture and understanding, theoretically and practically, of an online vocabulary learning module. Walter Dick and Lou Carey are widely viewed as the torchbearers of the ADDIE methodology, through their book *The Systematic Design of Instruction* (Dick & Carey, 1996). Akilli (2004) has proposed the FID^2GE model, also consisting of four phases of design; analysis, design, development and evaluation, which stands for "**F**uzzified **I**nstructional **D**esign **D**evelopment of **G**ame-like **E**nvironments" for learning in which the name was derived from the dynamism, non- linearity and the fuzziness of games (p. 139-142) as shown in Figure 3.0 :
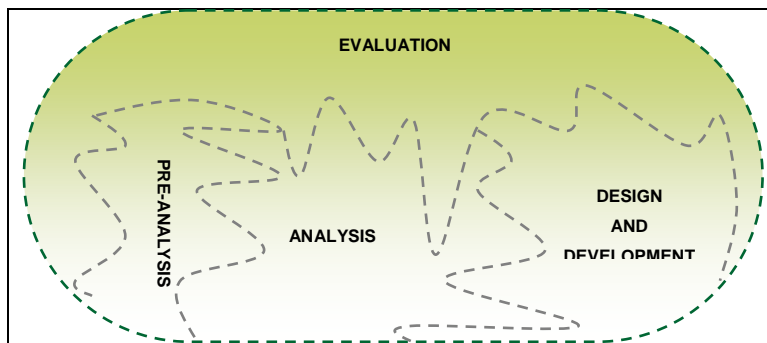
Figure 3.0 : FID^2GE model

The researcher, however, opted to use the adapted ADDIE's model (Figure 1.0) instead of FID^2GE due to the uncertainty of the implementation phase in FID^2GE and the existence of five (5) main phases in ADDIE to facilitate the research. The argument of whether ADDIE is a model or just a process is not the objective of discussion in this paper. To reiterate, the ADDIE model is chosen for its systematic generic approach in instructional design, which clarifies the instructional framework to the designers or researchers in order to ensure the effectiveness of instructional products with creative processes (College Station, 2001).

e) Improved theory, product and design principles based outcome :
The refinement of theories from the literature in the *iterative cycles of testing and refinement of solutions in practice* (Reeves, 2006 & Herrington, 2007) begun at the front-end analysis phase directed at analysing four (4) components of needs analysis which was adapted by Dabbagh (2006) and as shown in Figure 4.0. The participants involved were 113 out of 133 students studied Arabic language in semester 3, 2008/2009 as well as

the lecturers and were required to answer the needs and pre-design survey of an online Arabic vocabulary games in CFSIIUM (Muhammad Sabri and Nor Aziah, 2011). The validation of the instrument was completed by a lecturer, from the Institute of Education (INSTED, IIUM), teaching the subject of Research Methodology in IIUM.
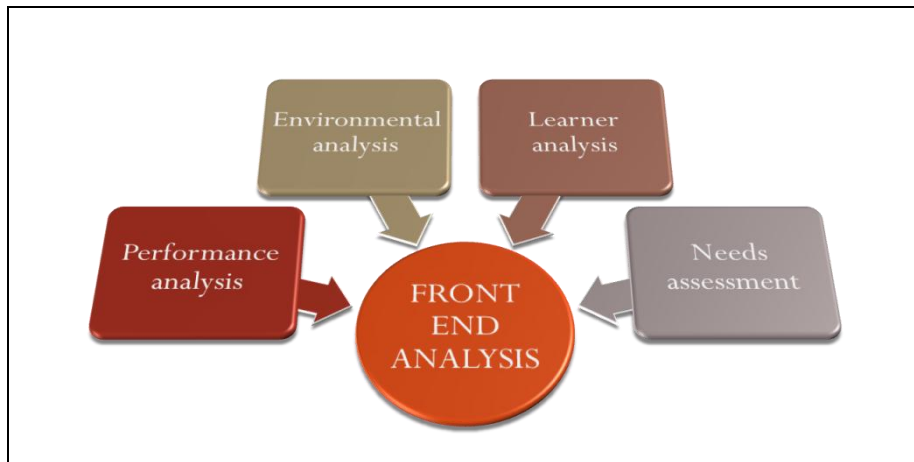
Figure 4.0 : The Analysis Procedure in Developmental Research

The initial design from the analysis phase was then validated by an expert who is an Arabic language lecturer from the Centre for Language and Pre-University Academic Development (CELPAD) of IIUM in order to refine the contents of Arabic language integrated in the online games. The theories were also refined by an expert from the Centre for Professional Development (CPD) of IIUM who specializes in instructional design and teaching using technology. At the end of this phase, the design and development principles were established to guide the development process. The details of procedures conducted were previously explained in Table 2.0.

Design and Development of Online Arabic Vocabulary Learning Games Prototype
The online vocabulary learning games was designed as a final research product of additional teaching and learning aid in Arabic vocabulary learning and was hosted in a web-based environment. The general outlines of design and development of this online Arabic vocabulary games prototype are as the followings:
  a) Constructing general research framework
  b) Conducting front-end analysis procedures
  c) Validations from various experts (ID & SME)
  d) Consultations from various experts (ID & SME)
  e) Constructing 'Initial design principles'
  f) Revising and validating 'design principles'
  g) Development of initial pre-prototype
  h) Revisions of prototype 1 and prototype 2 in iterative and cyclic and process – meant for changes and improvement of final games prototype
  i) Conducting formative evaluation of design and development among various experts, lecturers, and learners
  j) Final product is ready for use

The samples of website screenshots are as shown below in Figure 5.0 and Figure 6.0 :

Figure 5.0 : Main Page of Online Arabic Vocabulary Learning Website

Figure 6.0 : Screenshot of Online Arabic Vocabulary Learning Website

Main Characteristics of Online Arabic Vocabulary Learning Games Prototype
a) It is designed mainly for Arabic learners in CFSIIUM.

b) It has a compendium of 34 varieties of games and distributed into 7 levels of vocabulary difficulties.
c) It is supported by online learning tools such as instructions to play, learning objectives for every game, online translator, online dictionary, games glossary in English to Arabic and 2 vocabulary test games.
d) It is functioning as a supportive teaching and learning tool for Arabic language in the classroom and multimedia laboratory as the followings:.

i) The lecturer facilitates (facilitator)
ii) Learners collaborate (collaborative learning)
iii) Has the potential for self-instruction (synchronous and asynchronous modes)
iv) Supportive learning tool for blended/hybrid learning
v) Can be used between 14 weeks of semester (flexibility)

Challenges and Obstacles

Design and development research (DDR) provides an alternative to conduct rigorous and systematic design research based on solid theoretical foundations. It possesses the necessary approaches to design and develop the principles of the games prototype with the flexibility of revision in iterative cycles of user testing sessions in real and authentic setting. However, each endeavor is not without its own challenges and barriers. The challenges and obstacles mentioned in this paper were established from the experience of researcher during the design and development of this online games prototype and are as the followings:

a) The limitation of technical support in Raptivity ® software in Arabic writing systems and fonts exists, and has caused some restrictions in using Arabic conveniently, especially in the display of Arabic fonts with the vowel sounds.
b) The limitation of games design templates in this software also restricted the design of language games with advanced features such as in displaying overall scores for all players for the purpose of competition, more choices of attractive games templates, colours, and buttons.
c) This study is specifically designed for elementary level Arabic learners only based on the selection of vocabulary games and may not be suitable for higher level of learning.
d) The financial implication is one of the restrictions to producing a high technology games for this study which has resulted in the researcher in using the Raptivity ® software as a platform to develop Arabic vocabulary games.
e) This software can be used by all educators with proper training and briefing without the need for a high level of computer competency skills such as in using advanced authoring software to develop games such as the Adobe Flash, and SwishMax ®. Thus, this software could not be used to develop the advanced features of language games.

SUGGESTIONS FOR EDUCATORS AND INSTRUCTIONAL DESIGNERS

a) The technical limitation of this software in Arabic writing systems and fonts should be improved and enhanced in order to make it more compatible, convenient and user-friendly to Arabic learning application.
b) The limitation of games design templates in the Raptivity ® software can also be upgraded and enhanced with advanced features such as in displaying overall scores for all players for the purpose of competition, more choices of attractive games templates, colours, and buttons.
c) The future research and study of using game-based learning in Arabic language could attempt to design and develop the games that use different learning platforms compared to this study such as the arcade, console, CD-based and handheld or mobile learning games.
d) The educational institutions that offer Arabic language learning should play more active role in producing attractive and interactive teaching and learning aids in order to enhance students' motivation and attitude in learning process and improving their achievement and performance.
e) The Arabic language teachers and practitioners should be more aware of and knowledgeable with the latest teaching technology and computer skills. Some groups with high computer skills in every educational institution can be trained periodically in a cluster training in order to help them producing new teaching and learning aids in Arabic language.
f) There should be sessions of cooperative work and research activities between language teachers such as the Arabic, English or other languages with the instructional designers and computer experts to design and develop advance and effective games for teachers and learners.
g) Other ID models may be used in the design and development of games based on the objectives, structures, expected outcome, technology or others issues based on the suitability and purpose of games design and development.

SUMMARY

This paper has described an effort to design and develop an online Arabic vocabulary learning games prototype in IIUM using the design and development research (DDR) methodology and approach. This Arabic educational DGBL is now in function and linked to several learning and research institutions such as My-Arabic at CELPAD, IIUM (Link: http://myarabic.e-celpad.com/), Malaysian Foundation of Innovation (Link : http://www.yim.my/databank/index.cfm?menuid=5&action=show&ib=128&), and educational blog in Arabic learning such as http://mari-belajar-bahasa-arab.blogspot.com/. The outcome of this project will hopefully enhance the process of teaching and learning Arabic language in IIUM as well as in other institutions. This research is hoped to trigger more in-depth research methodologies and approaches in the design and development on online educational games based on real needs in the real settings of learning environment and institutions, This prototype has reflected a set of design and development principles for an online Arabic vocabulary learning games in the Malaysian context specifically and for non-native Arab speakers in general.

NOTES ON CONTRIBUTOR

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EXAMINING THE RELATIONSHIP BETWEEN TEACHERS' ATTITUDES AND MOTIVATION TOWARD WEB-BASED PROFESSIONAL DEVELOPMENT: A STRUCTURAL EQUATION MODELING APPROACH

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ABSTRACT
This study was conducted to investigate elementary school teachers' attitudes and motivation toward web-based professional development. The relationship between teachers' attitudes and motivation was explored using the AWPD (Attitudes toward Web-based Professional Development) and MWPD (Motivation toward Web-based Professional Development) surveys, respectively. The AWPD consisted of five scales, including "Perceived usefulness", "Perceived ease of use", "Affection", "Anxiety", and "Behavior". The MWPD also consisted of five scales, including "personal interest", "social stimulation", "external expectation", "practical enhancement", and "social contact". Data gathered from 322 elementary school teachers were examined through structural equation modeling. The results indicate that, in general, the teachers' attitudes and their motivation toward web-based professional development were significantly positively correlated with each other. It was also found that teachers with higher motivation have more positive attitudes toward web-based professional development.
Keywords: attitudes, motivation, web-based professional development

INTRODUCTION
In the past decade, the rapid diffusion of the Internet has not only generated a renewed interest in the role of new information and communication technologies (ICTs) in educational contexts, but has also affected the ways people teach and learn (DeLacey & Leonard, 2002). With the rapid development of the Internet, teachers have more opportunities to employ it in their practices, and to advance their professional development (Park, Lee, & Cheong, 2007). Recently, the advantages of web-based learning have been widely recognized and accepted. Research suggests that technology-mediated learning environments afford more study flexibility and broader accessibility, while also improving students' performance (Lee, Cheung, & Chen, 2005).

The relevant studies of learners' acceptance and usage of web-based learning have been highlighted (Liaw, Huang, & Chen, 2007; Kao & Tsai, 2009). The Theory of Reasoned Action (TRA) argues that individuals' beliefs define their attitudes and thereby shape their intentions, which in turn, guide their behavior. Extended from TRA, the Theory of Planned Behavior (TPB) stipulates that individuals' beliefs can be explained by their behavioral intentions, which are jointly influenced by their attitudes, subjective norms, and perceived behavioral control. Further, the Technology Acceptance Model (TAM), which is adapted from TPB, has been widely used to predict user acceptance and usage behavior (Davis, 1989). In TAM, beliefs of individuals determine their attitudes toward using a particular system and, in turn, these attitudes foster their intention to use it. This intention influences the decision of actual technology usage. These causalities have been thoroughly studied and broadly accepted (Suh & Han, 2002). The TAM has shown that motivation formulates the mechanism of human behavior and action.

With the proliferation of the Internet, researchers have modified TAM and demonstrated it empirically in the context of web-based learning (Shin, 2007). Some recent studies have investigated learners' acceptance of web-based learning environments (Lee, Cheung, & Chen, 2005; Raaij & Schepers, 2006). These studies have revealed that teachers' motivation toward web-based professional development may be an important issue for investigation. As such, this study incorporates the motivational perspective to explore and predict teachers' acceptance and usage of web-based learning. Many previous Internet technology-related behavioral studies have

used the belief-attitude-intention-behavior chain represented by the TAM formulation to successfully predict learners' online acceptance behavior (Heijden, 2003; Saadé & Bahli, 2005). In addition, past studies investigating the role of motivation in Internet use have also confirmed that it has a positive impact on new technology adoption and use (e.g., Stafford & Stern, 2002; Vandenbroeck, Verschelden, & Boonaert, 2008). Moreover, instrumental use of media and technology with greater motivation has been found to produce stronger attitudinal and behavioral effects on the use of media and technology (Rubin, 2002). Hence, it is plausible to hypothesize that teachers' motivation toward web-based professional development may affect their attitudes.

In sum, the major purpose of this study was to probe the relationship of teachers' motivation and attitudes toward web-based professional development. To this end, two questionnaires were administered. By gathering questionnaire responses from 322 elementary school teachers in Taiwan, this study aimed to answer the following question: What are the relationships between the teachers' motivation toward web-based professional development and their attitudes toward web-based professional development?

RELATED LITERATURE

In the past decade, a great number of studies have focused on the factors such as beliefs and attitudes that influence learners' usage behaviors regarding information technology and web-based learning (Liaw, Chang, Hung, & Huang, 2006; Kao & Tsai, 2009). In these studies, researchers have mostly paid attention to exploring students and teachers' various characteristics of information technology and web-based learning. However, few studies have focused on constructs related to the web-based professional development of teachers. As a result, the issue of teachers' characteristics in terms of web-based learning should also be highlighted when they have more opportunities to learn and advance their professional development on the Internet.

Attitudes toward web-based learning & professional development

Previous studies have revealed that attitudes toward a new technology play an important role in its acceptance and usage (Davis, Bagozzi, & Warshaw, 1989; Liaw, 2002). Over the past decade, researchers have explored learners' attitudes toward computers, the Internet and web-based learning (Colley & Comber, 2003; Kao & Tsai, 2009; Tsai & Lin, 2004). However, comparatively fewer studies have been conducted to investigate teachers' attitudes toward web-based professional development. Hence, one of the purposes of this study was to assess these attitudes. The literature has shown that the Technology Acceptance Model (TAM), introduced by Davis (1989), has built a powerful model for explaining and predicting users' computer intentions and acceptance. An individual's actual system usage is determined by attitudes and behavioral intentions. In TAM, perceived usefulness and perceived ease of use are hypothesized as being the fundamental determinants of user acceptance (Davis, 1989). Besides, according to Taylor and Todd's (1995) Decomposed Theory of Planned Behavior (Decomposed TPB), attitudes can be decomposed into "perceived usefulness," "perceived ease," and "compatibility".

Motivation toward web-based learning & professional development

Moreover, this study aimed to explore the psychological factors that might be related to the educators' attitudes. One of the factors is motivation, which refers to the process whereby goal-directed activity is instigated and sustained (Schunk, Pintrich, & Meece, 2008). Previous studies have shown that learners' attitudes can be discussed from a motivational perspective (Rubin, 2002; Saadé & Bahli, 2005). Also, some studies have explored and examined various constructs related to web-based learning in educational settings. However, relatively few have focused on educators' motivation and their attitudes toward web-based professional development. Hence, this study aimed to investigate the relationship between the educators' motivation and their attitudes toward web-based professional development.

METHOD

Sample

The participants of this study were randomly drawn from 30 elementary schools in the northern region of Taiwan. The final sample comprised 322 Taiwanese elementary school teachers with actual experience of web-based professional development. Among the participating teachers, 99 (30.7%) were male and the remaining 223 (69.3%) were female. In terms of Internet experience, 160 (49.7%) reported using the Internet less than 12 hours per week, 73 (22.7%) reported 13 to 24 on-line hours per week, and 89 (27.6%) more than 25 hours per week.

Instruments

To assess the teachers' motivation and attitude toward web-based professional development, two instruments were adopted in this study.

The Motivation toward Web-based Professional Development Survey (MWPD) administered in this study was

adapted from Kao, Wu and Tsai's (2011) survey. The items developed in this study were mainly based upon the original items, and the authors consulted with two experts in educational technology and five elementary school teachers with actual experience of web-based professional development. The initial pool of items in the survey included a total of 30 items, which were presented using a seven-point Likert mode (ranging from 1, "strongly disagree" to 7, "strongly agree"). Five scales were designed for the MWPD as follows:

1. *Personal interest scale*: People who score highly on this scale participate in web-based professional development for its own interest. That is, they care about the inherent joy of this form of professional development that impels their participation.
2. *Social stimulation scale*: People who score highly on this scale are usually lonely or bored in regular life or teaching and so participate in web-based professional development to meet others and to grapple with problems in their social life.
3. *External expectation scale*: People who score highly on this scale participate in web-based professional development because of the expectations of someone at work.
4. *Practical enhancement scale*: People who score highly on this scale are committed to "doing good" in education. That is, they think web-based professional development helps them do good work in education.
5. *Social contact scale*: People who score highly on this scale participate in web-based professional development because of the joy of interacting with others.

The Attitudes toward Web-based Professional Development Survey (AWPD) implemented in this study was adapted from Kao and Tsai's (2009) survey. The 27 items were also presented with a seven-point Likert scale (from 1, "strongly disagree" to 7, "strongly agree"). The details of the five scales are as follows:

1. *Perceived usefulness scale*: assessing perceptions of the extent to which teachers perceive that the impact of web-based professional development is positive and useful. The higher the scores, the stronger the attitudes toward the usefulness of web-based professional development.
2. *Perceived ease of use scale*: assessing perceptions of the extent to which teachers perceive that web-based professional development is easy to attain.
3. *Affection scale*: measuring perceptions of the extent to which teachers express favorable feelings about web-based professional development. Higher scores suggest more positive feelings about web-based professional development.
4. *Anxiety scale*: measuring perceptions of the extent to which teachers experience anxiety about web-based professional development. The scale score is scored in reverse. Thus, higher scores indicate less anxiety about web-based professional development.
5. *Behavior scale*: measuring perceptions of the extent to which teachers perceive actual practice and willingness to use web-based professional development. The higher the scores, the stronger willingness to use web-based professional development.

RESULTS
Instrument validation
To validate the MWPD, both exploratory factor analyses (EFA) and confirmatory factor analyses (CFA) were conducted in the research. In the EFA, the extraction method was performed by principle component analysis, and the rotation method was varimax with Kasier normalization. The EFA results presented in Table 1 show that the MWPD consisted of 22 items with five scales. The factor loadings for the retained items are also shown in Table 1. The reliability coefficients for the scales respectively were 0.83 (personal interest, 5 items), 0.83 (social stimulation, 5 items), 0.86 (external expectation, 4 items), 0.87 (practical enhancement, 4 items), and 0.86 (social contact, 4 items). The alpha value of the whole MWPD questionnaire was 0.90, and these scales explained 68.08% of variance totally. Therefore, these scales were deemed to be sufficiently reliable for assessing teachers' motivation toward web-based professional development.

In addition, a series of CFA was conducted by LISREL in order to re-confirm the validity and reliability of the MWPD. The fitness of items for each scale of the MWPD was examined and the results are presented in Table 1. As shown in Table 1, all the t-values of the 22 items on the five scales of the MWPD exhibited statistical significance at the 0.001 level. Further, the factor loadings of all the items were higher than 0.5, indicating that all of those items within each scale were highly correlated with each other and, therefore, revealed convergent validity. The reliability of the MWPD was evaluated again by assessing the composite reliability coefficient of each scale. Table 1 shows that all of the composite reliability coefficients were larger than 0.70, indicating adequate levels of reliability for the constructs. In sum, the results in Table 1 show high validity and reliability of the MWPD instrument.

Similar to the MWPD validation, the fitness of the items for each scale of the AWPD was examined and the results are presented in Table 2. The AWPD consisted of 22 items on the five scales. As Table 2 shows, the reliability coefficients for the scales respectively were 0.91 (perceived usefulness, 6 items), 0.88 (perceived ease of use, 6 items), 0.84 (affection, 3 items), 0.88 (anxiety, 3 items), and 0.85 (behavior, 4 items). The alpha value of the whole AWPD questionnaire was 0.91 and these factors explained 72.93% of variance totally. Therefore, these scales were deemed to be sufficiently reliable for assessing teachers' attitudes toward web-based professional development.

Table 1: A summary of the EFA and CFA results for the MWPD (n=322)

Scale	Item	M	SD	EFA (Exploratory factor analyses)				CFA (Confirmatory factor analyses)		
				FL[a]	EV[b]	VE[c]	C[d]	FL[a]	t-value	CR[e]
Personal interest	PI1	5.91	0.73	0.70	3.25	14.13%	0.83	.63	Fixed-item	0.84
	PI2	5.98	0.66	0.82				.78	10.90***	
	PI3	6.00	0.67	0.74				.83	11.36***	
	PI4	5.89	0.73	0.76				.75	10.63***	
	PI5	6.04	0.69	0.70				.55	8.43***	
Social stimulation	SS1	5.29	1.07	0.77	3.23	14.02%	0.83	.84	Fixed-item	0.75
	SS2	5.35	1.30	0.81				.86	17.53***	
	SS3	5.89	0.94	0.57				.51	9.27***	
	SS4	5.12	1.29	0.76				.72	14.08***	
	SS5	4.61	1.56	0.65				.64	12.14***	
External expectation	EE1	4.38	1.44	0.85	3.05	13.25%	0.86	.82	Fixed-item	0.80
	EE2	4.60	1.34	0.91				.92	18.27***	
	EE3	4.81	1.17	0.66				.61	11.33***	
	EE4	4.42	1.32	0.85				.78	15.62***	
Practical enhancement	PE1	5.42	1.02	0.73	3.21	13.96%	0.87	.78	Fixed-item	0.83
	PE2	5.55	0.97	0.82				.87	8.48***	
	PE3	5.56	1.01	0.86				.89	8.52***	
	PE4	5.84	0.85	0.72				.82	8.32***	
Social contact	SC1	5.58	0.96	0.78	2.92	12.71%	0.86	.81	Fixed-item	0.80
	SC2	5.69	0.86	0.80				.81	15.46***	
	SC3	5.62	0.96	0.74				.80	15.31***	
	SC4	5.72	0.87	0.74				.72	13.47***	

Overall α= 0.90, total variance explained is 68.08%

*** $p < 0.001$

[a] Factor Loading

[b] Eigen-value

[c] Variance Explained

[d] Cronbach α

[e] Composite Reliability

Moreover, in the CFA, the fitness of items for each scale of the AWPD was examined. The results are presented in Table 2, which shows that all the t-values of the 22 items on the five scales of the AWPD exhibited statistical significance at the 0.001 level. Further, the factor loadings of all the items were higher than 0.6, indicating that all of those items within each scale were highly correlated with each other and, therefore, revealed convergent validity. In addition, at the construct level the composite reliability coefficient of each scale shown in Table 2 was larger than 0.70, indicating adequate levels of reliability. In sum, the results in Table 2 show the high validity and reliability of the AWPD instrument.

Table 2: A summary of the EFA and CFA results for the AWPD (n=322)

Scale	Item	M	SD	EFA (Exploratory factor analyses)				CFA (Confirmatory factor analyses)		
				FL[a]	EV[b]	VE[c]	C[d]	FL[a]	t-value	CR[e]
Perceived usefulness	PU1	5.93	0.82	0.78	4.20	19.10%	0.91	.79	Fixed-item	0.85
	PU2	5.90	0.83	0.83				.78	15.34***	
	PU3	5.86	0.91	0.82				.79	15.37***	
	PU4	5.78	0.81	0.71				.80	14.94***	

		Mean	SD	a	b	c	d		t-value	e
	PU5	5.80	0.90	0.72				.82	15.13***	
	PU6	5.92	0.75	0.69				.73	13.46***	
Perceived ease of use	EU1	5.72	0.92	0.62	3.84	17.45%	0.88	.72	Fixed-item	0.81
	EU2	5.85	0.87	0.76				.81	14.03***	
	EU3	5.75	0.89	0.66				.79	13.38***	
	EU4	5.68	0.97	0.65				.73	12.05***	
	EU5	5.40	0.96	0.73				.72	11.78***	
	EU6	5.75	0.89	0.73				.72	12.03***	
Affection	Af1	5.70	0.81	0.71	2.33	10.58%	0.84	.89	Fixed-item	0.78
	Af2	5.63	0.96	0.83				.79	16.57***	
	Af3	5.69	0.74	0.57				.74	13.98***	
Anxiety	An1	4.65	1.52	0.90	2.64	11.99%	0.88	.92	Fixed-item	0.85
	An2	4.89	1.41	0.91				.90	20.02***	
	An3	4.75	1.46	0.83				.73	15.40***	
Behavior	B1	4.36	1.39	0.70	3.04	13.82%	0.85	.64	Fixed-item	0.80
	B2	4.86	1.23	0.80				.75	11.51***	
	B3	5.41	1.04	0.78				.87	11.81***	
	B4	5.31	1.01	0.82				.86	11.83***	

Overall α=0.91 ,total variance explained is 72.93%

*** $p < 0.001$

[a] Factor Loading

[b] Eigen-value

[c] Variance Explained

[d] Cronbach α

[e] Composite Reliability

Structure model

By performing SEM with LISREL, the relationship between the MWPD and AWPD was explored to test how well the proposed model reproduces the observed data (Hair et al., 2006). The five scales of the MWPD were used as the predictor variables, while the five scales of the AWPD were used as the outcome variables for the analysis. Overall structural model fit was assessed with various measures (Bentler, 1995; Sorbom & Joreskog, 1982). Kelloway (1998) has suggested that the use of a chi-square test is reasonable when the study involves a large sample. However, as the chi-square is very sensitive to sample size, the degree of freedom can be used as an adjusting standard by which to judge whether chi-square is large or small (Joreskog & Sorbom, 1989). Therefore, in this study, the chi-square per degree of freedom was used. Other types of goodness-of-fit measures include root mean squared error of approximation (RMSEA), root mean square residual (RMR), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), the comparative fit index (CFI) , and incremental fit index (IFI). Each of the fits of the structural model and the recommended values of the fit index are shown in Table 3. The χ^2/DF ratio of the model was 2.99, suggesting a fairly good fit. Moreover, the model in Table 3 shows an RMSEA of 0.07 and an RMR of 0.04, and the GFI, AGFI, NFI, CFI, and IFI values are all over 0.90, indicating that the model has a highly satisfactory fit.

Table 3: Fit measures for the structural model

Fit index	Structural model	Recommended value
χ^2/DF	2.99	≤5
Root Mean Square Error of Approximation(RMSEA)	0.07	<0.08
Root Mean Square Residual(RMR)	0.04	<0.05
Goodness-of-Fit Index(GFI)	0.94	>0.90
Adjusted Goodness-of-Fit Index(AGFI)	0.91	>0.90
Normed Fit Index(NFI)	0.90	>0.90
Comparative Fit Index(CFI)	0.93	>0.90
Incremental Fit Index(IFI)	0.93	>0.90

The structural model was estimated using the maximum likelihood method. Table 4 provides a summary of the parameter estimates (completed standard coefficients) and the *t*-values for the model. The results in Table 4 indicate that the MWPD partially affected the AWPD. In particular, 'personal interest' had significant positive effects on 'perceived usefulness', 'perceived ease of use', 'affection', and 'anxiety' but not 'behavior'. Moreover, it was found that 'social stimulation' had statistically positive effects on 'perceived usefulness' and 'behavior', while 'practical enhancement' had a positive effect on 'perceived usefulness'. It is noted that 'social

contact' had a statistically positive effect on 'affection' and 'behavior'. However, 'external expectation' had a slightly negative effect on 'anxiety'.

Table 4: SEM results for the relationship between MWPD and AWPD

Parameter estimates for the structural model		
Model 3	Parameter estimates	*t*-value
Personal interest → Perceived usefulness	0.22***	3.98
Personal interest → Perceived ease of use	0.19***	3.32
Personal interest → Affection	0.21***	3.86
Personal interest → Anxiety	0.29***	4.86
Personal interest → Behavior	0.09	1.59
Social stimulation → Perceived usefulness	0.15*	2.43
Social stimulation → Perceived ease of use	0.12	1.91
Social stimulation → Affection	0.06	0.93
Social stimulation → Anxiety	-0.12	-1.78
Social stimulation → Behavior	0.14*	2.30
External expectation → Perceived usefulness	0.00	0.08
External expectation → Perceived ease of use	0.06	1.09
External expectation → Affection	-0.09	-1.58
External expectation → Anxiety	-0.13*	-2.23
External expectation → Behavior	0.01	0.11
Practical enhancement → Perceived usefulness	0.14*	2.14
Practical enhancement → Perceived ease of use	0.07	0.98
Practical enhancement → Affection	0.13	1.88
Practical enhancement → Anxiety	0.05	0.72
Practical enhancement → Behavior	0.10	1.46
Social contact → Perceived usefulness	0.09	1.36
Social contact → Perceived ease of use	0.12	1.75
Social contact → Affection	0.19**	2.98
Social contact → Anxiety	0.05	0.70
Social contact → Behavior	0.27***	4.25

* $p < 0.05$；** $p < 0.01$；*** $p < 0.001$

DISCUSSION AND CONCLUSIONS

This research set out to explore the relationship between teachers' motivation and attitudes toward web-based professional development. To this end, two questionnaires to assess teachers' motivation toward web-based professional development (i.e., the MWPD) and attitudes toward web-based professional development (i.e., the AWPD) were used in this study. Employing structural equation modeling, the results showed that the MWPD and AWPD implemented in this study were sufficiently reliable to assess elementary school teachers' motivation and attitudes toward web-based professional development. Mostly, the findings demonstrate the pivotal role that teachers' motivation toward web-based professional development can play to improve their attitudes. Specifically, the different motivations toward web-based professional development impact differently on their attitudes. Personal interest is shown to enhance attitudes toward web-based professional development, such as perceived usefulness, perceived ease of use, affection, and less anxiety. In other words, teachers with stronger personal interest would express more useful, favorable, comfortable and easier perceptions, and in turn are more willing to engage in web-based professional development.

There are several findings bearing practical implications for enhancing educators' attitudes toward web-based learning and helping them to leverage technology in their personal development. First, we found that teachers experiencing stronger social stimulation would tend to perceive web-based professional development as being more useful. Second, teachers with more social contact tend to have favorable feelings about and willingness to use web-based professional development. Third, teachers with stronger practical enhancement motives are likely to have increased perceptions of the usefulness of web-based learning. Lastly, it is worth noting that teachers experiencing higher external expectations tend to have negative attitudes toward web-based professional development.

This study attests to and contributes to the theories of TAM and decomposed TPB by reaffirming the logical path connecting teachers' motivation and attitudes toward web-based professional development. By and large, teachers with stronger motivation express more positive attitudes and have better perceptions, less anxiety and frequent usage of web-based learning and technology for professional development. This suggests that, to

heighten teachers' attitudes toward web-based professional development, their motivation should be stressed beforehand. In particular, policy makers as well as educators should take measures to induce teachers' personal interest, and provide them with opportunities of social stimulation and practical enhancement, so as to improve their perception of the usefulness of web-based professional development.

In addition, according to prior research demonstrating the positive effects of training programs on learners' beliefs regarding the Internet (e.g., Lagana, 2008; Markauskaite, 2007), our findings suggest that educators should heed the need for effective learning programs and create suitable learning environments to improve teachers' Internet-related capabilities and learning confidence in web-based environments. It may be practicable to enhance teachers' motivation toward web-based professional development by utilizing useful training programs. This study contributes to the understanding of teachers' motivation and attitudes toward web-based professional development. By using the MWPD and AWPD questionnaires, educators and researchers can assess and review teachers' motivation and attitudes toward web-based professional development in a discriminatory way, with possibly higher validity. To complement this research, longitudinal studies are encouraged to unfold thoroughly the contextual ingredients concerning teachers' motivation and attitudes. Further research is encouraged to conduct follow-up studies for different school levels as well as various areas (such as urban or rural) to acquire a better understanding of the possible variations in the teachers' demographics in determining their web-based professional development. More studies on the interplay between teachers' self-efficacy, motivation, attitudes, and use intention in web-based professional development contexts are necessary to support the findings of this study. In sum, this study provides some innovative thoughts about elementary school teachers' motivation and attitudes toward web-based professional development, and the practical importance of the results is noted in that they can help policy makers understand teachers' perceptions and behaviors and adjust their professional development policies accordingly.

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IMPROVING 8TH GRADES SPATIAL THINKING ABILITIES THROUGH A 3D MODELING PROGRAM

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ABSTRACT
Implementation of emerging technology in sub disciplines of mathematics education provides a potential for educators to elaborate the capacity of digitized learning for human being. Spatial thinking is considered as a factor of scientific deduction from a multi disciplinary point of view. This paper reports a study aimed at exploring the effect of a 3D Modeling program on the spatial ability of the 8th grade students through an experimental research design. The study also focuses on the relation between the gender difference and spatial thinking. The study population was consisted of 82 8th grade students and divided into the control group (n=40) and the treatment group (n=42). The data in the study were collected through a qualitative research method. According to the findings of the research, the success rate of post test increased after the application in terms of differential aptitude, mental rotation and spatial visualization. On the other hand, irrespective of the relevant literature, female pupils were observed as better performers comparing to the males on post application of the measurement instruments.
Keywords: Spatial ability, spatial visualization, mental rotation, concrete manipulatives, 3D modeling, Google SketchUp

INTRODUCTION
All aspects of mathematics teaching and learning are being pervaded by the tremendous improvements in technology. As the computer technology progressed, it improved mathematics by allowing the emergence of further disciplines of the field; for instance, fractal geometry did not exist until the advent of high-speed computers (Tooke & Henderson, 2001). Tall, (2009) summarizes the impact of computers in mathematics in three parts: *symbolism* of *numeric computation*, *graphical* display, and *enactive* interface allowing selection and manipulation of objects drawn onscreen. The implementation of technology in mathematics instruction has been recommended on many occasions by the National Council of Teachers of Mathematics (NCTM, 1996, 2000) and the Conference Board of the Mathematical Sciences (2001). Since computers have changed the ways that mathematics are taught and learned, mathematics *educators* should know the realities as well as the possibilities for human learning in an age of information technology.

Recent discussions of teaching and learning approaches have emphasized the role of visualizations and graphical representations to enhance students' learning experiences (Frank, 2005). With 3D visualizations, students can experiment with different 'what-if' scenarios and actively discover unique solutions to the problems (Messner et al, 2003). The National Council of Teachers of Mathematics recommends that the mathematics curriculum for grade 5-8 should include the study of the geometry of one, two, and three dimensions in a variety of situations, so that students can visualize and represent geometric figures with special attention to developing spatial sense (NCTM, 1989). Also, the initiative establishing learning trajectories and achievement targets for Dutch primary school identified several spatial activities as being important in primary school education (Van den Heuvel-Panhuizen & Buys, 2005). Another study promoting the use of technology in geometry education was conducted by González and Herbst (2009) by analyzing how students solved geometry problems over four days, with two days spent using static diagrams and the other two with dynamic diagrams drawn using a calculator with dynamic geometry software. Dynamic Geometry Software (DGS) are computer programs which allow one to create and then manipulate geometric constructions, primarily in plane geometry. In most DGS, one starts construction by putting a few points and using them to define new objects such as lines, circles or other points. After some construction is done, one can move the points one started with and see how the construction changes. González and Herbst (2009) say when students used dynamic geometry software they were more successful in discovering new mathematical ideas than when they used static, paper-based diagrams. The dynamic geometry software really helped them make connections that they hadn't made before.

As the ability to construct, retain, retrieve, and manipulate visual images of two- and three-dimensional objects (Lohman, 1993), spatial thinking is one of the essential traits for scientific thought. Linn and Petersen (1985) identified three categories of spatial ability: spatial perception, mental rotation, and spatial visualization. Spatial perception is defined as the ability to "determine spatial relationships with respect to the orientation of their own body" (p. 1482). The mental rotation category includes both two-dimensional and three-dimensional mental rotation tasks, such as Cards, Figures, and Flags. Spatial visualization comprises spatial tasks that involve multistep, analytic procedures, and require flexibility in strategy selection. Clements and Battista (1992) underline the use of spatial thinking in representing and manipulating information in learning and problem solving. Spatial visualization (SV) provides another accurate predictor of success in a variety of academic areas (Humphreys, Lubinski, & Yao, 1993). As the ability to imagine shapes rotated into a new orientation (Shepard & Cooper, 1982), mental rotation (MR) is an important spatial ability for two reasons. Firstly, mental rotation is a simple, relatively atomic sub-skill, used extensively in more complex spatial skills such as spatial visualization. Secondly, mental rotation is the spatial skill that shows the largest and most persistent gender differences, with males performing better. The learning and transfer of spatial skills SV and MR are important to mathematics. There are many potential between-country cultural factors that might mediate spatial skills training and one of them is electronic media (Olkun, Altun, & Smith, 2005). The computer has a very important effect on student spatial visualization.

The use of technology may help learners to gain sufficient geometric reasoning (Battista & Clements, 1996). Students' conceptualizations of three-dimensional buildings can be based on faces; they do not consider the figure as three-dimensional nor do they consider the interior cubes in the building. Hirstein (1981) underlines that students are tend to confuse volume with surface area while they are finding the number of cubes in rectangular buildings. At a higher level of conceptualization, learners are fully aware of the three-dimensionality and space-filling properties of the cubes and of the whole building. Secondly, they may conceptualize a cubic building as being organized into columns, rows, and layers so that they account for both visible and hidden cubes systematically. Olkun, (1999) maintains that learners often return to a primitive strategy when they are exposed to advance level complex buildings.

Students' use of visual spatial imagery while solving math problems is positively and significantly correlated with mathematics problem-solving performance (Van Gardener & Montague, 2003). Through re-testing and practice, people can sometimes improve spatial skills within a narrow context, but such improvements have not transferred to other contexts globally (Olkun, 2003). Battista and Clements (1998) reported that elementary students are unable to coordinate the different orthogonal views of the cube configuration. In fact, to construct the three-dimensional cube building correctly and to explore the invisible cubes, mental configuration of the orthogonal views is necessary. Understanding two-dimensional representations of three-dimensional buildings is also a part of spatial visualization which includes mental integration of different views, such as orthogonal and isometric views.

The topic of gender differences in spatial ability is highly recurring in literature. It has been proposed that sex differences in spatial ability are the result of culturally based differences in socialization patterns and sex-typed activities (Goldstein, Haldane, & Mitchell, 1990). Males typically outperform females on several spatial tasks (Halpern & Collaer, 2005). In accordance with this research tradition, an additional aim of the current study was to examine boy-girl differences in spatial ability. Although male advantages have been found on various spatial tests, between different spatial tasks large variation exists in the size of these gender differences (Linn & Petersen, 1985; Voyer et al., 1995). From the experiential explanation of the gender differences in spatial ability, one can expect spatial training to have a greater effect on females' spatial test performance than on males'. According to this theory, males already have received a lot of training by experience and thus already perform close to their maximum potential, whereas females have more room to improve (Baenninger & Newcombe, 1989).

As one of the dynamic geometry sofware, Google SketchUp is a powerful, sophisticated, user-friendly Computer Aided Design (CAD) program (Fleron, 2009). It was developed initially by Last Software in 2000. They were acquired by Google in 2006 and the first free version of this software –Google SketchUp (GSU) – was released on 27 April, 2006. There are some pragmatic Issues that Make Google SketchUp Useful in Education. First and foremost, Google SketchUp (GSU) is free. Not only does this allow schools access to powerful software without the hassle of licensing and the budgetary issues that are so severe right now, but it also means students can download it and use it at home. Technically, GSU is robust. It is supported on PCs and Macs equally. Download times with a cable modem are about 2 minutes. There are relatively meager hardware requirements. This software has a very gentle learning curve, especially considering its remarkable power. The tool provides active, substantive, and curricular appropriate connections of mathematics to art, architecture, engineering, regional

planning, construction trades, graphic design, animation, graphics, and many other areas. Thus, it provides wonderful opportunities for collaboration between and among students, teachers, and professionals. Our goal here is to help provide a bridge for its curricular integration.

Integrating technology supported environments into Mathematics curriculum makes it possible to examine pupils' actions and thinking processes in detail, which allows to assess their strategies in more precise ways than can paper-and-pencil formats. Clements (1998) and Singleton (2004) point out that computer environment may reduce cognitive demand while working on a task and help teachers gain a deeper understanding of key difficulties. The potential of computer environments to provide insight into pupils' cognitive processes makes them a fruitful setting for research on how this learning takes place (Kolovou, Van den Heuvel-Panhuizen, Bakker, & Elia, 2008). In sum, it is crucial that teachers who deal with pupils in mathematics should have a good understanding of technology supported learning beside their pupils' capabilities, ie, their thinking skills.

METHODOLOGY

This study aims to determine how Google SketchUp program influences 8th grades spatial thinking ability and how the gender difference affects learners' spatial thinking traits through an experimental research design. First, all students were pre-tested by using geometry and spatial visualization tests (DAT-MRT-SV). Then one of the groups was assigned as control (n=40) and other as experimental (n=42). Two treatments, with and without the computer, were administered with programs that potentially develop spatial ability. An important question for a study on the effects of a learning material on spatial ability is whether spatial ability can be trained. In a meta-analysis, Baenninger and Newcombe (1989) found that spatial test scores typically improve by both practice (test-retest) and training. Furthermore, for training to be more effective than mere practice, the training has to be of at least medium duration, consisting of more than one training session during more than three weeks. Thus, a six weeks laboratory application conducted in the current study. Two treatments, with and without the computer, were administered with programs that potentially develop spatial ability. The computer treatment involved using Google SketchUp (GSU) labs that involve creating buildings from two-dimensional plans. The computer group did all the activities that control group had, firstly, and then they took their lessons with Google SketchUp (GSU) labs for 5 weeks. The treatment time ranged from 60 to 80 minutes for each lessons. Control group did not have computer experience. During the treatment, students in the experiment group had their lessons with computer experience for six weeks and solved computer-based problems. During the labs, learners used GSU to unfold the sides of a three-dimensional building to determine its two-dimensional plan. In addition, they used an internet site that rotates three-dimensional figures orthogonally and isometrically. The students in the control group continued on in their regular classes and were not shown any of the treatment materials. The control group also created buildings from two-dimensional plans on paper and drew two-dimensional plans of their dimensional shapes of which lengths were given. However, they did participate in the pre- and posttests. The pretests were administered in the fall semester in September 2010. Treatments were carried out until the end of November. After the treatment, the experiment and control groups were post-tested in a separate room within the same day.

Two research questions delineated for the study are as follows,

1.   Does the use of Google SketchUp have any effects on 8th grade learners' performance in spatial visualization as measured by the
   a.   Mental Rotations Test (MRT),
   b.   Differential Aptitude Test-Spatial Relations (DAT),
   c.   Spatial Visualization (SV) Test,
in comparison with the learners who did not utilize any 3D modeling programs or computers during the education?

2.   Does the gender difference have any effects on 8th grade learners' performance in spatial visualization as measured by the
   a.   Mental Rotations Test (MRT),
   b.   Differential Aptitude Test-Spatial Relations (DAT),
   c.   Spatial Visualization (SV) Test?

Participants

The participants of the study consisted of 82 eight grade students attending a primary school in Kirikkale in Central Anatolia of Turkey. The participants were administered treatment of the computer (n=42) and control group (n=40). For each group both males and females were recruited for participation. A signed consent form was obtained from the education division of the Kirikkale Proconsulate. Parents of the participants were also

informed via the administration of the laboratory school. In control group, the males (n = 25) and females (n = 15) and in the experimental group males (n = 26) and females (n = 16).

Materials
Participants took the Mental Rotation Test (MRT, Peters et al. 1995), Differential Aptitude Test (DAT, Bennett, 1947) and Spatial Visualization (SV, Winter et al. 1896) instruments in terms of measurement. The MRT is a twenty-four problem set. Each problem has a target figure shown on the left and four stimulus figures on the right. Two of these stimulus figures are rotated versions of the target figure, and two of the stimulus figures cannot be matched to the target figure. Students receive one point for both correct answers. The DAT/Space Relations (SP) measures capability of analyzing three-dimensional figures with a sixty-item aptitude test that analyses the ability to visualize 2D or 3D drawings, an expectation for jobs in engineering, architecture or design. The SV is a measure of the ability to construct three-dimensional buildings using manipulatives. The nineteen-item assessment requires translation of information from two-dimensional objects and to visually distinguish between a left-right or front-back orientation in both two and three dimensions. The question that the study sought for an answer was whether the students were only able to perform the assessment when they had experience in building and looking at three-dimensional objects. The overall Alpha value of the variables was found out as .80 as a reliability indicator. Besides, the Kolmogorov-Smirnov and Levene's test results revealed a normal distribution of the data as a pre-assumption of mean comparison tests.

RESULTS AND INTERPRETATION
Data gathered from 82 eight grade learners at a primary school in Kirikkale were analyzed through statistical package for social sciences (SPSS) version 15.0 for quantitative analysis. Since the main purpose of this research was to understand whether the utilized media (Google SketchUp) did have any effect on learners' performances in spatial visualization comparing to control group, descriptive statistics and independent samples t-test scores were calculated to summarize the data.

Participants responded to the tests prior to the program, and again after the program. Differences in scores of the pupils before and after participating in the program identified any change in performance in spatial ability as a result of the treatment. When we compared post-treatment and pre-treatment results there is an increase in spatial abilities for all students in both treatment programs. Based on this data, the pre-post differences nearly on each instrument, DAT, MRT, and SV were statistically significant with $p < .05$. This section will summarize the data in accordance with the research questions.

Table 1 depicts how experiment and control groups performed at pre and post tests of three different achievement tests of spatial visualization.

Table 1. *Group Differences in terms of measurement instruments*

Instrument	Group (42 / 40)	Mean	p-value
DAT 1	Experiment / Control	18.28 / 18.07	.866
DAT 2	Experiment / Control	23.33 / 19.65	.017*
MRT 1	Experiment / Control	4.85 / 3.60	.052
MRT 2	Experiment / Control	5.86 / 3.70	.001*
SV 1	Experiment / Control	5.30 / 5.12	.678
SV 2	Experiment / Control	6.95 / 5.62	.010*

Significance level is defined as .05

As for the Differential Aptitude Test, which forms the content of the first research question, while there is no significant difference between groups' performances prior to the treatment (18.28 / 18.07), experiment group utilized Google SketchUp program did significantly better at posttest comparing to those who did not use computers during the education (23.33 / 19.65). Similarly, total performances of both group members came out as very close to each other at the pre application of Mental Rotation Test (MRT) but the experiment group outperformed at post application of MRT in comparison to control group. The independent samples t-test results related to the first application of SV test indicated that there is no significant difference within research groups which means that a homogenous level of performance was obtained before the treatment. Respectively, post test results showed a significant variance in favor of experiment group exploiting Google SketchUp Software.

Table 2 is portraying the effect of gender difference on primary level learners' spatial visualization performances through three different tests.

Table 2. *Gender Differences in terms of measurement instruments for the participant groups*

Instrument	Group (32 / 50)	Mean	p-value
DAT 1	Female / Male	19.09 / 17.60	.259
DAT 2	Female / Male	23.50 / 20.28	.041*
MRT 1	Female / Male	4.31 / 4.36	.936
MRT 2	Female / Male	4.75 / 4.36	.576
SV 1	Female / Male	5.84 / 4.82	.034*
SV 2	Female / Male	6.90 / 5.92	.058

Significance level is defined as .05

As for the second research question, independent two-tailed test of the means were conducted between the scores of females and males. The mean values of the both applications of Differential Aptitude Test for females and males are as follows: DAT1 (F: 19.09 / M: 17.60), DAT2 (F: 23.50 / M: 20.28). The t-test results also imply that while the pre application did not indicate any significant differences (.259), post test of DAT showed a significant difference between girls and boys. The descriptive statistics portrayed the difference in favor of girls (F: 23.50 / M: 20.28). The results of Mental Rotation Test applied both before and after the treatment revealed no significant difference (.936 / .576). However, a positive variance was observed in favor of females at the post test of MRT (F: 4.750 / M: 4.36). On the other hand, while the pre-test of Spatial Visualization revealed a significant difference between the genders (.034), no significant difference was observed at the post application of the test (.058). The mean score of the participants at SV test pointed out that although both girls and boys achieved better at post test, girls' total performances at post test was higher in comparison with boys.

The results of the current study indicate that the use of computer programs such as Google SketchUp and other mental rotations programs may improve spatial ability. Besides, students may be able to improve this important ability more if they have additional computer experiences integrated within their course curriculum, in particular, by using Google SketchUp. The study should be repeated at various learner levels and should be supported by various covariates such as learners' features.

A study by La Ferla et. al, (2009) they made an international comparison of the effect of using computer manipulatives on middle grades students' understanding of three-dimensional buildings and they demonstrated significant differences on MRT and SV tests. The data indicates that the use of computer programs such as Google SketchUp and other mental rotations programs may improve spatial ability. The DAT measure may not have been significant since more time may have been needed for students to work with the various features of Google SketchUp in order to attain the benefits.

A study by Rafi (2008), for instance, examined the effect of Web-based activities and animation aided computer applications on the spatial visualization abilities of two test groups of primary school 2nd Grade students. The same study also included a control group taught through traditional teaching methods. Rafi's study finally concluded that the two test groups had higher levels of spatial ability than that of the control group.

CONCLUSIONS AND FUTURE CONSIDERATIONS

The results of this study showed that the use of a dynamic geometry tool had a positive effect on learners' spatial progressions. This effect was found, even though the pupils in the experiment group had never used the tool before. The fact that pupils found ways in which they could benefit from using the GSU to fold and unfold three-dimensional shapes. One of the more significant findings to emerge from this study is that working with the students improved their overall spatial ability which may mean that the amount of time needs to be increased and the specific types of labs and activities need to be repeated over time to obtain significant results. Besides, the benefits of learning Google SketchUp (GSU) in primary school will pay benefits for students as they move through the rest of their formal education as well. In particular, GSU can help provide connections and coherence with the secondary curriculum.

Finally, a number of caveats need to be noted regarding the present study. The most important limitation lies in the fact that the small sample size of the study prevents the transferability of the outcomes. One of the main weaknesses of this study was the paucity of information on ICT/software use backgrounds of the participants. One source of weakness in this study which could affect the measurements was that the variation of socio-economic status of the participants might affect the potential computer use skills of them. The current research has thrown up some questions in need of further investigation. More broadly, research is also needed to investigate various types of spatial abilities such as object visualization. If the debate is to be moved forward, a better understanding of other types of training programs that increase spatial visualization such as three-dimensional virtual reality programs needs to be developed. We may want to revise our treatment program.

Students may require more time outside of the classroom to work with GKU. One possibility would be to have students use an iPad with GKU both in and out of the classroom and have them log the amount of time they spend using the software. Also, for the MRT, students may need to work with manipulatives such as pop cubes to assist with the mental rotations as well as practice using the orbit portion of the GKU feature. Again, it may be linked to amount of time using the program and adjusting to a new software package that may lead to gains after a critical amount of time. If students are provided with a computer for use, we can log the amount of time they use the software and for what purpose.

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IMPROVING THE EFFECTIVENESS OF ORGANIC CHEMISTRY EXPERIMENTS THROUGH MULTIMEDIA TEACHING MATERIALS FOR JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

The purpose of the study aimed to explore the effects of three different forms of the multimedia teaching materials on the achievements and attitudes of junior high school students in a chemistry laboratory context. The three forms of the multimedia teaching materials, static pictures, video, and animation, were employed to teach chemistry experiments to 54 eighth-grade students in Pingtung County, Taiwan. The research tools included the self-editing questionnaire of learning achievement, the experimental step checklist, and the learning feedback questionnaire. Descriptive statistics and ANCOVA were administered to analyze the collected data. The findings of the study indicate that the video and animation have more significant effects on promoting students' learning achievements in a chemistry laboratory context than static pictures in terms of operating equipment, technical operation, experimental procedures, and observation performance. Additionally, the students indicated that video presentation can best assist them in understanding the experiments. Finally, the findings and suggestions of this study can be useful references for multimedia designers, teachers, and school administrators.
Keywords: junior high school, multimedia teaching material, organic chemistry experiment

1. INTRODUCTION

Given the prevalence and importance of information technology in daily life, it is valuable if teachers are able to utilize technology to improve students' learning effectiveness. In recent years, elementary and high school teachers have generally agreed that information technology is beneficial for teaching, and they have begun to explore improved approaches for applying it to teaching (Ministry of Education, 2008). However, the use of multimedia in the classroom clearly has positive implications for learners. For example, the combination of images and descriptions may help students construct concrete learning experiences, and audio effects provide multi-dimensional and immersive experiences, which can enhance the effects of teaching and stimulate motivation for learning. Additionally, multimedia can serve as a preamble that organizes the conceptual framework for students and facilitates their understanding of teaching materials (Mayer & Moreno, 2003).

In the past years, auxiliary chemistry experiment teaching materials were often composed of a series of diagrams and charts, which then evolved into films with captions and explanations provided by the experiments' designers. Nowadays, the multimedia teaching materials provided by booksellers have upgraded from instructional videos to 2D and 3D animations. However, the effects of 2D and 3D animations and forms of the multimedia teaching materials integrated with different experimental content in the laboratory instruction have not yet been investigated. Thus, this study aimed to explore the effects of various forms of the multimedia teaching materials, including static pictures, videos, and animations on the students' learning performance through examining the performances of the chemistry experiment tests. The findings of the study will provide suggestions for teachers and multimedia designers in the field.

2. LITERATURE REVIEW

Mayer (2001) proposed the Generative Theory of Multimedia Learning based on the paradigmatic dual-coding theory to describe learners' information processing procedures while participating in multimedia courses (Clark & Mayer, 2008). This type of learning model reflects the following four principles: 1) dual track: humans are

able to process text massages and picture information via different tracks through both visual and auditory perception; 2) limited capacity: each track has a limited information processing capacity; 3) active processing: humans can transform relevant information, organize information into consistent mental modules, and then make the learned information meaningful; and 4) transformation: these processes will input new knowledge into long-term memory. As a result, multimedia teaching should focus on assisting learners to be organized and to conduct meaningful coding as well as to make best use of information, pictures, animation, and audio effects make students more attentive and thus make received information processed and stored in long-term memory as well as link with old knowledge.

The purpose of multimedia is to provide multiple communication channels to address the differences between learners and to present teaching content through optimum modalities, including text, narration, graphics, illustrations, photographs, charts, animations, videos, music, sound effects, virtual reality, and interactive programs. Each multimedia teaching material has its own purposes and timing. If multimedia is applied well, students' learning efficiency may be enhanced. Mayer (2001) proposed a series of multimedia design principles, including multimedia, contiguity, segmentation, coherence, personalization, and individual difference. These principles state that teachers should emphasize important information and functions rather than squeezing more information into their teaching materials. Additionally, designers should make it possible to present texts and images simultaneously, to divide multimedia materials and present the desired segments, to delete repetitive and redundant information, and to find appropriate teaching materials. In doing so, learners will be able to achieve better learning effectiveness (Clark & Mayer, 2008; Mayer, Hegarty & Campbell, 2005; Mayer, Sobko & Mautohe, 2003; Inglese, Mayer & Rigotti, 2007).

Chemistry is considered both basic and applied science. When teaching chemistry, teachers should emphasize both theories and experiments; chemistry experiments play an important role in teaching and serve as an ideal tool for combining theory and practice. Therefore, chemistry experiments should focus on learning goals and developing students' laboratory skills, scientific reasoning skills, knowledge about experimental design, and comprehensive ability (Ministry of Education, 2008). Recent literature suggests that integrating multimedia into teaching can have more significant effects than traditional teaching. However, many of the studies on students' learning effectiveness tend to focus more on knowledge learning effectiveness, learning retention, and migration rather than on the influence of multimedia on laboratory skills (Arguel & Jamet, 2009; Münzer, Seufert & Brünken, 2009; McTigue, 2009; Harskamp, Mayer, & Suhre, 2007). As a result, this study aimed to explore the influence of various multimedia teaching materials on the learning of chemistry laboratory skills based on the theoretical framework of multimedia learning theory.

3. RESEARCH METHOD

3.1 Experimental design

A total of 54 eighth-grade students from a junior high school in Pingtung County in Taiwan participated in the experiment. The "chemistry experiment test" as the pre- and post-test tool was used with all students. Before the experiment treatment proceeded, the pretest was administered. Based on the students' chemistry grades in the first semester, they were randomly divided into three groups (A, B, and C) based on S-type allocation. Each group was assigned to perform a different experiment, and then the posttest was implemented.

Every group carried out two forms of the multimedia teaching materials. After the first form of the multimedia teaching materials was employed, the posttest was administered, and the students were then taught the method for performing a second experiment using the second form of the multimedia teaching materials. The independent variable was the type of multimedia teaching material used (static pictures, video, or animation); the dependent variable was the change in test scores from the pre- to post-test. Table 1 shows the experimental design of this study.

Table 1: Experimental design

Group		Pretest	The 1st Experiment	Posttest 1	The 2nd Experiment	Posttest 2
A	R	O_0	X_1	O_1	X_2	O_2
B	R	O_0	X_2	O_3	X_3	O_4
C	R	O_0	X_3	O_5	X_1	O_6

R: Random selection
O_0: pretests of groups A, B, and C; O_{1-6}: posttest after experimental treatment
X_1: static pictures; X_2: video; X_3: animation

3.2 Research tools

The research tools were the organic chemistry experiments, consisting of the dry distillation of chopsticks, the production of soap, self-designed chemistry experiment tests, and the self-developed learning satisfaction survey questionnaire. The multimedia teaching materials were grouped into three forms: animation, video, and static pictures. In Figure 1, it was 2D animation broadcasted by Macromedia Flash Player. Figure 2 shows the experiments conducted by demonstrators were video taped and displayed by Microsoft Windows Media Player. Figure 3, Microsoft PowerPoint was used to present static pictures, audio, and text. Audio content was extracted from the film; the descriptive text presented to students was identical in the animations and film. The subject matter in the three forms of multimedia teaching materials was identical.

The chemistry experiment tests used in the pre- and post-tests were based on the teaching contents to construct the experimental step checklist for evaluating student's performances on accuracy of experimental equipment usage, accuracy of experimental equipment operation, and the order of experimental procedures. Students would receive one point for completing each step correctly. The points were summed to produce the total score; the higher the total score, the better performance of the students' learning.

Figure 1: Images captured from the animation

Figure 2: Images captured from the video

Figure 3: Images captured from the static pictures

3.3 Experimental procedures
Prior to the experiment, students were grouped and assigned randomly and notified about the test time. Meanwhile, the instructor described the purpose of the experiment and reminded students to focus on the multimedia teaching materials and not to talk to each other as well as informed students of a test after viewing the multimedia materials would be employed. To avoid interference, the computers were partitioned and equipped with headsets.

Group A, B, and C were employed with the static picture, video, and animation instruction respectively. Each process took approximately 20 minutes. The experimental procedures were:(1) in the beginning of the experiment, the instructor introduced operational methods, test methods, and importance notices to students for three minutes; (2) the presentation speed and viewing time of the multimedia teaching materials were controlled until the students fully understood the content of the materials. After all of the students finished viewing the teaching materials, they were asked to conduct the experiment and evaluated by the instructors; and (3) after each experiment, the experimental test was employed and the experiment was complete. Then, students were asked to conduct the experiment following Steps 1 to 3.

4. RESULTS AND DISCUSSION

4.1 The experiment of distillation of chopsticks

The results of the statistical analysis of covariance (ANCOVA) show that F value of homogeneity of regression coefficients was non-significant (F=1.102, p= .340> .05), which confirms the assumption of regression. Therefore, the covariance analysis could be conducted. According to Tables 1 and 2, when the influence of the pretest results were eliminated, the form of teaching materials had significant influence on the chemistry experiment tests (F=10.877, p= .000< .05). The post hoc test suggests that the learning performance of the video group (M=5.925) was better than that of the static picture group (M=5.071); the learning performance of the animation group (M=6.170) was superior to that of the static picture group (M=5.071). However, there was no significant difference between the learning performance between the video group and the animation group. Further examining the strength relationship, the $\omega 2$ of the correlation index was 37.9%, suggesting that the chemistry experiment test results were strongly correlated with the forms of the multimedia materials used.

Table 2 Covariance of chemistry grades of three groups of students

Sources of variance	SS	df	MS	F	Post hoc test	ω^2
Covariance (Score of pretest)	4.463	1	4.463	8.314	Film＞Photo Animation＞ Photo	.379
Between group (Teaching methods)	11.679	2	5.839	10.877*		
Error	26.842	50	.537			

$^*p＜.05.$

Table 3 Adjusted mean and post hoc tests of each group

Adjusted mean Group	Picture （M=5.071）	Film （M=5.925）	Animation （M=6.170）
Picture	------------	＊	＊
Film	＊	----------------	
Animation	＊		---------------

$^*p＜.05.$

4.2 The experiment of soap production

The statistical result of the homogeneity of regression coefficients was non-significant (F=1.491, p= .235> .05), which confirms the assumption of regression. Therefore, the covariance analysis could be conducted. According to Tables 3 and 4, when the influence of the pretest results were eliminated, the form of the multimedia teaching material had a significant influence on the chemistry experiment test results (F=3.734, p= .031< .05). Post hoc test suggests that the learning performance of the video group (M=4.227) was superior to that of the static picture group (M=3.220); the learning performance of the animation group (M=4.170) was better than that of the static picture group (M=3.220). However, there was no significant difference between the video group and the animation group. Further examining the strength relationship, the $\omega 2$ of the correlation index was 7.8%,

suggesting that the chemistry experiment test results were moderately correlated with the forms of multimedia materials used.

Table 4 Covariance of chemistry grades of three groups of students

Source of covariance	SS	df	MS	F	Post hoc comparison	ω^2
Covariance (pretest score)	.009	1	.009	.006	Film＞Picture Animation＞ Picture	.078
Between group (teaching method)	12.057	2	6.028	3.734 *		
Error	80.713	50	1.614			

*$p＜.05$

Table 5 Adjusted mean and post hoc tests of each group

Adjusted mean / Group	Picture （M=3.220）	Film （M=4.227）	Animation （M=4.170）
Picture	------------	＊	＊
Film	＊	----------------	
Animation	＊		--------------

*$p＜.05$

To sum up, regardless of the experiments of dry distillation of chopsticks or soap production, the different forms of the multimedia teaching materials had significant effects on students' chemistry test scores ($F=10.877$, $p=.000<.05$, for the dry distillation of chopsticks experiment; $F=3.734$, $p=.031<.05$, for the soap production experiment). The comparison between the pretest and posttest scores suggested that the performance of the animation group and video group were significantly higher than those of the static picture group. The type of multimedia teaching tool used explained 37.9% and 7.8% of the variance in students' chemistry scores for the dry distillation of chopsticks and the soap production experiments, respectively, indicating an above-moderate correlation.

4.3 Analyses of the responses to the self-developed learning perception and satisfaction survey questionnaire
According to the literature and experts' suggestions and comments, a semi-structured learning perception and satisfaction survey questionnaire was constructed. After the experiments were terminated, the survey questionnaire was employed to the students in order to understand the students' reactions to incorporating multimedia teaching materials with experiments and their learning satisfaction. Chi-square test was used to analyze the collected data. The results of chi-square test are shown in Table 6.

Table 6: The statistical results of chi-square test on the three multimedia teaching materials

Category	Observed		Expected		adjusted residual	χ^2
	Frequency	Percentage	Frequency	Percentage		
Animation	19	35.2%	18	33.3%	1.0	
video	29	53.7%	18	33.3%	11.0	14.778*
picture	6	11.1%	18	33.3%	-12.0	
total	54		54			df＝2

*$p＜.05.$

Table 6 shows that the students' perception and learning satisfaction on the three multimedia teaching materials

reached a significant level (df=2, χ^2=14.77, p< .05), indicating the frequencies of the three multimedia teaching materials were significantly chosen by the students. Among the three teaching materials, 53.7% of the students voted video and of 11.1% voted picture. In addition, Tables 7 shows the statistical results of the students' preferences for the three multimedia teaching materials (1=most preferred; 3= least preferred).

Table 7: The descriptive statistical results of the students' preferences on the three multimedia teaching materials

Category	Mean	Standard Deviation	N
animation	1.54	.50	54
video	1.54	.57	54
picture	2.93	.38	54

The statistical results show that F=95.461, p<.05, reached the significant level. It indicated the students' preferences for the three multimedia teaching materials were significantly different. The results of Post Hoc showed that the students prefer animation and video to picture. Finally, the reasons why the students preferred multimedia teaching materials were summarized in Table 8.

Table 8: The reasons why the students preferred multimedia teaching materials

Multimedia Teaching Material	reason	Percentage (person)
animation （19）	-easier to understand -much simple and easy to understand	31.6%（6）
	-more interesting -more livid -like cartoon	57.9%（11）
	-can attract attention more	10.5%（2）
video （29）	-is closer to reality -closer to real things -just like being in the laboratory	51.8%（15）
	-can repeatedly review	3.4%（1）
	-can watch the whole process of the experiment	3.4%（1）
	-is clearer -can be understood easily	20.7%（6）
	-can be easily operated -understood more about the experiments	20.7%（6）
picture （6）	-can be better memorized	66.7%（4）
	-picture can be remained longer	33.3%（2）

According to Table 8, over 50 % of the students suggested that video can best assist in conducting experiments because video content is much closer to the real experiments in the laboratory and it was easier to understand. Additionally, about 35.2% of the students chose animation because it was vivid, interesting, and able to attract their attention to understand the operation of experiments. Only 11.1% of the students thought that picture could help them remember and understand the content longer. To conclude, the students preferred video and animation because these two multimedia teaching materials enabled them understand the operation of experiments more. On the other hand, the static picture was too boring to arouse their learning motivation.

5. CONCLUSIONS
The results of the posttests suggested that, regardless of the experiments (the dry distillation of chopsticks or the soap production), different forms of the multimedia teaching materials have significantly different effects on students' chemistry test grades. As a result, the hypothesis of a significant difference in posttest scores between the static picture group, video group, and animation group is supported. The post hoc tests also revealed that the chemistry test grades of the video group and animation group were higher than those of the static picture group. The correlation between type of multimedia teaching material and test scores was moderate, which is consistent with the findings of Dalacosta et al. (2008), Ayres et al. (2009), and Wong et al. (2009), who suggested that multimedia teaching materials have significant effects on students' operational skills because video and animation can portray complete and coherent procedures. This finding supports the temporal, spatial, congruity, and signal principles. According to the temporal and spatial principles, learners are more likely to retain information in their working memory when texts and images are simultaneously presented. According to the

coherence principle, irrelevant information should be excluded. Also, a magnifying function or arrows must be utilized to identify focal points according to the signal principle.

A single image in a video or animation does not represent all of the teaching material. Rather, multiple images are needed to portray the focal procedures and detailed measures that must be followed. The video and animation groups performed better than the static picture group in the equipment operation, accuracy of experimental procedures, and successful completion of experimental steps. Additionally, the students showed significant differences on choosing the most suitable multimedia teaching materials. Most of the students chose video and only few students chose pictures. Furthermore, the students preferred video and animation to picture. There was no difference showed between animation and video. The results of this study may provide useful references for multimedia designers, teachers, school administrators, and future studies. However, this study was limited a small research targets and research time. Thus, these factors should be taken into consideration in the future studies to make this research more complete.

6. SUGGESTIONS
The following suggestions were from the findings of the study made by the researchers for multimedia designers, teachers, school administrators, and future studies to refer to. For multimedia designers, the icon for speed control of aside should be created in order for learners to control based on their own learning needs. In addition, the principles of multimedia design should be implemented for designing the most effective teaching aided materials. Finally, since the cost of making animation was much higher than video, video can be made for assisting teaching experiments in the future. For teachers, video should be extensively used in experiment classes because it can effectively assist and enhance students' learning interest and motivation. Next, although video can effectively assist teacher and students in learning experiments, students are still encouraged to enter the laboratory to conduct experiments with hands-on practices under the best time arrangement and safety check. For school administrators, school should popularize and spread the use of multimedia teaching materials actively and the equipment and facility of multimedia should be sufficient and complete for every classroom. Finally, some other variables such as text color, font, speed of aside, voices of male and female, and students' computer literacy can be investigated in the future studies.

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INFORMAL LANGUAGE LEARNING SETTING: TECHNOLOGY OR SOCIAL INTERACTION?

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ABSTRACT
Based on the informal language learning theory, language learning can occur outside the classroom setting unconsciously and incidentally through interaction with the native speakers or exposure to authentic language input through technology. However, an EFL context lacks the social interaction which naturally occurs in an ESL context. To explore which source of language input would have a greater impact, this study investigated the effect of exposure on speaking proficiency. Two types of exposure were provided: audiovisual mass media as a source of language input in an EFL context and social interaction as a source of language input in an ESL context. A sample speaking test was administered to one hundred language learners in an EFL context (Iran) and another one hundred language learners in an ESL context (Malaysia). Then, thirty participants from each context who scored one standard deviation above and below the mean were selected as homogenous language learners. During the experiment, EFL participants had exposure to audiovisual mass media while the ESL participants were exposed to social interaction as a source of language input. At the end, both groups took another sample speaking test. The post-test showed that the EFL group performed better which was indicative of the fact that exposure to technology promotes speaking proficiency.
Keywords: exposure, mass media, social context, speaking proficiency, EFL context, ESL context

INTRODUCTION
In the last two decades, technology has dominated the world by sharing and showing a variety of programs to both instruct and entertain the audience. The impressive developments in audio, video, and computer-mediated communications programs offer many possibilities for teachers to construct activities around listening to TV and radio news programs, watching related videos, and holding conversations in real-time (Chinnery, 2005; Jingi & Ying, 1999; Parker, 2000; Salaberry, 2001; Bell, 2003; Ishihara & Chi, 2004; Bedjou, 2006). Moreover, technology has become the track upon which the express train of education is heading toward its destination. In fact, the growth of its application in the field of education and its rapid development in transforming the process of learning is unbelievable (Mayya, 2007). Computer Assisted Language Learning (CALL), computer and video equipped classrooms, the internet, e-mail, 'chat', and Mobile Assisted Language Learning (MALL) are just few examples of the application of technology to the endeavor of language teaching in formal language settings as well as informal language settings.

Informal language learning was first introduced and popularized by Knowles (1950). Rogers (2004) suggests that informal language learning is unstructured, unpurposeful but is the most extensive and most important part of all the learning that all of us do every day of our lives. On the contrary, formal language learning is structured, purposeful, and school based. Other researchers (Lightbown & Spada, 2001; Marsick & Watkins, 1990) have also described formal and informal language learning in the same way.

Whether language acquisition is to take place in formal or informal language learning settings in English as a second language context (ESL) or English as a foreign language (EFL) context, language learners need to have exposure and access to a sort of language input. In fact, language acquisition simply cannot take place in a vacuum without considering having exposure to some sort of language input (Gass, 1997). Needless to say, the source of language input for acquiring the language particularly in informal setting in both EFL and ESL contexts should not be neglected.

English is dominantly spoken or is the official language in an ESL context where language learners can make use of social interaction as a source of language input to acquire the language in an informal setting (Rogers, 2004). In other words, learners can have interaction with other people from different countries using English language as the medium of communication. Long's (1996) Interaction Hypothesis emphasizes that conversational interaction enhances SLA. Particularly, negotiation of meaning as a component of interaction

which triggers interactional adjustments by the native speakers or more proficient interlocutor can contribute to SLA.

In contrast, social interaction in English is very limited or does not exist as a source of language input for acquiring the language in an informal setting in an EFL context. English is considered as a foreign language rather than a second language in this context. As a result, English is not used as a medium of communication or for other purposes in society. Indeed, English is only used by language learners in formal language setting at universities or language institutes.

Nevertheless, different audiovisual mass media technologies are available in EFL contexts that make access to language input in formal as well as informal language learning settings readily available. Between audiovisual mass media technologies and social interaction, which source of language input would have a greater impact on speaking proficiency is the point for exploration.

REVIEW OF LITERATURE

The term "informal language learning" compared to formal language learning was first introduced and popularized by Knowles in his pioneer work *Informal Adult Education* (1950). Later Coombs and Ahmed (1974) defined informal learning as the lifelong process by which every individual acquires and gathers knowledge, skills, attitudes and insights from exposure to the environment at home or at work through reading newspapers and books or by listening to the radio or viewing films or television. Based on Coombs and Ahmed's definition, informal education is unorganized, unsystematic and even unintentional at times.

The distinction between formal and informal learning settings is significant also in debates about second language development. Lightbown and Spada (2001) describe informal setting as the contexts in which the adult learner is exposed to the target language at home or at work or in social interaction, and formal settings as the contexts where the target language is being taught to a group of second or foreign language learners. In the formal language learning setting, the focus of learning is on the language itself. On the contrary, in informal language learning setting the focus is on meaning. In informal language learning setting language learners interact with native speakers in the target language country, use different technologies at home or at work, watch a movie, or listen to music or song just as an entertainment which can lead to language learning Lightbown and Spada (2001). In other words, by viewing a movie or listening to a song in informal settings, language learners indirectly get involved in the language learning process when they try to understand the movie or the song by using a dictionary or subtitle (Pemberton, Fallahkhair & Mosthoff, 2004). According to Marsick and Watkins (1990), formal learning is classroom-based, and highly structured and purposeful.

A lot of research related to the present study consider the use of technology and interaction in ESL context to enhance language learning (Adams, Morrison, & Reedy, 1968; Decker, 1976; Keller, 1987; Clark & Sugrue, 1991; Phillips, 1998; Hubbard, 1998; Clifford, 1998; Egan, 1999; Pemberton *et al*, 2004). Most of them reflect the behaviorist and interactionist view of language learning. The behaviorists consider learning the language through stimulus and response with the help of technology and the interactionists consider interaction with the native speakers in the target language country or ESL context to enhance language learning. Moreover, the existing research on the use of technology in informal language learning setting and language acquisition reflect an interest in the use of multimedia environments and computer-assisted language learning (CALL) both in-and-outside the classroom.

CALL is significant (Decker, 1976) because it provides instant feedback correcting drill exercises and tests. This type of exercises and tests in the use of technology generally reflects the behaviorists view of language learning. Rogers (2004) notes that the behaviorists have worked well in explicit teaching and computer-assisted instruction (e.g. learning through repetitions, drills and practice) but they would not be suitable for learning informally from exposure to audiovisual mass media.

Pemberton *et al* (2004) highlight that in an informal language learning setting, the participants are not involved in such repetitions and drills which are similar to activities of the classroom settings. In the same line, Rogers (2004) emphasizes that if different technological tools are to be used in informal setting for language learning, it should be unstructured, unconscious or unpurposeful.

Regarding the application of the behaviorist theory of language learning in relation to the use of technology in informal language learning environment, Rogers (2004) notes that the behaviorists have worked well in explicit teaching and computer-assisted instruction (e.g. learning through repetitions, drills and practice) but they would not be suitable for learning informally from exposure to audio/visual mass media. In other words, based on the

behaviorist approach, language learners are required to do some exercises and drills and follow some pre-designed activities even in informal settings.

In recent years, the use of "non-desktop" technologies such as audiovisual mass media, for example, TV is also attracting increasing interest amongst researchers in informal, adult and lifelong learning and second language acquisition (Milton, 2002; Evans, 2006; Mackenzie, 1997; Pemberton *et al*, 2004; Poon, 1992; Becker, 1996). According to Milton (2002), mass media technologies can give the teachers as well as the learners a wide variety of activities and experiences that can support language learning in informal settings as well as the formal settings of the school.

Exposure to mass media news, for example, TV and radio news, the pedagogical value of such materials, and the possibility of using TV and radio news at all levels of EFL/ESL settings in order to enhance different language skills have been the focus of many studies (Brinton & Gaskill, 1978; Poon, 1992; Baker, 1996; Cauldwell, 1996; Mackenzie, 1997; Berber ,1997; Beach & Somerholter, 1997; Cabaj & Nicolic, 2000; Bell , 2003; to name only a few).

However, very few or none at all attempts to investigate from the perspective of a comparison between social interaction as a source of language input in an ESL context and audiovisual mass media as a source of language input in an EFL context; which has a greater impact. Consequently, the present research aimed to compare the effect of exposure to two types of sources of language input to enhance language learning: audiovisual mass media as a type of language input in an EFL context compared to the social interaction as a type of language input in the ESL context.

STATEMENT OF THE PROBLEM
One of the problems that EFL learners confront in the EFL context such as Iran is how to improve their language proficiency. Limited access to a real context has forced teachers in Iran to rely on textbooks and other classroom materials in teaching the language. Consequently, for EFL learners to acquire a satisfying speaking proficiency, they themselves have to make great effort especially outside of the classroom. The instructors too have to help and guide the learners to choose authentic and appropriate materials. Technology is the only means to update oneself compared to traditional ways such as books. For the ESL context, the environment around is the source of language input. Learners get to communicate in the target outside of the classroom. Which source has a greater impact on the speaking proficiency of the learners? This research intended to investigate this.

RESEARCH QUESTION
More particularly, the present research was set to answer the following questions:

1. To what extent does social interaction improve language learners' language proficiency in ESL context?
2. To what extent does exposure to various programs from audiovisual mass media technologies improve language learners' language proficiency in EFL context?

METHOD
Participants
The participants of this study were initially one hundred language learners including both males and females from Iran as an EFL context and one hundred language learners including both males and females from Malaysia as an ESL context. Out of the initial participant from each context 30 participants were selected as intermediate language learners based on a speaking proficiency pre-test.

Instruments
Three instruments were utilized to carry out the present research. The first instrument consists of two sample IELTS speaking proficiency tests which were used as a pre-test and post-test. Prior to the study, the two sample IELTS language proficiency tests were verified to be parallel and reliable to increase the internal validity of the data.

Various speaking tests are available (Hughes, 2003; Farhady, et al., 2001; IELTS Center (2000); Heaton, 1990 and Underhill, 1987). However, a more updated checklist developed by Askari (2006) adapted from various checklists, was selected as the second instrument because it was deemed the most appropriate given the various components of the speaking proficiency: fluency, accuracy, comprehension, communication, vocabulary and accent (see appendix). The checklist scores each speaking test out of 30. Moreover, each component incorporates five points. The validity of the checklist was verified by Askari based on a pilot study.

The third instrument was a self report sheet which was used to collect data about the participants' amount of exposure to social interaction or various audiovisual mass media programs such as news, movies, cartoons, and so on from different technologies outside of the classroom contexts.

Procedure
This research was conducted based on a pre-test and post-test design. The procedure underlying the present research consists of three stages. The first stage concerns the verification of the instruments. The second stage is related to the selection of the participants. Finally, the last stage is concerned with the exposure period which lasted for two months.

Before the participants were selected, the reliability of the sample speaking proficiency pre-post tests was verified. To do so, the tests were given to a group of language learners in both contexts separately. Then, the reliabilities of both tests were calculated separately by means of KR-21 formula. The reliability of one test was 0.78 and the other one was 0.82 which indicated that the two sample speaking tests were verified in terms of reliability.

Then, the tests were given to one hundred EFL students including both males and females in Iran and one hundred ESL learners in Malaysia. When the scores of the tests were obtained, 30 randomly selected participants who scored one standard deviation above and below the mean were selected as homogeneous language learners from each context. In relation to scoring procedure, it should be mentioned that each speaking test was scored out of 30 based on the checklist. In order to increase the reliability of the speaking scores, rating activities were carried out first by the researcher himself and then by an inter-rater and later the mean score of speaking the pre-post tests for every participant was calculated.

Throughout the experiment, the participants in group one (ESL context) were asked to keep a diary of the amount of exposure to social interaction in English outside of the classroom. Moreover, they were asked to keep note of the possible problems related to their experience of having social interaction in English. In contrast, the participants in group two (EFL context) who did not have the chance to have social interaction in English were asked to have exposure to their preferred type of programs from various audiovisual mass media technologies and keep a diary of their daily amount of such exposure. Similar to ESL participants, EFL participants were also asked to report on the problems related to their having exposure to various audiovisual mass media programs from different technologies.

At the end of group one (ESL context) participants' exposure to social interaction and group two (EFL context) to various audiovisual mass media programs from a range of audiovisual mass media technologies, all the participants took the second parallel speaking proficiency test as a post-test to observe if there was any improvement in their speaking proficiency and the extent of the improvement.

The results of the post-test showed a significant difference between EFL and ESL participants' performance. EFL participants outperformed the participants in ESL context. This seems to indicate a greater positive impact from exposure to audiovisual mass media technology than social interaction on speaking proficiency development.

RESULTS AND DISCUSSION
Research question one
In relation to scores obtained from the pre-post tests by the participants in the first group (ESL context), there was a minor increase in the mean score in the post-test. However, in order to investigate the significance of this improvement, a statistical analysis of t-test was conducted. The result of the t-test showed that the t-observed was smaller than the t-critical which was indicative of the fact that the increase in the mean score was not significant to contribute to speaking proficiency development. In other words, the ESL participants could improve their speaking proficiency through exposure to social interaction in an informal setting but the results did not translate into a significant improvement.

The following table (1) shows the statistical analysis of the data obtained from the administration of the pre-post tests to group one (ESL context).

According to the data obtained from the diaries of this first group, each participant had social interaction in English for the average amount of 132 minutes a day (more than those in the second group). Regardless of the bigger amount of exposure, group one participants failed to improve their speaking proficiency through exposure to social interaction.

Plausible reasons that group one participants could not improve their speaking proficiency to a significant extent are the quality of the language input received and modified comprehensible input. In an ESL context such as Malaysia, the social interaction outside the school is provided by common people who speak English but are mostly non-native speakers of the language, not ESL teachers. The quality of the language input is in doubt.

Secondly, in maintaining the flow of the interaction, the interactants could simplify the input for comprehensibility purpose thus compromising on language learning purpose. The less than proficient speakers probably modified their input for the sake of comprehension and communication. The type of language input which is embedded in the interactionally modified input tends to be either at the language learners' current language proficiency level or even lower than that.

In short, in an ESL context, the aim to communicate and comprehend the message meaning may at times seem counter-productive to second language learning purpose and result in less than desirable language input for the language learner outside of the classroom.

Research question two
Regarding the scores obtained from the pre-post tests by the participants in the second group (EFL context), the change in the mean score in the post-test was greater than that of the first group (ESL context). Subsequently, a statistical analysis of t-test was also conducted in order to observe the significance of this increase. The result of the t-test showed that the t-observed was greater than the t-critical which was indicative of the fact that the increase in the mean score was significant enough to contribute to language proficiency enhancement. As a result, low level language learners could improve their language proficiency to a significant extent through exposure to various audiovisual mass media sources. Following is the statistical analysis of the data obtained from the administration of the pre-post tests to group two (table 2).

The data obtained from the second group participants' diaries showed that each participant had the minimum daily amount of 71 minutes exposure to various programs from different audiovisual mass media technologies in informal setting. This amount is less than the first group's.

The results obtained from the analysis of the pre-post tests scores of group two participants are in line with the studies conducted on effectiveness of exposure to various audiovisual mass media technologies that can provide the necessary language input for language learning (Brinton & Gaskill, 1978; Milton 2002; Evans 2006; Mackenzie 1997; Pemberton et al. 2004; Becker 1996; Cauldwell 1996).

It comparing the scores obtained and the input from the self report diaries, it can be concluded that the quality of the input that language learners receive is much more important than its quantity. Although social interaction can be used as a source of language input for second language acquisition, the results of the present study reveal that the amount of quality language input that language learners may receive in a social interaction context is very limited. Although there is negotiation of message meaning which according to the interactionist hypothesis aids second language acquisition, in some cases, the negotiation provides limited amount of quality input for language acquisition.

In contrast to the ESL context, the participants in the EFL context reported the use of dictionary and/or subtitles in order to comprehend the language input offered through the audiovisual mass media technology. The language input through this source could not be modified but somehow offered a rich data for language development, in this case, speaking proficiency.

CONCLUSION
Language learners in EFL/ESL contexts can make use of various sources of language input for language enhancement in informal setting. For example, language learners in ESL context can have exposure to social interaction in English in informal setting which has the potential to boost language learning. However, although social interaction in English does not exist in EFL context, language learners in EFL context can have access to various sources of language input through different audiovisual mass media technologies. In the same line, the present study aimed at filling the gap in the experimental work on finding an authentic source of language input that can best contribute to developing speaking proficiency in an EFL context which lacks the social context similar to that of the ESL one. Consequently, the effect of exposure to audiovisual mass media in EFL context, on one hand, and social interaction in ESL context, on the other hand, on speaking proficiency was studied.

The results of the study were indicative of the fact that exposure to authentic language input from various audiovisual mass media technologies in informal setting can contribute more to language development than

exposure to social interaction in English. The results showed that language learners can improve their speaking proficiency to a significant extent through exposure to audiovisual mass media technologies in informal setting. In contrast, for the sake of comprehension and communication, social interaction in English may hinder the development of language learners. Accordingly, for the language practitioners in EFL/ESL contexts, recognizing the limitations in the environment to provide language interaction in a social situation, the findings of this study serve as an important reminder of the possibility of incorporating authentic input from the various audiovisual technologies such as TV in the lesson planning.

Finally, the point should be highlighted that the present study was conducted with intermediate language learners. Different results may be obtained if the study is conducted with other language proficiency levels such as advance level. Moreover, considering the fact that all ESL contexts are not the same in terms of the quality of the language input which is embedded in social interactions in English, different results may also be obtained if the study is conducted in another ESL context.

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Appendix 1
The Sample Checklist for Measuring Communicative Abilities:

Scale I- Fluency:

- ☐ 5- Speaks fluently.
- ☐ 4- Speaks with near-native like fluency, pauses and hesitations do not interfere with comprehension
- ☐ 3- Speaks with occasional hesitations.
- ☐ 2- Speaks hesitantly and slowly because of rephrasing and searching for words.
- ☐ 1- Speaks in single word and short patterns, unable to make connected sentences.

Scale II- Comprehension:

- ☐ 5- Understands academic discourse without difficulty.
- ☐ 4- Understands most spoken language except for very colloquial speech.
- ☐ 3- Understands academic discourse with repetitions, rephrasing, and clarification.
- ☐ 2- Understands simple sentences, words; requires repetitions, slower than normal speech.
- ☐ 1-Understands very little or no English.

Scale III- Communication:

- ☐ 5- Communicates competently in social academic settings.
- ☐ 4- Speaks fluently in a social academic settings, errors do not interfere with meaning.
- ☐ 3- Initiates and sustains conversation, exhibits self confidence in social situations.
- ☐ 2- Begins to communicate for personal and survival needs.
- ☐ 1- Almost unable to communicate.

Scale IV- Vocabulary:

- ☐ 5- Uses extensive vocabulary in any domain appropriately.
- ☐ 4- Uses varied vocabulary to discuss general topics and in special interests.
- ☐ 3- Uses academic vocabulary, some word usage inappropriate, slightly damages the message.
- ☐ 2- Uses limited vocabulary, constant use of one word.
- ☐ 1- Inadequate basic vocabulary.

Scale V- Structure:

- ☐ 5- Masters a variety of grammatical structures, almost no error.
- ☐ 4- Occasional grammatical errors but no problem with understanding.
- ☐ 3- Uses some complex sentences but lacks control over irregular forms.
- ☐ 2- Uses predominantly present tense verbs, constant errors interfere with understanding.
- ☐ 1- Severe errors make understanding completely impossible.

Scale VI- Accent:

- ☐ 5- Acceptable pronunciation, with few traces of foreign accent.
- ☐ 4- Speaks with few phonemic errors, but almost intelligible pronunciation.
- ☐ 3- Occasional errors necessitate attentive listening.
- ☐ 2- Constant phonemic errors make understanding extremely hard.
- ☐ 1- Severe problems make understanding almost impossible.

Table 1. Descriptive statistics related to ESL participant's speaking proficiency pre-post tests results

ESL	N	MEAN	SD	t-test
Pretest	30	1.96	.58	_0.235
Posttest	30	2.00	.41	

T-observed=-0.235   T-critical=1.671   T-observed smaller than t-critical

Table 2. Descriptive statistics related to EFL participants' speaking proficiency pre-post tests results

EFL	N	MEAN	SD	t-test
pretest	30	2.13	.50	_4.253
posttest	30	2.61	.46	

T-observed=-4.253   T-critical=1.671   T-observed bigger than t-critical

KNOWLEDGE MANAGEMENT IN E-LEARNING PRACTICES

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ABSTRACT
Thanks to extension of IT in educational activities, the difficulties based on time and space are disappearing and the management and the execution of these activities can be implemented more effectively and beneficially. Even though there are significant developments about e-learning both in academic and professional platforms, there are some main questions that must be considered like: How can e-learning and knowledge management be integrated? Do these present e-learning systems fulfill the requirements of knowledge management? Are provided facilities from these systems being utilized in knowledge management accurately? In this paper, firstly e-learning, and then knowledge and knowledge management concepts are considered with their major points. In the next section it is considered that how e-learning systems can be integrated with knowledge management; under the subjects of knowledge management models, system features, and requirements of knowledge management.

Keywords: E-learning, e-learning systems, knowledge management, integration.

INTRODUCTION

Today, organizations need to develop fast and accurate responses to changes which increase their scope and speed day by day. In this context, knowledge management and educational activities gain increasingly importance for all kinds of institutions, not just business enterprises. In the knowledge age we are living, an organizational structure which is flexible, can fulfill customer demands through the effective use of resources, and protect and improve competitiveness, can only be created on the basis of an approach, which regard knowledge as the most basic and strategic factor. Further, in knowledge management studies conducted "education" is a subject of special importance, and instead of "organizational learning" now "learning organizations" are discussed.

With the spread of information technologies in educational activities, time and space-based barriers are removed, as well as the management and execution of these activities can be performed more effectively and efficiently. Although there has been significant progress in e-learning studies performed both on academic and vocational platforms, there are still some questions that need to be answered. The main of these are as follows: How can e-learning be integrated with knowledge management? Are the current e-learning systems able to fulfill the requirements of knowledge management? Are the opportunities offered by e-learning systems used in knowledge management properly? In this study, firstly e-learning, and then knowledge and knowledge management concepts are dealt with their major points. In the next section it is discussed how to integrate e-learning and knowledge management on the basis of knowledge management models, system specifications and requirements of knowledge management.

E-LEARNING

With changing circumstances and technology, economic, social, cultural and social life has significantly changed. In particular, enterprises operating in highly competitive sectors should address "education" like any other strategic agenda item and use it as one of the strongest tools. Training activities that are effectively carried out facilitate to increase employee productivity, to establish stronger and effective relations with business partners, as well as to increase brand awareness and customer preference. The fact that enterprises operate in challenging competitive conditions make education more critical (Rosen, 2000, p. 1).

In the literature there are different definitions of e-learning. However, when these definitions are considered from a wide perspective, it is seen that they emphasize generally the same features. In the European e-Learning Action Plan, the concept is defined as follows: "the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration". In this definition, electronic technologies are regarded as vehicles for education services and resources, and as the conduits for cooperation and communication. In an essential context, the concept can be defined as follows: Online access to learning resources, anywhere and anytime (Holmes & Gardner, p. 14). Some of the other definitions of the concept are as follows:

- E-learning is best defined as the category consisting of training and learning over the Web – training that can be delivered over an intranet, extranet or the Internet (Rosen, 2000, p. 20).

- E-learning is learning at a distance that uses computer technology (usually the Internet) (Henderson, 2003, p. 2).
- E-learning is essentially the network-enabled transfer of skills and knowledge. E-learning refers to using electronic applications and processes to learn. E-learning applications and processes include Web-based learning, computer-based learning, virtual classrooms and digital collaboration (Mihalca et al., 2008, p. 2).

In the context of learning and performance issues, the concept of e-learning can be defined from a broader and comprehensive point of view as follows: E-learning is the use of Internet technologies in order to create a rich learning environment which includes a large variety of instruction and information resources and solutions, and also to deliver this environment. And the goal of e-learning is to improve individual and organizational performance. In this definition, both instructional and information solutions took place, so different applications of e-learning in training and non-training environments are emphasized. In educational environments; course contents and applications are employed in relevant systems, even homework and exams can be electronically performed. On the other side, in non-training educational environments, in addition to formal education, informal education which means providing necessary information and collaboration environments is also realized. With informal education activities it is aimed that employees develop and update their knowledge. For example, doctors need a lot of formal training. However, they also learn in other ways, for example, by reading scientific journals, accessing new medical research data etc. Therefore, an instructional solution may not be required in all learning activities (Rosenberg, 2005, p. 72).

As with the concept of e-learning, there are also a large number of definitions in the literature regarding the types of e-learning. One of the main classifications divides e-learning activities into two main groups, synchronous and asynchronous e-learning. In synchronous e-learning, communication between instructors and students is carried out without delay. Synchronous interaction can be realized over chat sessions, collaborative electronic blackboards, etc. (Rosen, 2000, p. 20). In other words, with synchronous learning, all the students and instructors are in the same (virtual) environment at the same time. Although this type of learning seems similar to the traditional classroom learning, here there is no being of physically together. The main features of the synchronous learning can be summarized as follows:

- It is instructor-led,
- It is collaborative. Students can "talk and interact" with each other,
- It is scheduled (synchronous). Everyone is "there" at the same time (Henderson, 2003, p. 132).

With asynchronous learning, instructor can come together and communicate with a student group over the Internet. However, it is not required that all persons are online at the same time. Students are alone by studying learning materials, as well as by interacting with the instructor and other students by leaving messages. It is anticipated that the messages are answered in a specific period of time, for example, within a few hours. In this method, student can work alone, but continues to provide communication with an instructor or student group. The main features of the asynchronous learning are:

- It is student-led,
- It is semi scheduled (asynchronous). Everyone is "there", but not at the same time.
- It is collaborative. Students can "talk and interact" with each other by living messages (Henderson, 2003, pp. 135-136).

KNOWLEDGE AND KNOWLEDGE MANAGEMENT

The current time frame we are living in is called several different names, such as the digital age, information age, knowledge age etc. In this age, there are a large number of important developments in the nature of economics. One of the main is that economic structure is based no more on tangible products and manufacturing, but on intangible products and assets (knowledge, information, and so on). In this context, the differences between tangible and intangible assets and their reflections on the economic relations come to the question. Tangible assets are finite / limited assets; they can be used by only one person at a time. They decrease in value by using and sharing. On the contrary, knowledge which is an intangible asset is unlimited, can be used by many people at the same time and increases by using and sharing. Besides, the integration of different streams of knowledge may produce new knowledge assets which would be more refined and have more value. On the other hand, today, the benefits offered by knowledge sharing are increasing and this fact leads to widespread initiatives of collaboration. It is seen that knowledge sharing, for example in form of business alliances, is realized wide spread worldwide, even among competitors (Halal, 2006, p. 4).

Although importance of knowledge and its strategic meaning to organizations are widely accepted, there is no knowledge management model which is accepted worldwide, because of the characteristics of knowledge. Firstly, knowledge is a human-based construct which means that knowledge is created in minds of people. In this creation, human-based factors such as intuitions, beliefs, culture, experiences, etc. play a determining role. On the other side, the meaning of knowledge is context-dependent; knowledge has a specific meaning only in a specific context. The context in which knowledge is created, shared and used determines the meaning respectively importance of knowledge. Besides, knowledge management (KM) is a new approach compared to other management approaches such as total quality management, human resources management etc, and has no proven tools and methods yet. In this context, new technologies for example social software should be examined in relation to their contribution potentials to knowledge management practices. In addition, knowledge is an intangible asset and intangible assets can not be directly managed. Management process of intangible assets can be only indirectly formed. Indirect management means that relevant conditions impacting knowledge creation, knowledge development and knowledge sharing are analyzed and improved. In this way, different requirements for an effective knowledge management should be fulfilled (Probst et al., 1998; Kendal & Creen, 2007; Yılmaz, 2010).

In the literature, the objectives of knowledge management are defined from different point of views. The common understanding in these definitions is that KM is closely related to business excellence, competition and innovation capability of the organization, as well as process efficiency / effectiveness. In order to achieve these objectives, KM focuses on productive management of all intangible resources, for example individual knowledge assets, experiences, databases, know-how etc. Another important point related to KM is that relevant studies are conducted within the framework of corporate strategy (Bhatt, 2001; Nerdrum & Erikson, 2001; Beijerse, 1999; Mittelmann, n.d.; Probst et al., 2006; Riempp, 2003; Yılmaz, 2007; Yılmaz & Gürder, 2010). If business excellence is accepted as the main objective of KM, it can be divided into knowledge-based objectives listed below:

- Conversion of individual knowledge into organizational knowledge: It involves the conversion of knowledge, which is only in the minds of employees, into organizational rules, standards, structures and technologies.
- Creation of knowledge transparency: The organization should be able to determine capabilities which it currently has and must have them in the future. In this context, the organization should lead their employees to acquire necessary skills.
- Facilitation of information-based operations: It has an important role regarding the management of data and information that constitute the basic elements of knowledge. The correct processing of real data, and so the conversion of data into accurate information enable to have accurate knowledge and to decide effectively. Hence, knowledge and decisions are created on the basis of existing data and information.
- Preservation of important experiences: It can decrease the dependence on people and substantially prevent repetition of past mistakes
- Development of an organization-specific knowledge assessment system: The characteristics of knowledge mentioned above require considerable effort spent in this field (Reinmann, 2001; Probst et al., 1998; Probst et al., 2006; Röhl & Romhardt, 1997; Yılmaz & Gürder, 2010).

INTEGRATION OF E-LEARNING WITH KNOWLEDGE MANAGEMENT
The question how to integrate e-learning with knowledge management is closely related to the underlying knowledge management model. As mentioned above, there is no knowledge management model, which has proven successful and is widely accepted. In this study, the integration of e-learning with knowledge management is handled on the basis of the knowledge spiral model developed by Nonaka and Takeuchi (1995). In this model, tacit and explicit knowledge represent the two basic types of knowledge. According to this model, organizational knowledge is created with interactions/conversions which take place continuously between tacit and explicit knowledge. Tacit knowledge is based on personal experiences, can not be easily implied and transmitted, and incorporates human-specific factors such as beliefs, perspectives, culture etc, which can not be clearly interpreted. On the contrary, explicit knowledge can be easily implied, formalized and communicated. The person who has this type of knowledge is conscious of having it and can speak about it. The interaction/conversion modes between tacit and explicit knowledge are socialization, externalization, combination, and internalization (Nonaka & Takeuchi, 1995). The relevant modes and contribution potentials of e-learning systems regarding these modes can be explained as follows:

- Socialization: In this mode, tacit knowledge is transferred between individuals through interactions. In other words, tacit knowledge is converted into tacit knowledge again. Competency and skills

measurements facilitate to determine the people who have specific interests, skills and knowledge in the organization.

- Externalization: The tacit knowledge is converted into explicit knowledge in a repository. The e-learning system can capture knowledge to teach to other people. In this way, the knowledge capture process is developed.
- Combination: The explicit knowledge is extended with other explicit knowledge assets. Knowledge about products and processes of the business is structured to enable that learning processes are carried out more effectively and efficiently. In this context, pedagogical techniques are used.
- Internalization: In this mode, the explicit knowledge that is needed by a particular person or group is extracted from the repository and transferred to him/her or the group, where it is translated into tacit knowledge. Competency and skills measurements facilitate to determine the people who lack the knowledge to do their task effectively and to provide them online training. E-learning systems provide assessments and alternative learning methods to ensure that people have learned the knowledge (Woelk & Agarwal, 2002, p. 2).

Nowadays, knowledge management systems mainly focus on knowledge acquisition, storage, retrieval and maintenance (e.g. update), whereas e-learning systems are often monolithic and can not sufficiently support knowledge development and sharing (Mihalca et al., 2008, p. 1). However, as mentioned above, knowledge is a human-based construct and the creation of knowledge requires that relevant information are understood and internalized by people (Kendal & Creen, 2007). Learners acquire information and process experience. In this process, new information and experience are added into the knowledge base of the learner. Besides, in acquiring information and processing experience, the learner perceives, selects and integrates new information and experience into the current knowledge base and so, he/she changes it. In addition, "learner selects and constructs knowledge that is useful and appropriate for him/herself and in turn uses this to drive and determine his/her own continuous learning process". Besides, "learning process can be seen as process for…learning that becomes an individual process of interaction between the individual and his/her environment, in which the subjective reality of the learner is actively constructed". Therefore, if the computer technology will be used to support learning activities which should develop and create knowledge, then new pedagogical processes are required. On the other hand, with the tendency for technology-oriented development, information dissemination and acquisition are focused on (Mihalca et al., 2008, pp. 2-3).

The most important difference between e-learning and knowledge management systems is that they have totally different objectives. E-learning systems try to provide structured learning contents and intercommunication possibilities to specific topics so that learners are supported to develop their knowledge. On the other side, knowledge management systems provide knowledge through content management systems which have search and sort facilities, and also collaboration possibilities with experts and other users on various topics (Ausserhofer, 2002; Putzhuber, 2003, p. 10). In recent years, a lot of research which aim at integration of e-learning systems with knowledge management have been carried out. In this context, the common focus of e-learning and knowledge management can be stated as follows: How can human knowledge and its use within an organization be enhanced? (Dongming & Wang, 2005, p. 4).

Putzhuber (2003, p. 10) defines the common points of these systems as follows:

- E-learning and KM systems provide knowledge in different forms to the users. This content can be reused, annotated, modified or whatever else is needed for different approaches.
- The system architecture is almost the same for both concepts. It is a client-server-architecture with high complexity in the server-part whereas the clients are more or less thin ones.
- For both systems it is very important to provide communication and cooperation facilities. These vary from e-mail over chats to forums or other forms of cooperation.
- Also personalization plays an important role for both approaches. Relevant systems for both concepts support some kind of personalization either role-based or person-oriented.
- Last but not least, some kind of access regulation is available, either group or person specific. It is very important to provide only specific information to specific users and groups.

Within the framework of the common points mentioned above, it is seen that a better conjunction between the systems is dependent on design of the content that can be used for both systems. In addition to its teaching function, e-learning content should be designed to provide information in a categorized and structured context. This requirement and objective is also shared by knowledge management systems. Besides, it is possible that content of the KM system can be assessed as a kind of repository for content of the e-learning system. In such a case, only additional and specific metadata would be required. In addition, knowledge gathered by the

knowledge management system could be used as course in the e-learning system. Topics the many knowledge management users are curious and need to develop their knowledge about can be easily determined on basis of statistical evaluations (Putzhuber, 2003, p. 11).

Integration of e-learning with knowledge management processes can create synergies to significantly improve the creation of new knowledge and the performance of learning processes. As mentioned above, the question how to integrate e-learning with knowledge management is closely related to the underlying knowledge management processes respectively modeled. If these processes are stated as knowledge creation, knowledge structuring and knowledge dissemination, it can be seen that knowledge dissemination and creation occur in e-learning. However, the link between knowledge dissemination and creation are rather weak from organizational point of view. On the one side, new (individual) knowledge gained by learning is not sufficiently made explicit. On the other side, there is a lack of structuring mechanisms that enable to retrieve and reuse knowledge assets created by other people. In this context, the conversion of tacit knowledge into explicit knowledge and application of structuring mechanisms on learning resources are of special importance to the integration of e-learning with knowledge management (Angkasaputra et al., 2004, pp. 4-5).

For the integration of e- learning systems and knowledge management, the knowledge management model which is to be based upon should at first be determined. How this integration can be provided should be evaluated within the framework of the related model. This mentioned integration can basicly be explained as follows, based upon Nonaka and Takeuchi's Knowledge Spiral Model: The integration of the staff (employees) to the effective procedures is determined with respect to knowledge source maps and knowledge domains. Staff share their expertise and knowledge with each other by means of the interaction and collaboration options provided by the system; these options can be the chat rooms, discussion forums and coordination meetings thru internet calls. New possibilities for interaction and communication provided by knowledge management systems would definitely increase the efficiency at this stage (socialization).

The next step will be the transformation of tacit knowledge into explicit knowledge; where the knowledge and experiences shared by the staff in the previous stage, should be saved in the e-learning system. The saving procedure should be done within the framework of a certain structuring and classification system. Content management systems and knowledge structure maps can be useful at this stage (externalization). As mentioned above, one of the most important functions of knowledge management systems is to provide options for knowledge structuring and classification.

The successful combination of the explicit knowledge obtained through the process, with already existing knowledge that is to be reached, via either intra or inter institutional sources, should be maintained. Knowledge management systems can have important contributions at these stages as well, since knowledge acquisition, retrieval and maintenance are among their main functions. On the other hand, knowledge management systems also support content development through the network within the system. The combination of the established knowledge with pedagogical methods is vital at this stage (combination). In the final stage of the knowledge spiral model, explicit knowledge is transformed into tacit knowledge and this process is called internalization. Before moving onto this stage, such tools of knowledge management as knowledge asset maps and knowledge application maps can be utilized to determine to whom the knowledge or network shall be conveyed. Those who are concerned can easily reach the knowledge saved by others by means of structuring and retrieval mechanisms provided by the knowledge management system and hence evaluate this knowledge together with those provided by the e-learning systems. Thus, significant contributions are provided to the formation of new schemas (internalization).

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LEARNING EFFECTIVENESS AND COGNITIVE LOADS IN INSTRUCTIONAL MATERIALS OF PROGRAMMING LANGUAGE ON SINGLE AND DUAL SCREENS

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ABSTRACT
The teaching and learning environment in a traditional classroom typically includes a projection screen, a projector, and a computer within a digital interactive table. Instructors may apply multimedia learning materials using various information communication technologies to increase interaction effects. However, a single screen only displays a single teaching view to learners. In this study, we proposed a dual-screen learning environment to present multiple learning contents simultaneously and investigated learning effectiveness and cognitive loads of learners between single- and dual-screen learning environments. We compared different instructional materials in programming language instruction using two types of learning environments with single and dual screens. We designed three types of instructional materials, descriptive material, progressive material, and worked-example material, to arrange the instructional slides of programming language course. The results of this study showed significant differences in learning effectiveness, and the degrees of clarity and difficulty of instructional materials in both learning environments. This study may help explain the learning effects between single- and dual-screen environments, and provide instructors with a better understanding of how a dual-screen learning environment affects learning effectiveness and cognitive loads in programming language instruction.
Keywords: learning effectiveness; cognitive load theory; programming language instruction; dual-screen learning environment

INTRODUCTION
An instructor typically makes use of a single projection to present and instruct a series of instructional slides in a traditional classroom. The instructor instructing a programming language course may utilize the corresponding programming development software to demonstrate an example for explaining the presented instructional slides. To clarify the instructional content, the instructor must repeatedly switch to present the teaching content between textual explanations from presented slides and operate the screen view while using the programming development software. The rapid switching and successive presenting between the presented slides and the programming development software may affect the knowledge construction of learners. The successive and simultaneous presentations may also lead learners to increase their cognition load to compensate for the limited human memory system. Previous studies refer to multiple images presented simultaneously in presentations as multi-image presentations (Atherton, 1971; Westwater, 1973; Jonassen, 1979; Burke & Leps, 1989). These studies are based on the Perrin theory of presenting multiple images to enhance learning effects of learners in learning multimedia materials (Perrin, 1969). He pointed out that presenting images simultaneously allows learners to select their own learning sequence. However, instructional materials are not limited to multiple images on a single display (or screen) with increasing technologies for presentation. Recently, multimedia learning technologies have been widely used in the traditional classroom. Instructors can use these technologies to present richer and more meaningful instructional materials. Mayer (2005) indicated that learners can easily refer to connections in the working memory during simultaneous presentation of texts and images in multimedia instruction. Multimedia instruction includes multi-image presentations that display multiple correlated instructional materials to assist learners in constructing knowledge. Many previous reviews (Kulik et al., 1980; Khalili & Shashaani, 1995; Bayraktar, 2002; Liao, 2007) on the effects of computer-assisted instruction using multimedia learning technologies suggest that multimedia improves learning effectiveness, irrespective of subject matter. The effectiveness of multimedia instruction has been associated with factors such as knowledge

level and aptitude (Mayer & Gallini, 1990; Najjar, 1996; Mayer, 2005; Atkinson et al., 2009; Seo & Woo, 2010).

We believe that multi-image presentations designed into multimedia instruction can assist learners to construct knowledge with multiple correlated instructional contents displaying on two adjacent screens. Some studies have provided multi-image presentations with graphic software, animation, or webpage, to help learners conceptualize mathematic instruction activities (Yerushalmy, 1991; Borba & Confrey, 1996; Adydin, 2005). Researchers have also evidenced the usefulness of learning strategies with multimedia technology for learner cognitive processes (Lee et al., 2006; Van Gerven et al., 2006). The information processing system has pointed out the limited capacity of the human memory system (Klatzky, 1980). The human memory cannot simultaneously process two information streams encoded with only one code of dual channels (verbal and visual channels). The various sources of materials, which could be text and text, or text and mathematical equations, or different multimedia material formats, may cause learning effects such as split-attention and worked-example effects in learner cognition. Based on the above suggestions and findings from previous studies, this study investigated critical impact factors in learning effectiveness and cognitive loads between learners processing information using one or two screens in the classroom.

Before comparing the differences in learning effects between single- and dual-screen environments for teaching a programming language course, we constructed a digital interactive table (DIT) in a computer classroom for instructors to use both learning environments. This DIT included a control system to control the connections between multiple computers and projectors. The dual-screen learning environment (DSLE) was used to present instructional slides and demonstrate a screen view of programming development software simultaneously on two adjacent screens. The single screen learning environment (SSLE) was also applied to display the presented instructional slides and demonstrate a screen view of programming development software successively on a single screen. In this case, the major difference between DSLE and SSLE are the presentation modes of instructional materials. SSLE is a linear and successive presentation with two instructional materials on a single screen and DSLE is a simultaneous presentation with two instructional materials on two adjacent screens.

This study adopted a multi-image presentation and multimedia learning theory to display instructional materials simultaneously. The aim was to assist learners in their learning concept of programming language by simultaneously presenting various instructional materials as textual explanations and demonstrating operational procedures as programming worked examples. The theoretic positions in this study aimed to provide an answer to questions about using various textual explanations corresponding to operational procedures between single- and dual-screen learning environments. The textual explanations consisted of three types of instructional materials, descriptive material, progressive material, and worked-example material. The primary research question addressed whether various textual explanations presented in both learning environments would affect learning effectiveness and cognitive loads of learners. Thus, the experiment was investigated in two learning groups (SSLE and DSLE) whose learners received these three types of instructional materials. This experiment was divided into three parts, learning effectiveness, the degree of clarity, and the degree of difficulty of presented instructional materials. Learning effectiveness expected to understand the learning factors of various instructional materials in programming language instruction. The degrees of clarity and difficulty were used to realize the cognitive loads of learners under diverse presentations. This study may lead to a better understanding of the learning effects of teaching with descriptive, progressive, and worked-examples instructional materials in a dual-screen learning environment.

THE STUDY
This study constructed a teaching environment with dual screens in programming language instruction. The main ideas of this environment were to extend teaching space and improve learning effectiveness. The following sections describe the setting of the dual-screen learning environment and the background of programming language instruction in this learning environment.

Setting of DSLE
Integrating technology into the classroom implies that instructors should strive to understand appropriate ways to support meaningful learning in technology-rich classrooms (Keengwe et al., 2008). This study developed the DSLE to present rich and meaningful information in instructional slides and to demonstrate the screen view of programming development software onto two adjacent screens. Low (1968) stated that no single image can establish certain memory combinations, but a multi-image with a group of images perceived simultaneously often recalls long forgotten memories. The multi-image presentation of Perrin (1969) includes three significant characteristics: a larger screen to contain more information, simultaneous images to display multiple images, and appropriate information density to present rich and complete information. This type of multiple image presentation has been evaluated with various multimedia learning materials (Mayer, 2005). Many previous

reviews (Kulik et al., 1980; Khalili & Shashaani, 1995; Bayraktar, 2002; Liao, 2007) have investigated the learning effectiveness of multimedia information, suggesting that learners aided by computer-assisted instruction performed better than those who received instruction through traditional classroom lectures.

A traditional classroom for computer-assisted instruction to present multimedia information consists of a single projector system within the digital interactive table. Thus, a larger screen or dual screens are needed to build assisted teaching equipment in the classroom for presenting rich information for multimedia learning. The multimedia learning environment is typically built with a digital interactive table (DIT) in the classroom. The DIT has been used in classroom learning to assist the instructor in presenting written or electronic multimedia materials. The traditional DIT consists of one computer, a projector, a control device, or an interactive handwritten system constructed inside an integrated table. Instructors have widely applied multimedia instruction with various multimedia learning materials in the classroom learning environment for enhancing learning. Multimedia learning materials present in various formats (such as texts, graphics, audio, animations, or videos) to meet the needs of various courses. Therefore, a traditional classroom with a single projection screen presents some limitations. An instructor who presents two or more multimedia materials using a single screen has to switch the presented view frequently. The presented information density increases when the instructional materials include too much information. Thus, learners must search for learning content while the instructor is teaching. Finally, since a single projection screen limits the amount of multimedia material that can be presented, the instructor cannot present rich and complete learning materials to learners.

A traditional classroom with a single projector typically uses a VGA cable to connect to the computer. This study used a control device to integrate multiple VGA signals as three inputs and displays on two screens as two outputs and set the control matrix, called the multiple-screen hub device, inside the DIT. Instructors can present two different types of multimedia materials simultaneously such as instructional slides, instructional videos, or camera views. This device allows instructors to use one or two computers to connect with the DIT to provide richer and more complete multimedia materials. The control matrix allows for choosing two of three inputs to display on two outputs. Figure 1 shows the setting of the DIT which consists of the multiple-screen hub device and the projector control system of two projectors and screens. Using the DIT setting for dual screens in the classroom, the instructor can control two VGA signals from the computer(s) to project onto two screens effectively. The DIT described here could serve as the basis for a study using single and dual screens in programming language instruction. The following section theoretically illustrates how programming language instruction in a DSLE affects learners from a cognitive perspective.
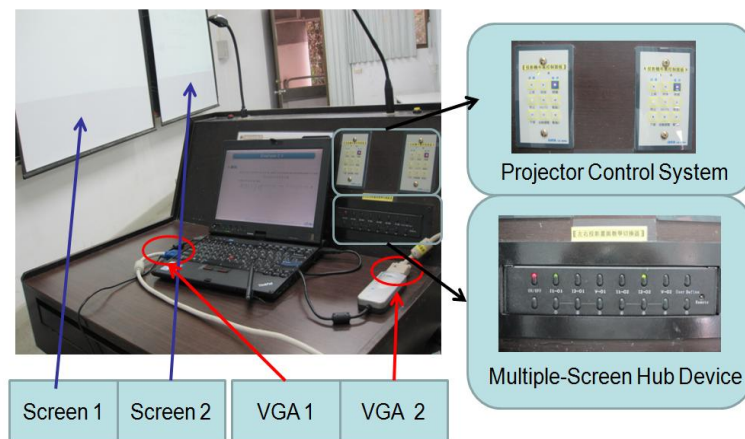
Figure 1. Setting of the digital interactive table (DIT)

Programming Language Instruction in a DSLE
In a traditional computer classroom with a single projection system, the instructor faces the problem to simultaneously instruct both views of instructional slides and demonstrating corresponding worked examples in programming language instruction. It will lead to limit the instructional effects between them. As mentioned above, the instructor has to present two instructional views successively and frequently, which may confuse learners in their knowledge construction during frequent learning content switches between both instructional views. In this study, the DSLE primarily involved two adjacent projection systems in a computer classroom as shown in Figure 2. Two projection screens displayed two types of instructional materials with the same instructional objectives from the PC or laptop of the instructor. The instructor could use the right screen to display instructional slides as textual explanations and the left screen to show programming development

software as corresponding visualizations simultaneously. The designed objective of DSLE was to present richer textual and visual materials simultaneously as a multi-image presentation in a short teaching time. The cognitive theory of multimedia learning by Mayer (2005) pointed out that learners can easily refer to connections between two views of adjacent projection screens without splitting their attention. This study focused on two learning effects derived from the cognitive load theory, split-attention, and worked-example effects, to improve the learning effects and to reduce the cognitive loads of learners.

Why should split-attention and worked-example effects be considered in the design of a dual-screen learning environment? Split-attention effect is an instructional technique developed from cognitive load theory to facilitate learning (Chandler & Sweller, 1992; Lee et al., 2006; Van Gerven et al., 2006). Chandler and Sweller (1992) found that when learners are required to split their attention between various sources of information, this effect would be evident. They also used an empirical study to prove that integrated text and diagrams without split attention format effectively reduced cognitive load. Based on this suggestion, we used one screen to present instructional material integrating text and diagrams and another screen to present the corresponding worked examples adjacently. Demonstrating a worked example is another effective method for instructors to instruct learners in problem solving skills (Sweller et al., 1990; Renkl & Atkinson, 2003). They have suggested a way to use worked examples and found that integrating text and diagrams within worked examples reduces extraneous cognitive load. The worked example effect suggests that learners gain a deeper understanding of a skill domain when they receive worked examples at the beginning of cognitive skill acquisition (Lewis, 2005; Renkl, 2005; Sweller, 2006; Schwonke et al., 2010). The split-attention and worked-example effects closely relate to numerous interacting elements (Sweller, 2010). The interacting elements associate with searching for critical features (integrating text and diagrams or demonstrating a worked example) within an instructional material and should be eliminated.

The Sweller and Chandler study (1994) argued that element interactivity is an important factor of cognitive load theory. Element interactivity refers to the number of elements simultaneously processed in working memory for understanding information. If information possesses a high degree of element interactivity, elements cannot individually process in working memory, making the material more difficult to understand. In contrast, the working memory can process and understand information with low element interactivity without considering other elements. Thus, element interactivity drives the intrinsic load. The demands on working memory capacity imposed by element interactivity are intrinsic to processing information (Paas et al., 2003). Excess element interactivity also causes extraneous load and cannot be eliminated without altering information procedures, such as instructional activities. However, a germane load could result in the working memory recourse to deal with element interactivity associated with intrinsic load. Sweller (2010) argued that total element interactivity generated by intrinsic and extraneous loads determines total working memory load. Our research design used the ranking scale technique to investigate learner working memory loads in cognitive load measurement between various instructional materials and learning environments in our experimental course.

Figure 2. A programming language instruction in DSLE

RESEARCH DESIGN

This study used the quasi-experimental design to measure learning effects, including learning effectiveness of learners, and the degrees of clarity and difficulty of learner cognitive loads in three types of instructional materials. The following describes the research design details about the participants, instructional materials, procedures, and instruments.

Participants

Forty-two students enrolled in the undergraduate-level course, "Windows Programming in Microsoft Visual Studio Dot Net 2005", participated in this study. All participants were randomly assigned to two groups: one group (twenty-three students), the SSLE group, was taught in a traditional classroom with single-screen instruction and another group (nineteen students), the DSLE group, was assigned to learn via dual-screen instruction. Their ages ranged from twenty to twenty-two years. The participants only possessed basic programming ability of C/C++ programming language and were novice learners in Windows programming. This course focused on advanced programming skills of C/C++ and visualized design of Windows programs. After completing the course, participants could understand complicated design flows of object-based programming language and the data structure of Windows programming, to solely implement a complete Windows application.

Instructional Materials

Participants of both groups were taught eight instructional units of basic windows controls in Windows programming, such as CView, CDocument, CList, CMap, CButton, CEdit, CListBox, CComboBox, CStatic, and CTime, which are the basic data and user-interface object classes of Microsoft Foundation Classes (MFCs) developed by Microsoft. These units were designed into three types of instructional materials, descriptive material, progressive material, and worked-example material, to arrange instructional slides. The descriptive material presented static textual and visual content. Figure 3 shows the learning content of the descriptive material. The progressive material was designed with dynamic textual and visual content as animation objects within PowerPoint slides. Figure 4 shows the stepwise learning content of the progressive material. Figure 5 shows the worked-example material in PowerPoint slides used a worked example, which is an executable programming instance of designing a basic calculator. Learners can simultaneously study the programming concept through a workable sample.
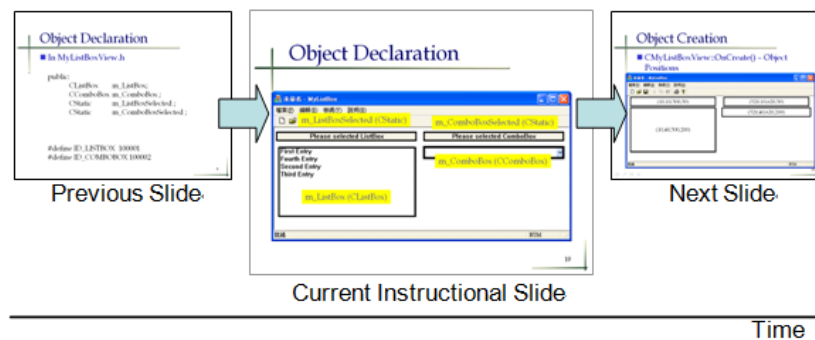
Figure 3. Descriptive material with static textual and visual content
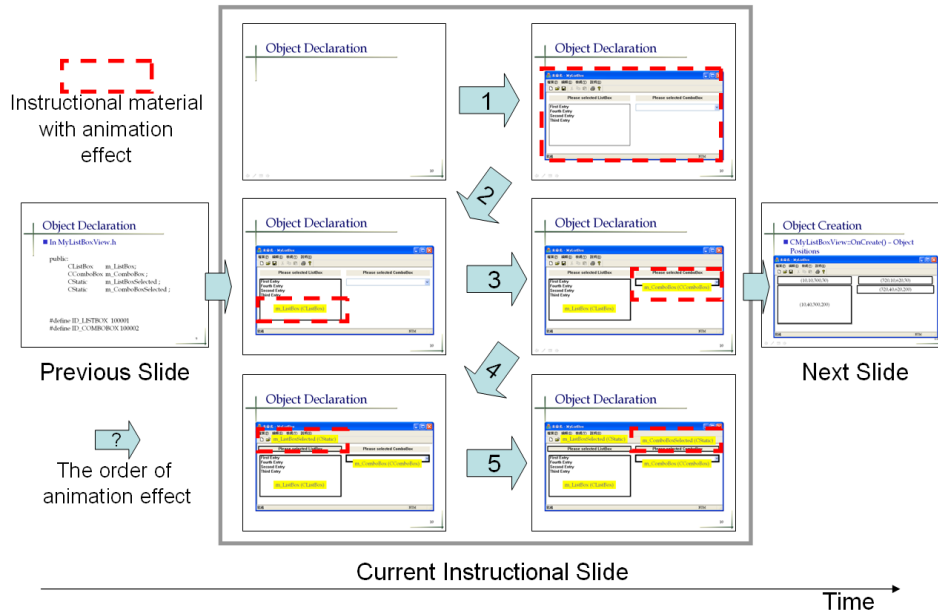
Figure 4. Progressive material with animation effects on textual and visual contents
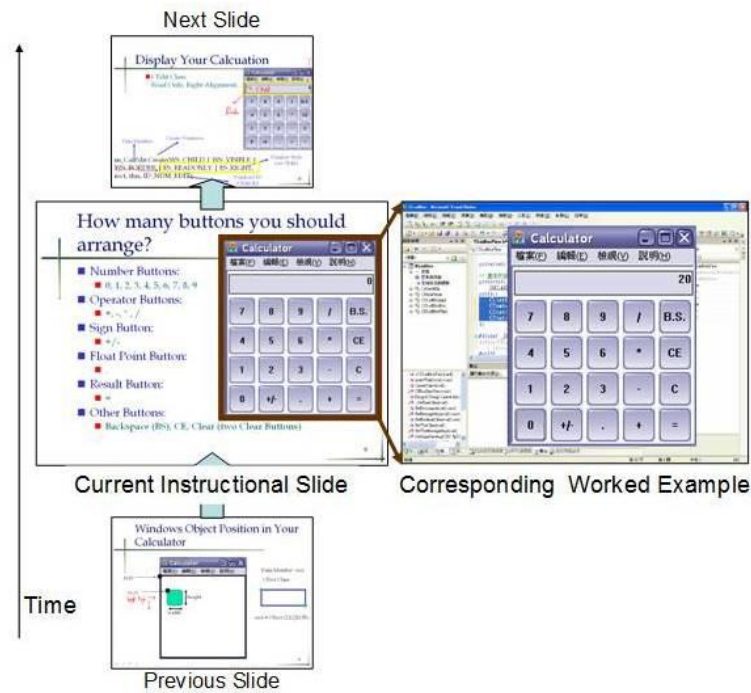
Figure 5. Worked-example material with an executable program instance

The instructor teaching these three types of instructional materials in SSLE uses a single projector to display the instructional contents, which requires carefully switching the screen view between explaining instructional materials and using the programming language software to demonstrate the corresponding programming codes. Thus, learners can only see one of these two views without information searching, and the instructor has to switch the view in a single projection screen. In contrast, the instructor can use two adjacent screens to simultaneously instruct with material slides and demonstrate a worked example using programming language software without interleaving these two instructional contents in DSLE. Therefore, learners can simultaneously see both screen views as multi-image presentations, and the instructor can change both screen views to instruct immediately.

Procedures

Participants in the two groups were assigned to study the three types of instructional materials in three weeks, described in the above section as descriptive material, progressive material, and worked-example material. In the SSLE, the instructor frequently interleaved the screen view of instructional slides such as PowerPoint slides and the screen view demonstrating a worked example using programming development software (Microsoft Visual Studio Dot Net 2005). In the DSLE, the instructor simultaneously showed these two screen views and chose one of the two screen views to teach. The instruments in this study were used to address learning effectiveness and cognitive load measurement. Participants were asked to complete the instruments after learning these three types of instructional materials. The instruments measured learning effectiveness and two degrees of cognitive load for each material.

Instruments

We examined participant learning effectiveness and cognitive loads by comparing the differences between SSLE and DLSE in learning three types of instructional materials. Each measurement consisted of various items according to the features of these eight instructional units mentioned above. In the descriptive material designed for the descriptive knowledge of these units, there were 14 items for learning effectiveness, three items for the degree of clarity, and three items for the degree of difficulty. In the progressive material for the conceptual knowledge of these units, there were nine items for learning effectiveness, three items for the degree of clarity, and three items for the degree of difficulty. In the worked-example material for providing executable examples to explain basic windows controls, there were 12 items for learning effectiveness, two items for the degree of clarity, and two items for the degree of difficulty.

Learning effectiveness of multimedia instruction was modified based on three main factors: specific skills, learning ability, and easy-to-learn (Hui et al., 2008). Hiltz et al. (2000) referred to learning effectiveness as the extent to which a learner believes s/he has acquired specific skills in learning programming language. We also considered learning ability to represent a critical dimension of learning evaluation (Bødker & Graves Petersen, 2000). In the study of Martin-Michiellot and Mendelsohn (2000), instructional materials delivered in an easy-to learn fashion can enhance the learning effectiveness learners. All question items in the learning effectiveness measurement were based on a 5-point Likert-type scale, with 1 as strongly disagree and 5 as strongly agree.

In terms of measuring cognitive load, the degrees of clarity and difficulty investigated the intrinsic and extraneous cognitive loads of learners. The degree of clarity refers to the extraneous cognitive load regarding the clarity of multiple-information displayed on the screen. The extraneous load (Sweller & Chandler, 1994) is associated with the presentation of learning materials. The degree of clarity of learning materials affects these two forms of learner cognitive load. The degree of difficulty refers to the intrinsic cognitive load regarding the difficulty of multimedia learning materials. Sweller (2010) described intrinsic load as the mental work imposed by complexity. Therefore, we investigated the learning effects of learners on the degree of difficulty of learning materials using diverse presentations. This study adopted the experimental measurement modified for previous studies (Paas, 1992; Pollock et al., 2002). The rating scale technique has been widely used to measure working memory load and mental effort within cognitive load researches (Gopher & Braune, 1984; Paas et al., 2003). The rating scale is a very reliable measurement in cognitive load researches according to reliability and validity analysis. The modified measurement in this study was designed on a 7-point Likert-type scale in two dimensions, the degree of clarity from 1 (strongly clear) to 7 (strongly unclear) and the degree of difficulty from 1 (strongly easy) to 7 (strongly difficult). The degree of clarity represents the highest score as the highest extraneous cognitive load. The degree of difficulty represents the highest score as the highest intrinsic cognitive load.

ANALYSIS AND RESULTS

The analysis used the statistical software package, SPSS. The One-Sample Kolmogorov-Smirnov test was used to test the normal distribution between SSLE and DSLE groups due to the few samples of less than 30 participants in both groups. The p-values of each item in these two groups were all higher than .05. The items in the SS and DS groups were all normally distributed and the independent t-test analysis was used to test the differences between these groups. Reliability as a measure of internal consistency was then calculated. In the descriptive material, the alphas for learning effectiveness, the degree of clarity, the degree of difficulty were .93, .89, and .90 respectively. In the progressive material, the alphas were .91, .83, and .92 respectively. The alphas of the worked-example material were .94, .92, and .93 respectively. Finally, the independent t-test and effect size were computed to find the differences between SSLE and DSLE in learning these types of instructional materials. Table 1 shows the results for these materials analyzed by t-test and effect size analyses. Effect size is a measure of relationship strength between two variables. Following the suggestion of Cohen (1988), we considered an effect size of .2 to be small, .5 to be medium, and .8 to be large. Cohen's *d* was also computed to determine the effect size where a positive effect size represents improvement and a negative effect

size represents deterioration.

Table 1: T-test analysis of the degree of clarity, the degree of difficulty, and learning effectiveness

Material	Perspective	Source	Mean	SD	T-value	Effect size Cohen's *d*
Descriptive material	Learning effectiveness	SSLE (23)	45.96	7.47	-1.535	
		DSLE (19)	49.84	8.93		
	The degree of clarity	SSLE (23)	7.61	2.78	4.858**	1.53[L]
		DSLE (19)	3.95	1.93		
	The degree of difficulty	SSLE (23)	12.70	2.79	.541	
		DSLE (19)	12.05	4.52		
Progressive material	Learning effectiveness	SSLE (23)	29.26	4.77	-2.551*	-.79[M]
		DSLE (19)	32.94	4.53		
	The degree of clarity	SSLE (23)	6.87	2.38	2.502*	.78[M]
		DSLE (19)	5.05	2.30		
	The degree of difficulty	SSLE (23)	13.07	2.94	1.177	
		DSLE (19)	11.74	4.46		
Worked-example material	Learning effectiveness	SSLE (23)	37.04	5.73	-4.408**	-1.35[L]
		DSLE (19)	45.74	7.05		
	The degree of clarity	SSLE (23)	5.47	1.78	3.843**	1.34[L]
		DSLE (19)	3.26	2.10		
	The degree of difficulty	SSLE (23)	8.39	1.85	1.647	
		DSLE (19)	7.05	3.12		

* $p<.05$; ** $p<.005$; [L]: Large effect size; [M]: Medium effect size

In learning with all three materials, learners in the DSLE group exhibited enhanced learning effectiveness and recognized that the learning materials were clearer and easier than those in the SSLE group. The t-test of learning with the descriptive material showed a statistically significant difference between the SSLE and DSLE groups in the degree of clarity perspectives (t (41) = 4.858**, p<0.005; large effect size=1.53), but with no significant difference in both learning effectiveness (t (41) = -1.535, p>.05) and the degree of difficulty perspectives (t (41) = 0.541, p>.05). The t-test of learning with the progressive material showed statistically significant differences between the SSLE and DSLE groups in both learning effectiveness (t(41)=-2.551*, p<.05; medium effect size=-.79) and the degree of clarity perspectives (t(41)=2.502*, p<.05; medium effect size=.78), but with no significant difference in degree of difficulty perspectives (t(41)=1.177, p>.05). The t-test of learning with the worked examples material showed statistically significant differences between the SSLE and DSLE groups in both learning effectiveness (t(41)=-4.408**, p<.005; large effect size=-1.35) and the degree of clarity perspectives (t(41)=3.843**, p<.005; large effect size = 1.34), but with no significant difference in the degree of difficulty perspective s (t(41)= 1.647, p>.05).

DISCUSSIONS

The empirical findings present the results of learning effectiveness and cognitive loads in the degrees of clarity and difficulty and the effects of instructional material between the SSLE and the DSLE. Three significant findings by reviewing the above findings are worth summarizing:

Our research suggested three types of instructional materials for multi-image presentation in SSLE and DSLE in order to find the impacts of learning effectiveness and cognitive loads in learning programming language course. Results of previous research comparing linear and simultaneous presentations indicate investigation of only a few significant differences (Atherton, 1971; Westwater, 1973; Burke & Leps, 1989). This study adopted the Perrin theory (1969) to provide two simultaneous views of screens and richer learning content to increase information density. The t-test of learning effectiveness showed statistically significant differences between the SSLE and DSLE groups in learning with progressive and worked-example materials. These results indicated that presenting progressive and worked-example materials in a DSLE benefitted learner specific skills, learning ability, and ease in learning programming language. These finding are in accord with the results of the previous studies which have test learning effectiveness, despite the fact that these studies performed multimedia instruction in different learning domains (Adydin, 2005; Liao, 2007).

The intrinsic load for each type of instructional material showed no difference between SSLE and DSLE for the degree of difficulty. These results imply no difference in the intrinsic loads of learners in the two learning environments in learning these instructional materials. In the study of Sweller and Chandler (1994), the intrinsic

load focused on learners understanding natural complexity. This study found that learner intrinsic loads in learning programming language were not affected, whether the instructional materials were presented in a SSLE or a DSLE. The extraneous load was imposed from non-optimal instructional procedures (Sweller et al., 1998; Sweller, 2010). This study used the degree of clarity to examine participant perception of instructional procedures in learning programming language with single or dual screens. Results from the degree of clarity perspective showed significant differences on these three types of instructional materials between a SSLE and a DSLE. Based on these results, the interactive element in DSLE is lower than SSLE, particularly in learner extraneous loads. However, learners in a DSLE did not accumulate extraneous loads searching for interactive elements presented on two screens simultaneously.   These findings indicate that presentations in a DSLE could provide a clearer environment to reduce learner extraneous loads in learning programming language.

The effect sizes of these three types of instructional materials showed that the worked-example material exhibited large effect sizes on learning effectiveness and the degree of clarity than other types of materials. This finding accords with the results of previous tested effectiveness and cognitive loads in programming language instruction, although these studies used various measures of worked-example materials. The principle of worked examples in multimedia learning asserts that learners gain a deeper understanding of a skill domain when they receive worked examples at the start of cognitive skill acquisition (Lewis, 2005; Renkl, 2005; Schwonke et al., 2010). Lewis (2005) proposed an animated form to demonstrate worked examples. The animated worked examples were primarily useful for training complicated cognitive skills to learners. Schwonke et al (2010) used the different ratios of worked solution steps and to-be-solved problem steps on cognitive skill acquisition in geometry. They found that no ratio of worked steps in examples was most beneficial for the acquisition of procedure knowledge related to a difficult principle. These findings of this study and the previous studies lead us to believe that more worked examples should be used to design instructional materials which could increase the learning effects of learners in multimedia instruction.

CONCLUSIONS

This study examined the learning effectiveness and cognitive loads of participants in learning programming language using three types of instructional materials and found some significant differences between SSLE and DSLE. Based on the above findings, learners in a DSLE group showed enhanced more effective and recognized clearer and easier learning materials than those in the SSLE group. The t-test of the degree of clarity showed statistically significant differences between SSLE and DSLE groups in learning using all three types of instructional materials, especially in learning with worked-example material. The results of this study could be useful for instructors responsible for instructing programming language courses in multimedia learning environments, regardless of whether the classroom uses single or dual screens. The limitation of this study is rooted in the small group of participants who were investigated in this experiment. Due to the study involving only two small groups, the results could not be generalized as representative of the population. Thus, generalization of the results to other populations with various instructions may be limited. Future studies should be aware of the limitations of this study.

Although the sample in the current study was small, the following recommendations could serve as suggestions for researchers experimenting with dual or multiple screen environments in a similar context. We recommend that DSLE is not only suitable to visualize Windows programming courses, but also for other types of programming languages. For example, when instructing networking-programming language courses, one screen can present learning materials for instructing programming illustrations, while the other screen can simultaneously display executable examples on the web browser. A dual-screen learning environment can be designed to extend the windows view of a large map to introduce the geographic distribution of the entire map, without segmenting displays. Such the learning environment can also be implemented in an online video conference room with triple screens. One screen could display the video view of the speaker. The second could present the speaking slides, and the third could present the introductory slides of the speaker or supplements to the conference, such as slides for translation. Although the set up cost of the DSLE is more expensive than single screen environments, the use of a dual-screen environment might provide an efficient and usable environment for teaching and learning.

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PERCEIVED SOCIAL SUPPORTS, COMPUTER SELF-EFFICACY, AND COMPUTER USE AMONG HIGH SCHOOL STUDENTS

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ABSTRACT
This study investigated the function of social supports and computer self-efficacy in predicting high school students' perceived effect of computer use. The study was survey method to collect data. The questionnaires were distributed to the high school students in Taiwan. 620 questionnaires were distributed and 525 questionnaires were gathered back with 84.67% return rate. The results of structural equation modeling (SEM) and model invariance analysis indicate that perceived peer support played an important role in predicting the effects of advanced computer self-efficacy. However, general computer self-efficacy was the factor more strongly associated with student computer use. The results were analyzed to provide useful insight into the development of student computer competency. The modified scale was a valid and reliable instrument for large scale population. This study provided representative results for further related studies. Educational implications and suggestions for future research are proposed.
Keywords: perceived social supports, computer self-efficacy, computer use

INTRODUCTION
The rapid change of computer technology has transformed into an important part of our lives. Computers and Internet access are becoming increasingly common in schools. Although originally intended as a means to provide individualized instruction for students, computers and Internet support collaborative learning in the classroom (Littleton & Light, 1999). However, the computer has captured the attention of educators and the academic community, and technology use is becoming increasingly important. The prevalent use of computers in education may provide learners more opportunities for web-based learning (Engelbrecht, 2005). Computers and the Internet have become important tools in our daily life, as well as useful tools for social psychological research (Imhof, Vollmeyer, & Beierlein, 2007; Kao & Tsai, 2009; Topkaya, 2010; Vekiri & Chronaki, 2008).

Researchers and practitioners have focused on psychological and social factors that may influence learner computer use. Studies over the past decade have found that psychological factors influence individual computer use (Barbeite & Weiss, 2004; Compeau & Higgins, 1995; Hsu, Wand & Chiu, 2009; Kao & Tsai, 2009). However, comparatively few studies have examined social factors linked to computers (Chu, 2010; Schepers, Jong, Wetzels & Ruyter, 2008; Vekiri & Chronaki, 2008). The social support theory discusses the various sources of positive or protective influences associated with individual social relationships and networks (Berkman, Glass, Brissette, & Seeman, 2000). The present study considered the influence of family support and peer support on students' computer learning based on the theory of social support. Vekiri and Chronaki (2008) categorized various forms of support as parental and peer support. Gonzalez-DeHass, Willes, and Holbein (2005) indicated that when parents pay more attention to school-related and extracurricular activities, provide encouragement and praise, and express positive values and expectations, children have positive self-efficacy beliefs and intrinsic motivation for school learning.

The self-efficacy theory derives from the social cognitive theory (Bandura, 1986), which significantly influences many areas. Computer self-efficacy refers to beliefs in one's capabilities to use the computer (Compeau & Higgins, 1995). This study also explored social factors related to computer self-efficacy. Computer self-efficacy has been identified as an important determinant of computer-related tasks and computer usage (Hassan, 2003). Previous research suggests that computer self-efficacy has been shown to play a significant role in an individual's decision to use computers (Marakas, Yi, & Johnson, 1998; Ong, Lai, & Wang, 2004).

Previous research on computer self-efficacy indicated that computer experience had a significant positive relationship on computer self-efficacy beliefs (Potosky, 2002). Computer self-efficacy refers to individual self-efficacy about using computers (Murphy, Coover, & Owen, 1989), and has been identified as a major determinant of computer-related ability and usage in organizational contexts (Madhavan & Phillips, 2010). However, several previous studies have examined factors affecting computer self-efficacy beliefs (Busch, 1995; Harrison & Rainer, 1992; Hassan, 2003; Potosky, 2002). Computer self-efficacy may determine the success of computer learning. In other words, the social cognitive theory provides a solid theoretical foundation for the concept of computer self-efficacy. In other studies, computer self-efficacy has a significant positive relationship with enhanced higher performance (Compeau & Higgins, 1995), and increased computer usage (Compeau, Higgins, & Huff, 1999).

PURPOSE OF THE STUDY
In this study, it is aimed to identify the effect of different types of social supports (Perceived Family Support, PFS vs. Perceived Peer Support, PPS) and Computer Self-efficacies (General Computer Self-efficacy, GCSE vs. Advanced Computer Self-efficacy, ACSE) on Computer Use (CU). The purposes of this study are:

(a) To identify the effect of different types of Social Support and Computer Self-efficacies on high school students' perceptions of the effects of Computer Use.
(b) To understand the relationship among Social Support, Computer Self-efficacy, and Computer Use.

Figure 1 illustrates the model developed for this purpose.
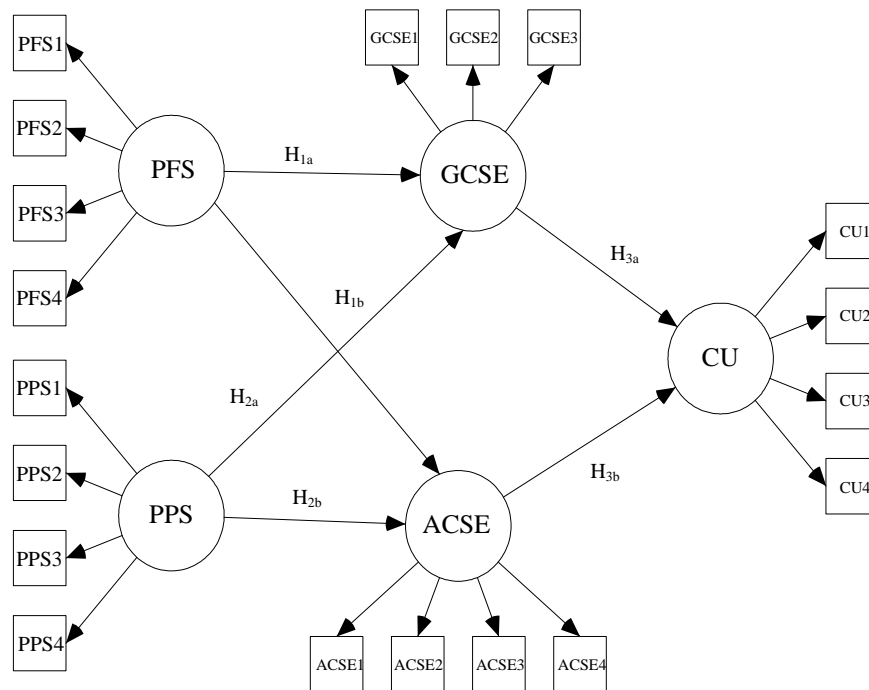
Figure 1: The Research Model

LITERATURE REVIEW
Perceived Family Support and Computer Self-efficacy
Some studies have separated social support into parental and peer support (Vekiri & Chronaki 2008). Family support reflects personal beliefs about sufficient resources when approaching new technology (Thather, Loughry, Lim, & McKnight, 2007). Several studies have demonstrated the effect of family support on computers and computer self-efficacy, while studies have examined the relationship between family support on computer and computer self-efficacy (Chu, 2010; Chu & Chu, 2010; Schepers, Jong Wetzels & Ruyter, 2008; Vekiri & Chronaki, 2008). These studies have found family support to be the strongest predictor of computer self-efficacy. Barbeite and Weiss (2004) distinguished between general computer self-efficacy and advanced computer self-efficacy. Previous studies have found that individuals with advanced levels of computer self-efficacy are more likely to possess higher computer self-efficacy than individuals at beginning levels (Barbeite & Weiss,

2004; Harrison & Rainer, 1992; Torkzadeh & Van dyke, 2001). From the discussion above, the following hypotheses are proposed:

H_{1a}: Perceived family support is positively associated with general computer self-efficacy.
H_{1b}: Perceived family support is positively associated with advanced computer self-efficacy.

Perceived Peer Support and Computer Self-efficacy
Social influence has been proved to be an important factor that affects attitude or behavior intention. The relative influence of peer supports typically increases the use of technology (Thatcher, Loughry, Lim, & McKnight, 2007). Martins and Kellermanns (2004) found peer encouragement to positively associate with learner satisfaction and perceived usefulness of a web-based course management system. Peer supports can provide help with the further social and academic competencies (Wentzel, Battle, Russell, & Looney, 2010). Classmates themselves can support each other with important information by modeling social and academic competencies (Schunk, 1987). With regard to self-efficacy for academic and social tasks (Bandura, 1986) are more likely to be influenced by teacher and peer supports and in turn, directly influence student outcomes (Wentzel, et al., 2010). However, peer support has been less investigated, although it may exert a strong influence on attitudes toward learning and schooling in young people (Wentzel, 1998; Zhao, Lu, Wang & Huang, 2011). Subsequently, two further hypotheses are as follows:

H_{2a}: Perceived peer support is positively associated with general computer self-efficacy.
H_{2b}: Perceived peer support is positively associated with advanced computer self-efficacy.

Computer Self-efficacy Mediates Social Support and Computer Use
Support leads to behavior change, and research has suggested that an effective way of improving the association of support and behavior is to increase individual self-efficacy (Rosland et al., 2008). Perceived self-efficacy is related to superior performance, which may moderate the influence of computer use (Chu, 2010). Computer self-efficacy has been shown to have a strong, positive relationship on performance during computer training (Webster & Martocchio, 1992). Computer self-efficacy plays a key role in system use and helps people more easily acquire many skills associated with effective computer use (Markas, Gavanagh & Gega, 1998). People with higher levels of personal computer self-efficacy demonstrate higher levels of aptitude and confidence when using a computer, and are therefore likely to find using a computer easier and more efficient than their counterparts (Agarwal, Sambamurthy, & Stair, 2000; Venkatesh, 2000; Venkatesh & Davis, 1996). Several studies have indicated the association between computer self-efficacy and user attitudes toward computers (Hsu, Wang, & Chiu, 2009; Smarkola, 2008; Zhang & Espinoza, 1998). Therefore, the following hypotheses can be proposed:

H_{3a}: General computer self-efficacy mediates perceived family support and computer use.
H_{3b}: General computer self-efficacy mediates perceived peer support and computer use.

METHOD
Participants
Data gathered from the questionnaire were analyzed under the following five sections of student background: gender, grade level, parental encouragement toward computer use, hours of computer use per week, and hours of Internet use per week. Table 1 indicates the demographic profile of the participants, consisting of 47% male, and 53% female students. Of the respondents, 30.3% were 10th Grade students, 35.4% were 11th Grade, and 34.3% were 12th Grade in high schools. More than 55.4% of parents encouraged their children to use the computer. Over 78.7% of the respondents used computers less than five hours per week. Over 56% of the respondents used the Internet less than five hours per week.

Table 1 Profile of respondents

Demographic profile	Frequency	Percentage
Gender		
Male	247	47%
Female	278	53%
Total	525	100%
Grade		
10th Grade	159	30.3%
11th Grade	186	35.4%
12th Grade	180	34.3%

Demographic profile	Frequency	Percentage
Total	525	100%
Parental encouragement toward computer use		
Yes	234	44.5%
No	291	55.4%
Total	525	100%
Hours of computer use per week		
Under 5	413	78.7%
6-10	61	11.6%
11-15	20	3.8%
16-20	8	1.8%
21 and above	23	4.4%
Total	525	100%
Hours of Internet use per week		
Under 5	294	56.0%
6-10	124	23.6%
11-15	48	9.1%
16-20	22	4.2%
21 and above	37	7.0%
Total	525	100%

n=525

Procedures

To develop a valid and reliable questionnaire, this study formulated several items, based on related literature and previous research. Students completed the questionnaire in their regular classrooms. Each student completed a self-report questionnaire that included two sections. The first section involved demographic information. The second section consisted of five items pertaining to the Perceived Family Support Scale, five items concerning the Perceived Peer Support Scale, five items relating to the General Computer Self-efficacy Scale, five items relating to the Advanced Computer Self-efficacy Scale, and five items regarding the Computer Use Scale. All items followed 7-point Likert-type scale. The second section contained 25 items. The average response time lasted approximately 25-30 minutes.

Measures

Perceived social supports

This study categorized social supports for using computers into two dimensions: perceived family support and perceived peer support. The perception scales of family and peer influence for using computers, implemented in this study, were developed by Vekiri and Chronaki (2008). The sample question in the perception of family support included "My parents encourage me to use computers," and "My parents think that computer proficiency is useful for my future." The Cronbach'a alpha reflected a good level of internal consistency ($\alpha= .91$). Sample items in the perception of peer support included "My friends are interested in computers," and "When my friends and I get together, we enjoy doing things on the computer." Internal consistency was measured with Cronbach's alpha ($\alpha= .84$). All items were rated using a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Computer self-efficacy

The Computer Self-efficacy Scale implemented in this study was developed by Barbeite and Weiss (2004), consisting of nine items, each followed by a 7-point response scale ranging from 1 (strongly disagree) to 7 (strongly agree). Computer self-efficacy was also divided into two levels of computer experiences: general and advanced. Four of the items measured general computer self-efficacy (GCSE), such as the basic computer and Internet skills (e.g., "I feel confident making selections from an on screen menu"). The reliability of GCSE was measured with Cronbach's alpha ($\alpha= .83$). Another four items asked about advanced computer self-efficacy (ACSE), and assessing student confidence in learning advanced skills from the computer and Internet (e.g., "I feel confident about troubleshooting computer problems"). The reliability of ACSE was measured with Cronbach's alpha ($\alpha= .85$).

Computer use

The Computer Use Scale implemented in this study was developed based on several relevant students (Chu, 2010; Hsu, Wang, & Chiu, 2009; Madhavan & Phillips 2010; Vekiri & Chronaki, 2008). All items using a

7-point Likert-type scale was developed to assess student computer use. The questions were rated on a 7-point scale with scoring from 1 (strongly disagree) to 7 (strongly agree). The Cronbach alpha reflected a good level of internal consistency (α= .86).

Data Analysis
The data were analyzed using descriptive statistics, the Pearson correlation coefficients, and structural equation modeling. Descriptive statistics were used to describe and summarize the properties of the accumulated data collected from respondents. Correlation analysis was then used to find the relationship between perceived social supports, computer self-efficacy, and computer use. Structural equation modeling was used to test the model.

RESULTS
Development of Instruments
To develop an effective survey, 25 items relevant to the five constructs of the proposed research model were adopted from existing literature and refined based on the specific topic of this study. These items were pilot-tested with 150 students from various high schools to examine internal consistency and reliability using the Cronbach alpha coefficient analysis. An overall Cronbach's alpha coefficient of all the items of a construct greater than 0.7, considers the items highly reliable (Kanna & Tan, 2005).

The questionnaire was further modified and refined based on pilot test results. The final questionnaire consisted of 19 items to assess the five constructs of the proposed research model. Items included in the final revised questionnaire were considered highly reliable if the individual Cronbach's alpha coefficients of the five constructs were all greater than 0.7 (see Table 2). Items in this study were measured using a 7-point Likert scale ranging from (1) strongly disagrees to (7) strongly agree. In addition, six other items were removed from the study due to the factor loading values less than 0.4.

To assess internal consistency, an estimate of composite reliability offered a useful measure for overall test reliability. According to Bagozzi and Yi (1988), a composite reliability of at least .60 is considered desirable. The reliability estimates ranged from .80 to .88, indicating acceptable reliability for the constructs. In addition, all items have significant t-value loading on their respective constructs (p < .01). The measure of average variance extracted (AVE) that is greater than .5 indicated acceptability (Fornell & Larcker, 1981). AVE extracted exceeded .5 (ranged from .5 to .68). Therefore, AVE and composite reliability also exceeded .5 and .6 thresholds, respectively, suggesting adequate measurement reliability.

Table 2 Cronbach's alpha coefficient of the constructs

Construct	Cronbach's α	Composite α	AVE	Number of item
1. Perceived parental support	.91	.80	.50	4
2. Perceived peer influence	.84	.87	.63	4
3. General computer self-efficacy	.83	.86	.68	3
4. Advanced computer self-efficacy	.85	.87	.62	4
5. Computer use	.86	.88	.65	4

Relationships between Family Support, Peer Support, Computer Self-efficacy, and Computer Use
Table 3 presents descriptive statistics for each of the constructs in the proposed research model. It indicates favorable perceptions of general computer self-efficacy in students and correlation coefficients among the questionnaire scales. The relationships between social supports, computer self-efficacy, and computer use indicated significant positive correlation of all the variables with each other. Perceived family support had significant and positive correlation with perceived peer support (r = .18, p< .01), general computer self-efficacy (r= .19, p< .01), advanced computer self-efficacy (r = .27, p< .01), and computer use (r = .17, p< .01). Perceived peer support had significant and positive correlation with general computer self-efficacy (r= .33, p< .01), advanced computer self-efficacy (r= .36, p< .01), and computer use (r = .41, p< .01). General computer self-efficacy had significant and strong correlation with advanced computer self-efficacy (r= .56, p< .01) and computer use (r= .36, p< .01). Advanced computer self-efficacy had significant and positive relationship with computer self-efficacy (r= .30, p< .01). These variables indicated significant correlation of many of the variables with each other, but were all less than .60.

Table 3 Correlation Analysis

Variables	M	SD	1	2	3	4
1. Perceived family support	4.06	1.04	—			
2. Perceived peer support	4.94	1.15	.18[**]	—		
3. General computer self-efficacy	5.88	1.07	.19[**]	.33[**]	—	
4. Advanced computer self-efficacy	4.08	1.31	.27[**]	.36[**]	.56[**]	—
5. Computer use	5.69	0.96	.17[**]	.41[**]	.36[**]	.30[**]

n=525, [**]p< .01

Confirmatory Factor Analysis
Measurement models
Results from confirmatory factor analysis demonstrated that all of the scales used in the study formed adequate measurement models and thus provided evidence for construct validity of the measures. Table 4 indicates the fit indices of the measurement models.

Table 4 Evaluation of measurement models for constructs used in the study

Variables	χ^2	df	p	NFI	CFI	GFI	AGFI
1. Perceived family support	6.843	2	< .01	.985	.989	.994	.968
2. Perceived peer support	1.745	2	.418	.998	1	.998	.992
3. General computer self-efficacy	6.189	2	.045	.996	.997	.994	.970
4. Advanced computer self-efficacy	33.966	2	< .01	.964	.965	.967	.836
5. Computer use	20.767	2	< .01	.983	.984	.981	.905

Structural models
This study used several fit indicators to assess the model: goodness-of-fit (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI) comparative fit index (CFI), and root mean square error of approximation (RMSEA) developed by Bentler (1990). The GFI, AGFI, NFI, and CFI approaches all exceed the recommended level of .9. The RMSEA indicates a fair fit if its value ranges between .05 and .08 (Browne & Cudeck, 1993). The ratio of chi-square to degrees of freedom is acceptable when the value is less than 5 (Kline, 2005). The model indicates an adequate fit between the hypothesized model and the observed data (χ^2=411.232, df=144, χ^2/df=2.856); GFI= .922, AGFI= .897, NFI= .914, CFI= .942, and RMSEA= .060) (Table 5). The results of AGFI exhibited a moderate but acceptable level of overall model fit, providing support to the validity of the structural model. Figure 2 illustrates the hypotheses supported with a solid line, along with their path estimates.

Table 5 Summary of Goodness-of-fit Indices

Fit Index	Recommended Level of Fit	Proposed Research Model
χ^2	n. s. at p < .05	411.232
χ^2/df	< 5	2.856
AGFI	> .90	.897
NFI	> .90	.914
CFI	> .90	.942
RMSEA	.05~ .08	.060
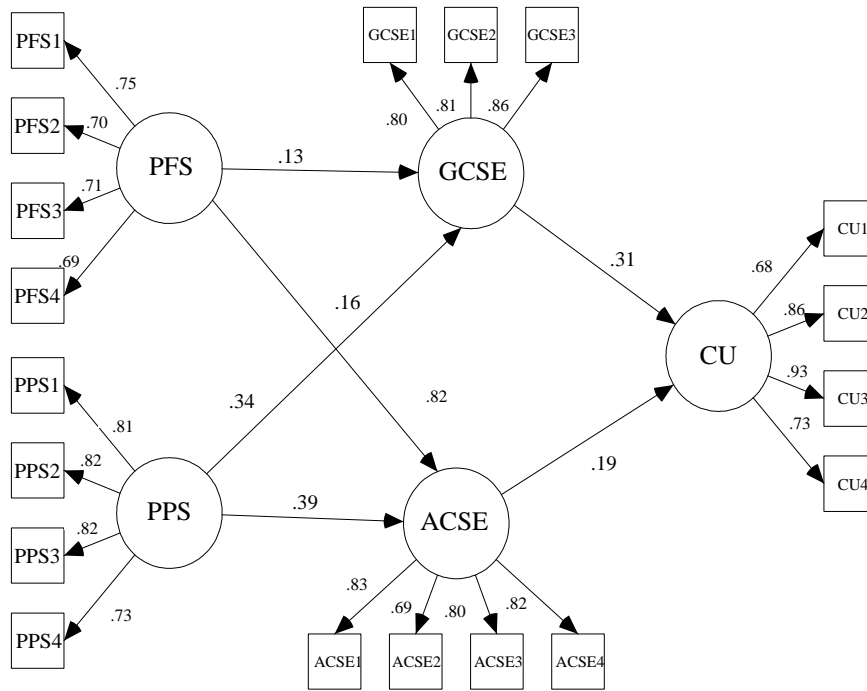
Fig. 2: Hypothesized model with path coefficients

Hypothesis testing

This study developed a conceptual model based on the literature of family support, peer support, general computer self-efficacy, advanced computer self-efficacy, and computer use. Six of the hypotheses drawn from this theoretical and empirical literature were supported. Table 6 illustrates the results.

Table 6 Results of hypotheses test

Hypothesis	Results
H$_{1a}$: Perceived family support is positively associated with general computer self-efficacy.	Supported
H$_{1b}$: Perceived family support is positively associated with advanced computer self-efficacy.	Supported
H$_{2a}$: Perceived peer support is positively associated with general computer self-efficacy.	Supported
H$_{2b}$: Perceived peer support is positively associated with advanced computer self-efficacy.	Supported
H$_{3a}$: General computer self-efficacy mediates perceived family support and computer use.	Supported
H$_{3b}$: General computer self-efficacy mediates perceived peer support and computer use.	Supported

DISCUSSION

From a practical perspective, the relationships among social supports (perceived family support vs. perceived peer support), computer self-efficacy (general computer self-efficacy vs. advanced computer self-efficacy), and computer use may provide a clue regarding how teachers can help their students use the computer effectively. This study contributes both theoretically and practically to the field of research. Theoretically, this study proposed a research model for empirical studies to link perceived family support, perceived peer support, general computer self-efficacy, advanced computer self-efficacy, and computer use. The results from structural equation modeling provide strong support for the hypothesized relations. The results of this study support key hypotheses drawn from the social cognitive theory of Bandura.

First, this study indicates that perceived family support and perceived peer support exert significant impact on computer self-efficacy. Perceived peer support plays a more important role than family support in predicting

computer self-efficacy. Peer support is the strongest predictor of advanced computer self-efficacy. The fact that mutually supportive relationships among students help them learn advanced computer skills might support this finding. However, perceived peer expectations for prosocial behavior may influence on their students' motivation to behave in socially competent ways (Wentzel, Filisetti, & Looney, 2007). Zhao et al. (2011) found that friends and classmates had an important personal influence on high school students. This result is consistent with previous studies (Chu, 2010; Vekiri & Chronaki, 2008) showing that perceived social support has a very strong influence on computer self-efficacy of students. A positive social environment in the classroom is related to computer self-efficacy beliefs of students. Students in a positive social environment tend to possess higher levels of computer self-efficacy. One possible implication from this result may be that peer support plays a particularly important role in improving student motivation to adopt various computer technologies. Thus, it is important to build peer support networks that will be a foundation for ongoing learning environment. The positive social relationships help to encourage more individuals to share knowledge (Teh, Chong, Yong, & Yew, 2010).

Second, this study indicates that general computer self-efficacy significantly influences computer use. The results of model fitness strongly support that general computer self-efficacy explains the level of student perception regarding their computer use. Teo (2009) investigated the relationship between computer self-efficacy and intended uses of technology. His sample consisted of 1,094 student teachers at a teacher training institute in Singapore. The results of his study found that student teachers' self-efficacy was a significant influence on the use of technology. That is, teachers' beliefs about computers has a significantly influence on computer usage. General computer self-efficacy plays a more important role than advanced computer self-efficacy. This result also indicates that general computer self-efficacy may equip students to better assess their computer ability. Prior research has also examined how computer self-efficacy affects computer usage (Fagan, Neill, and Wooldridge, 2003; Vekiri & Chronaki, 2008). This result is consistent with a previous study (Fagan, Eisenberg, Frazier, Stoddard, et al., 2003) that computer self-efficacy has a positive effect on computer usage. Computer self-efficacy is an important determinant in affecting individual's decision to use computer (Hill, Smith, & Mann, 1987). In addition, advanced computer self-efficacy also has significant influence on student computer use, possibly due to advanced computer self-efficacy as a component of user acceptance in advanced technology. Learners with better support and guidance during learning are more likely to adopt confidence while learning, and a positive attitude toward the Internet (Wu & Tsai, 2006). Student confidence in computer skills may affect their willingness to learn computer skills (Sam, Othman & Nordin, 2005). Therefore, computer self-efficacy is a greater predictor of computer usage than computer experience (Madhavan & Phillips, 2010).

CONCLUSIONS AND LIMITATION

This study investigated the relationship among different types of social supports, computer self-efficacy and the effects of computer use for high school students. The present study, however, makes several noteworthy contributions into how high school students alter their motivation factors, and it suggests a greater focus on helping students to effectively utilize information technologies for their academic and personal needs. This study found that perceived peer support played a main role in predicting the effects of computer use, mediated by general and advanced computer self-efficacy. This supports the finding of Vekiri and Chronaki (2008) that perceived peer support was the factors more strongly associated with boys' and girls' computer self-efficacy and value beliefs. Peer support enhances students' general and advance computer self-efficacy, and leads to better computer use. Therefore, peers have a strongly positive influence on each other and play important roles in their learning context.

This study has several limitations that suggest further possibilities for empirical studies. For this study, three limitations in particular should be noted. First, the data from this study were collected through self-reports, which may lead to a common method variance, a situation that may inflate the true associations between variables, resulting in spurious significant findings. Social desirability bias may have affected exit survey results (Podsakoff & Organ, 1986). In addition, data were collected from 525 high school students in Taiwan. All samples are from high school students, therefore the study results cannot be generalized to other samples. Future studies should attempt to increase the sample size and incorporate more high schools.

Furthermore, this study examined the relationship among various types of perceived family support, perceived peer support, general computer self-efficacy, advanced computer self-efficacy, and computer use for high school students, combined these data into one conceptual model, and then tested the related hypotheses using structural equation modeling. The findings of this study suggest that perceived peer support played a crucial role for computer usage of high school students, and the results partially support the hypotheses.

IMPLICATIONS AND FURTHER STUDIES

With regard to directions for future research, this study investigated the relationship of social supports and Computer self-efficacy. This study has implications for high school students regarding their computer learning and research. The results indicate that peer support plays an important role to enhance computer self-efficacy of students. Teachers should capitalize on peer support to achieve better performance in computer learning. This finding has implications for academia. More specifically, the practical results of this study imply that teachers should create a safe social environment for their students to enhance computer adoption. Consequently, this study also provides detailed directions for teachers by relating family support, peer support, computer self-efficacy, and computer use.

Future studies may aim at longitudinal research to test causal hypotheses regarding computer self-efficacy and other key factors involved in computer use. This study collected data solely from 525 college-bound high school students in Taiwan. Future studies may compare various types of schools (e.g. high schools vs. vocational high schools). This study is limited to the influence of advanced computer self-efficacy. Other factors possibly will influence student computer use besides those mentioned above. Future studies might focus on variables such as computer experience, computer attributes, computer-related performance, and learning styles. Future studies can also use qualitative methods to examine the mental process of learners.

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STUDY ON INSTRUCTIONAL PARADIGMS OF VIRTUAL EDUCATION IN PAKISTAN: A LEARNERS' PERSPECTIVE

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ABSTRACT
The present study is aimed at examining instructional paradigms of virtual education in Pakistan. The population of the study consisted of learners from Master of Business Administration (MBA) Program at Virtual University (VU) of Pakistan. The researcher adopted convenient sampling technique and collected data from 600 learners through five-point (Likert scale) questionnaire. He analyzed data through mean scores and percentages. The study concluded that the VU of Pakistan followed learner-centered instructional paradigm. It exploited its Virtual Television Network supplemented by the internet for online instructional delivery. It involved learners by offering them activities comprising of case studies, assignments, and projects to promote confidence among them. The instructional paradigms reflected resilience but appeared to develop confidence by increasing performance of learners. However, the study reported some problems like electricity failure, social isolation, and lack of time management ability which affected their studies.
Keywords: instructional paradigm, virtual education, professional skills, interactive learning environment, synchronous learning, asynchronous learning

INTRODUCTION
Conventionally, teaching appears to be a process of transferring subject knowledge and information in face-to-face/classroom situations. Hussain (2008) described it as an art of crafting novice minds of students by helping them learn life skills. Crafting novice minds is not a simple task rather it demands professional skills relying on various instructional paradigms. Apparently, an instructional paradigm consists of various strategies, techniques, and styles of teaching. An instructional paradigm facilitates students' interactions to support & enhance their passion for learning, cognitive abilities, and encourage them for developing knowledge through research and reflective practice (Bronak, Sanders, Cheney, Riedl, Tashner, & Matzen, 2008).

The use of emerging instructional technologies generated new educational settings and replaced classroom instruction by 'virtual education' environments (Hussain, 2005). Virtual education is an innovative instructional paradigm mediated by modern technologies. It focuses on intentional acquisition of knowledge, skills, attitudes and competencies (Hussain, 2007a) in distributed learning environments (Dede, 1996). Virtual education appears to embrace innovative instructional strategies and styles of teaching as well as learning. Undoubtedly, it is promoting access to higher education and transforming the world into a knowledge society: knowledge for all and all for knowledge. It is based on active learning (Hussain, 2007b) paradigm and participatory approach to make students aware of their learning which takes place through interactions and reflections. It welcomes self-motivated and learning oriented students who participate in instructional process through constructive, collaborative, intentional and reflective (Jonassen, 2006) activities.

LITERATURE REVIEW
Virtual education seems to be taking place in interactive learning environments by using innovative and technology based instruction. Learners can actively participate in the process of knowledge building through information processing, its sharing, and learners' interactions & reflections in innovative and novel ways and/or styles. These interactions may be synchronous as well as asynchronous but develop critical thinking and analytical skills through reflective practices. The virtual learners constitute a community of diversified potential and therefore, have different learning styles. They adopt learning approaches according to their interest and aptitude. However, they prefer reflective practice and questioning technique which have greater impact on their learning (Meyer, 2004) in virtual environments. Learners may accumulate knowledge and develop confidence through questioning in interactive virtual learning environments. They involve themselves in dialogue and activities for understanding and accretion of new knowledge (Garrison, Anderson, & Archer, 2001). Participation in such situations may enhance their previous knowledge by raising their level of thinking in new directions. However, previous knowledge, learning styles & aptitude, preference, and experience of learners may help them learn through virtual education. That's why Bruner's (1996) advocacy that the previous knowledge is improved and enhanced through discussions within groups appears appropriate to pave for knowledge creation in virtual learning environments.

Knowledge creation and its dissemination appears central to all kinds of educational & academic endeavors and

virtual education accomplishes in collaborative learning environments (Hussain, 2005). Virtual education apparently plays dual role: firstly, knowledge generation & its dissemination and secondly, skill development to cater for the professional needs of 21st century's learners. Therefore, it adopts different instructional paradigms to realize its promise of preparing individuals to live and work in competitive age. It is generally assumed that virtual learners are adults (Rashid, 2003) and they have a life full of experiences. They also have some experience of using modern technologies which helps them enhance their learning (Hussain, 2008) through virtual education. Virtual education is a modern approach of imparting education even in developing countries. It is using information and communication technologies for promoting wider access. Among others, internet appears an established vehicle of virtual education because of its wider availability, affordability, acceptability and usability even in developing countries like Pakistan. Virtual learners seem to be using it eagerly. Mummert (2002) revealed that 80% of the internet users preferred to have correspondence via internet. In addition, Hussain (2005) found that virtual education provides opportunities of competency based education for enhancing performance of the learners.

Education and training is completed through interactions between instructor and learners and among learners. Tu (2000) viewed interactivity to be vital to the process of learning and its level (Muirhead, 2001) impacts on the quality of computer-mediated [virtual] instruction. It seems to be crucial for effectiveness of instructional process and Ko & Rossen (2004) asserted that instructors and students can enjoy enhanced and frequent interactivity for effective communication, sharing their learning experiences, and collaboration on research projects through online [virtual education] courses.

Apparently, the effectiveness of a course offered by virtual university depends upon its contents and delivery mechanism. MacKinnon (2002) described it as a challenge for instructors to design courses alike that of face-to-face courses in terms of their learning objectives, contents and assignments, and student learning outcomes. Such interactions may be established among learners themselves, between learners and textual material, and learners and learning materials assigned for preparing assignments. The same was supported by Bannan-Ritland (2002).

In virtual education, interaction and interactivity can take place by active involvement of learners in learning process. In this regard, the study of Townsend, Campbell, Curran-Smith, McGinn, Persaud, & Peters, (2002) affirmed enhanced interactivity of learners when they were involved in communication with their instructor instead of working in small groups on collaborative projects. It was due to grading their participation in posting questions or discussing case studies in virtual communities. Similarly, the study conducted by Larson (2002) reported increased interactivity in an online [virtual education] course on marketing on frequent instructor led discussions.

However, virtual learners in Pakistan face some problems which need to be addressed for enhancing the efficiency and effectiveness of virtual education in the country. Hussain (2005, 2007) found that virtual learners face some physical problems like blurred vision, headache, giddiness, and drowsiness. Similarly, the study conducted by Hussain & Rahmani (2009) depicted that virtual learners in Pakistani context faced problems associated with infrastructure including electricity failure and lack of its back-up. The learners reported their study difficulties and anxiety & depression because of such problems. The study also revealed some problems associated with their posture: backache due to long sitting for using the computer and fingers' joint pain. Some other problems like technology literacy, bandwidth of the internet, access to the cable network, and job assignments appeared to be the difficulties of virtual learners in Pakistan.

In spite of all the problems mentioned above currently, virtual education is accelerating with a great momentum; accommodating diverse students' body in different disciplines and courses. It appears to be a great blessing for the students of Pakistan particularly for those professionals who need a degree but can't study on campus. It mainly uses internet as instructional vehicle; however, other communication technologies like satellite television, video & teleconferencing, and compact diskettes are jointly used for its purposeful accomplishment. The Virtual University of Pakistan is pioneer public sector institution offering various academic programs across the country through innovative instructional paradigm.

VIRTUAL EDUCATION IN THE WORLD

The virtual education is an established mode of education in developed countries and it is getting popularity in developing countries like Pakistan. It promotes extensive opportunities from K-12 to higher education level. According to Watson & Kalmon (2006) there were 24 state-led virtual schools and 12 states in the process of forming these institutions in United States by this year including Florida Virtual School (FLVS) and Michigan Virtual School. DiPietro, Ferdig, Black & Preston (2008) mentioned that adaptation of face-to-face instructional practices for online settings appeared to be the reason for such expansion of virtual education. The expertise in

content development, communication skills, and instructional design were mainly focused. Similar is the case with college and university education in the USA and other developed and developing countries of the world. Regents College of New York State (www.regents.edu) affirms itself as America's First Virtual University. However, the main virtual universities include National Technological University (NTU) (www.ntu.edu): co-operative effort of 50 major universities, University of Phoenix which is a private virtual university (www.uophx.edu), The Western Governors University (WGU) which is a consortium (www.wgu.edu), California Virtual University (CVU) (www.california.edu) and Concord University School of Law (www.concord.kaplan.edu)

In Korea, the Korean government launched a two-year Virtual University Pilot Project (VUTP) and 65 universities and five companies participated in the project. By 2002 there were 15 Virtual Universities in Korea. Similarly, the Korean University Alliance for Cyber Education (KUACE (http://www.kuace.org) was established in 2001 for capacity building to offer virtual education programs and more than eighty higher education institutions joined it (Jung, 2002). Likewise, in United Kingdom the International Virtual University (www.ivu.org.uk), Clyde Virtual University (www.cvu.strath.ac.uk/) and Virtual University of Edinburgh (http://vue.edu.ac.uk/) are offering lifelong learning and non-traditional programs in the Great Britain.

The Edith Cowan University (www.cowan.edu.au/) is an evolution of an existing university into Virtual University in Australia. India is also promoting education through Virtual Universities. India's first virtual medical university the Medvarsity (http://www.medvarsity.com/) was established in 2000. It offers courses in collaboration with distinguished medical institutions like Royal College of General Practitioners and Apollo Hospitals Educational and Research Foundation to meet the International Standards. Similarly, the Tamil Virtual University (TVU) (http://www.tamilvu.org/coresite/download/tvu_rti_hdbk.pdf) was established in 2001 to address the educational needs of those who live outside the Tamil Nadu.

The Thailand ASEAN Virtual Institute of Science and Technology (AVIST) (www.avist.org/) is Consortium which aims at promoting education in the country. The African Virtual University (http://www.avu.org/) in African countries and the Virtual University Park with the Joint-Congress (http://www.szvup.com/Html/englishh/83264822729835.html) is disseminating education in China. The practice of earning a degree from a virtual university is in a state of wider acceptability leading towards establishment of new virtual universities and offering programs/ courses through virtual mode.

VIRTUAL EDUCATION IN PAKISTAN

The Virtual University of Pakistan is a pioneer in introducing and imparting 'Virtual Education' in the country. Established in 2002, it is providing education of international standards to all individuals of the country. It is empowering learners for challenging tasks by offering market-driven skill-based programs. It exploits a mix of modern educational technologies for instructional delivery to bring about socio-economic change in the country. It extends interactive learning environments by adopting Hybrid instructional paradigm which is based on modern information technologies (Toor, 2005). Internet appears to be the main pillar to supplement the instructional paradigm. Alongside Internet Technology, Virtual Television Network is bridging-up the distance between the learners and their tutors and the varsity.

Virtual education requires active involvement of the learners; therefore, activity-based contents are prepared. Hussain (2007a) stated that visionary and skilled educationists & active educational practitioners design & develop specialized courses. Generally, higher education institutions appear to focus on instruction and instructional paradigm according to the learners' psychology. Rashid (2003) assumed such learners to be adults and therefore, Virtual University of Pakistan follows andragogical approach in designing, developing and delivering the instructional materials (Hussain & Rahmani, 2009) to its learners. The university prepares its courses in English language; however, the medium of instruction is bi-lingual (Urdu and English). Toor (2005) stated that the Varsity broadcasts recorded lectures through its virtual television network. Students can interact with their instructors via internet during and/ or after the lecture from their homes, work places or classrooms at any of the virtual campuses. These lectures are available at the Varsity website and can be downloaded using university web accounts. These lectures are also accessible for the students & faculty of the formal universities.

The university hosts its Learning Management System (LMS) by providing the facility of Moderated Discussion Board (MDB) for the students. They may also send their queries via –e-mail to their respective instructor(s). The university has established linkage with private institutions constituting its 'Private Virtual Campuses' (PVCs) throughout the country. These campuses extend campus like facilities and students learn and interact in classrooms with a sense of belongingness.

OBJECTIVES OF THE STUDY

The study was conducted with the objectives:

a). to identify the practices of designing instructional materials in Pakistan
b). to examine the instructional paradigms of virtual education in Pakistan
c). to identify the problems faced by virtual learners in Pakistan

RESEARCH METHODOLOGY

The study was conducted with the main focus on evaluation of learners' reflections on instructional paradigms of virtual education in Pakistan. The study adopted survey approach of descriptive research for data collection. The population of the study consisted of learners of Master of Business Administration Programme of the Virtual University of Pakistan. The researcher adopted convenient sampling technique and administered research tool on 648 students. For data collection one research tool-Questionnaire on five points rating (Likert) scale was developed to elicit the opinions of the respondents. The research tool was developed to cover the basic components of instructional paradigm such as development of course contents and their presentation format & style(s), mechanism of instructional delivery or information dissemination, interactions of learners, learning activities prepared and offered to learners, involvement of learners in learning process and problems of virtual learners.

The researcher validated the research tool through its pilot testing at private virtual campus in Bahawalpur. The finalized research tool was administered on the respective sample through academic coordinators of the Private Virtual Campuses of the Virtual University of Pakistan. The response rate was 92.60% (as 600 responses complete in all respects were received). The data were coded and analyzed through Ms-Excel in terms of percentage and mean scores. The scale values assigned were highest 05 strongly agree (SA) to lowest 01 strongly disagree (SDA).

RESULTS OF THE STUDY AND DISCUSSION

The data collected through the questionnaire was analyzed in terms of percentage and mean scores. The results of the data analysis are presented in the tables given below.

Table 1. Opinions of virtual learners about course contents and their presentation

Statement/ Pedagogical Area	Level of Agreement: Frequencies & Percentage (% is given in parentheses below)					Mean Score
	SA	A	UNC	DA	SDA	
Development of Course contents and presentation						
Clear objective	166(27.7)	343 (57.2)	4 (.7)	18 (3.0)	69(11.5)	3.8
Relevant content	157(26.2)	333(55.5)	3 (0.5)	38(6.3)	69(11.5)	3.8
Clear concepts	167(27.8)	339 (56.5)	2 (0.3)	32 (5.3)	60(10.0)	3.9
Logical sequence	189(31.5)	324 (54.0)	3 (0.5)	31 (5.2)	53 (8.8)	3.9
Informative	196(32.7)	327(54.5)	3(0.5)	29 (4.7)	45 (7.5))	4.0
Activity based	177(29.5)	349 (58.2)	2 (0.3)	12 (2.0)	60 (10)	4.0

Course contents and format & style(s) of their presentation are considered to be the path leading towards achieving objectives of the course(s). The researchers identified practices of designing and developing instructional materials through reflection of the respondents. Table-1 reflects the opinions of virtual learners about designing and developing course contents and styles of their presentation.

Majority of the learners was of the opinion that objectives of courses were clear and understandable (84.9% and mean score 3.8) for their maximum realization. The clear objectives helped them move in right academic direction and they aimed at their high achievement through appropriate learning activities, interactions and reflections. The university designed to offer relevant contents of instructional materials (81.7% with mean score 3.8) for achieving the objectives of course(s) and ultimately that of the programme(s). The contents of instructional materials were self-elaborative offered in different forms and formats. The virtual learners were said to be self-motivated and course contents assisted them in associating their learning with work situations in order to create knowledge.

The concepts included in the courses were clearly explained (84.3%, mean score 3.9) for better understanding and comprehension of learners. The concepts (either abstract or concrete) were exemplified and elaborated in practical manner. This practice of explaining the concepts through examples and relating with situations appeared to enhance inductive reasoning and cognitive abilities of virtual learners leading them to draw conclusions and inferences of different situations, occurrences, events and incidents. The university organized

the learning materials in logical sequence (85.5% and mean score 3.9). The concepts were said to be coherent with the previous knowledge and learning experiences of learners, and articulated with objectives and learning outcomes of the course and/or program. Similarly, contents of instructional materials were informative and instructive (87.2% with mean score 4.0) leading virtual learners towards new knowledge. It might have raised their awareness of and about facts to expand intellectual capacity. It facilitated them in cross-fertilizing information with personal experiences for knowledge generation. The virtual learners, thus, appeared to be processing the information cognitively for expanding their knowledge horizontally and elevating it vertically.

The instructional process accomplished appropriately by offering learning activities (87.7% with mean score 4.0) to learners for their reflection. These activities provided opportunities for learning by doing, hence making learners capable of evaluating and analyzing their personal experiences. They were expected to elevate from the existing to the expected level of knowledge, enjoying their academic autonomy. Activities appeared amongst key aspects of virtual education for developing and promoting mental capacities of learners, and affecting their understanding to realize experiences for learning.

Table 2. Opinions of virtual learners about instructional delivery

Statement/ Pedagogical Area	Level of Agreement: Frequencies & Percentage (% is given in parentheses below)					Mean Score
	SA	A	UNC	DA	SDA	
Instructional Delivery						
Easy language	204(34)	271 (45)	6 (1)	28 (5)	91(15)	3.8
Language of presenter	186(3 1)	317 (52.8)	3 (0.5)	17 (2.8)	77(12.8)	3.9
Personality of presenter	201(33.5)	321(53.5)	3 (0.5)	13(2.2)	62(10.3)	4.0
Soft voice	177(29.5)	349 (58.2)	2 (0.3)	12 (2.0)	60 (10)	4.0
Examples	146(24.3)	351 (58.5)	16 (2.7)	18 (3.)	69(11.5)	3.8

Mechanism of instructional delivery and information dissemination is one of the basic components of instructional paradigm of virtual education. The researchers elicited the opinion of respondents to assess instructional practices in virtual education. Table-2 indicates opinions of virtual learners about instructional delivery. A clear majority of the learners affirmed that contents of instructional materials were presented in easy & understandable language (79%, mean score 3.8) according to their intellectual capacity and comprehension level. It helped them in understanding and interpreting the meaning of contents & concepts in more elaborative manner.

The virtual university of Pakistan exploits its virtual television network for imparting instruction supported by Internet. A prominent majority of the learners asserted that personalities of lesson presenters were good looking (87%, mean score 4.0) with appropriate gestures for effective non-verbal communication. The presenters appeared to be good communicators equipped with professional skills to impart right information in right manner. Instruction imparted through television created and sustained motivation among learners to have an impact on their learning and learning behavior. Similarly, accent of the presenters was easy (83.8%, mean score 3.9) and explicably understandable. The accent was enchanting learners' mind set making them receptive of the new forms and directions of knowledge creation and its dissemination.

The voice of the presenters was soft (87.7%, mean score 4.0) and clear with appropriate pulses & pauses. These pulses and pauses along with body movements of the presenters' played a supportive role to create classroom like situation. These were reported to be useful for keeping learners in study circles; enhancing their retention and eliminating course and/or program dropout. Such activities worked as a motivational force inspiring them complete courses and programs with in due time duration. Likewise, the presenter elaborated concepts with the help of examples from real life (82.9% with mean score 3.8) for creating scientific thinking among learners. Therefore, it is that the virtual university of Pakistan employed competent and experienced academicians and presenters for effective instructional delivery.

Table 3. Opinions of virtual learners about channels of communication & interactions

Statement/ Pedagogical Area	Level of Agreement: Frequencies & Percentage (% is given in parentheses below)					Mean Score
	SA	A	UNC	DA	SDA	
Learners' Interactions						
E-mail	354 (59.0)	243(40.5)	3 (0.5)	00 (00)	00 (00)	4.6
Moderated Boards	342(57.0)	254(42.3)	4 (0.7)	00 (00)	00 (00)	4.6
Telephony	113(18.8)	243 (40.5)	6 (1.0)	123(20.5)	115(19.2)	3.2

In most of the cases virtual education exploits innovative channels of communications to enhance learners' interactions. The present research evaluated learners' responses about such channels. Table-3 shows opinions of learners about channels of communication to enhance their interactions for learning in virtual environments. According to the table, an obvious majority of virtual learners used e-mail (89.5%, mean score 4.6) for asynchronous communication and interactions. They used e-mail for submitting their assignments to their tutors, and sharing teaching learning materials with one another. They shared learning experiences and information, seek guidance and help from their tutors and academicians, fellow students and technical staff of the Varsity through using e-mail. However, the use of e-mail by virtual learners appeared to be in a state of momentum supporting and supplementing instruction imparted through virtual television network of the Varsity.

The Virtual University of Pakistan hoisted its Learning Management System for promoting virtual discussion through moderated boards (99.3%, mean score 4.6). The learners were using these moderated boards for augmenting and expanding their academic collaboration for learning through questioning. Questioning appeared to be a catalyst for developing confidence among the learners. They were given the opportunities of learning different techniques of 'how to raise question(s)' and analyze & process multiple responses.

Similarly, majority of respondents made telephone or mobile phone calls (59.3%, mean score 3.2) for promoting synchronous communication & interactions with faculty and their fellow learners. It enhanced their interactions through verbal communication. They could get immediate responses, feedback & comments on their work/assignments indicating the worth and quality of their work. Synchronous interactions seemed to be useful for gratifying academic queries of learners. Such interactions were assumed necessary to develop academic relationships between learners and tutors. Apparently, the Virtual University of Pakistan employed active instructional paradigm by exploiting synchronous and/ as well as asynchronous channels of communication and interaction for self-directed learning.

Table 4. Opinions of virtual learners about learning activities

Statement/ Pedagogical Area	Level of Agreement: Frequencies & Percentage (% is given in parentheses below)					Mean Score
	SA	A	UNC	DA	SDA	
Learning Activities						
Case studies	243 (40.5)	243 (40.5)	3 (0.5)	82 (13.7)	29 (4.8)	4.0
Assignments	343 (57.2)	254 (42.3)	3 (0.5)	00 (00)	00 (00)	4.6
Discussion	201 (33.5)	321 (53.5)	3 (0.5)	13 (2.2)	62 (10.3)	4.0
Seminars	119 (19.8)	256 (42.7)	6 (1.0)	173 (28.8)	46 (7.7)	3.4
Constructive feedback	272 (45.3)	256 (42.7)	4 (0.7)	25 (4.2)	43 (7.2)	4.1
Quizzes	254 (44.0)	273 (45.5)	4 (0.7)	25 (4.2)	34 95.7)	4.2

Involvement of learners in teaching learning process results in their effective learning. Different learning activities are prepared and offered to learners for transforming their information into knowledge and then competencies. Table-4 indicates that virtual learners worked on case studies (81.0%, mean score 4.0) for gaining relevant information and/ or knowledge of and about the phenomenon. The tutors seemed to be involving virtual learners in teaching learning process by assigning them case studies relevant to their subject(s) and area(s) of specialization(s). It was expected that after completing such case studies learners would become capable of evaluating and analyzing the situations and/or phenomenon under study.

They were engaged in preparing a certain number of assignments (99.5%, mean score 4.6) for each course with the aim of developing inductive and deductive reasoning. The tutors involved them in assignment work for developing creativity and art of academic writing. The data reported that it resulted in developing academic writing skill among learners –flow of ideas, coherence & consistency among concepts and uniformity of the language and style.

The university arranged discussions in which virtual learners took part (87.0%, mean score 4.0) either synchronously or asynchronously for sharing information or their view points about a topic/or concept and learning experiences. It aimed at eliminating their shyness and introversion by acting and reacting and using the right language and verbatim in different situations. It also provided them with the opportunity to interact with academia of diverse intellectual and profile. Similarly, discussions were accompanied by participating in online seminars (62.5%, mean score 3.4) for detailed information and knowledge of some specific topic(s) or issue(s) of emerging importance. The data revealed that learners participated in such seminars with pleasure by exchanging information and experiences.

Formative and summative system of evaluation is used to assess the learning achievement of virtual learners. Formative evaluation is conducted through assignments. Marking of assignment and comments of the tutors are considered as motivational force for augmenting learning. The virtual learners submitted their assignments as a requirement of each course. The data reflected that tutors were optimistic and encouraged virtual learners through positive feedback (88%, mean score 3.1) and motivational comments on the assignments. They specifically pointed out the parts of the assignments which needed improvement and commended the good work. They provided guidelines on how to prepare assignments. This practice was reported to be a process of academic mentoring which promoted liaison between tutors and their learners.

Along with the activities mentioned above, the university organized quizzes (89.5%, mean score 4.2) for evaluating and assessing subject knowledge of the virtual learners. Like other academic activities, the Varsity considered quizzes to be essential to develop quest for learning and enthusiasm for achieving academic highness among fellow learners. They aimed at excelling in academic activities necessary for learning. It was clear from data that Virtual University of Pakistan ensured active participation of learners by adopting participatory approach of instructional delivery.

Table 5. Opinions of virtual learners about learning through virtual education

Statement/ Pedagogical Area	Level of Agreement: Frequencies & Percentage (% is given in parentheses below)					Mean Score
	SA	A	UNC	DA	SDA	
Learners' Involvement in Learning Process						
Collaborative learning	243(39.0)	303(50.5)	3(0.5)	26(4.3)	34(5.7)	4.1
Interactive learning	215(35.8)	303(50.5)	5(0.8)	32(5.3)	45(7.5)	4.0
Self-directed learning	211(35.2)	312(52.0)	4(0.7)	29(4.8)	44(7.3)	4.0

Innovative approaches and strategies are adopted to address the varied potential of virtual learners. The study found out the type of learning which was promoted by the Varsity to address diversified intellect. It is evident from the data given in the table-5 that the Virtual University of Pakistan provided and promoted opportunities of collaborative learning (89.5% mean score 4.1) by establishing a community of virtual learners or interest groups. The tutors assigned them academic tasks and activities in groups. Apparently, learners were geographically distributed, but actually, they were enjoying their virtual groups' dynamism for learning in community. They were reported to be helping each other and shared their learning experiences, contents & academic activities, and information about courses and surroundings. This practice emerged to bridge their personal experience with new learning resulting in knowledge building.

Learning is said to be accomplished successfully in interactive environments. The Virtual University of Pakistan extended interactive learning environment over the net. The virtual learners practiced such interactive learning environments (86.3% mean score 4.0) in their virtual community. They developed social networks and interacted freely. They were of the opinion that they were provided opportunities of self-directed learning (87.2% mean score 4.0) to learn more objectively and concisely according to their andragogical styles and study patterns. Apparently, the virtual learners were learning through innovative individualized and group activities.

Table 6. Opinions of virtual learners about their problems in virtual education

Statement/ Pedagogical Area	Level of Agreement: Frequencies & Percentage (% is given in parentheses below)					Mean Score
	SA	A	UNC	DA	SDA	
Problems of Virtual Learners						
Electricity Failure	209(34.8)	321(53.5)	3(0.5)	24(4.0)	43(7.2)	4.0
Social/ family problems	186(31.0)	339(56.5)	3(0.5)	27(4.5)	45(7.5)	4.0
Isolation	221(36.8)	322(53.7)	4(0.7)	23(3.8)	30(5.0)	4.1
Time management	209(34.8)	341(56.8)	5(0.8)	19(3.2)	26(4.3)	4.1

Learners face some problems at all levels of education and virtual education is not an exception. The researchers identified some of the problems of virtual learners through their reflection. Table-6 revealed that virtual learners in Pakistan faced the problems of [and due to] electricity failure (88.3%, mean score 4.0) which appeared to be a big barrier in learning through virtual interactions. Virtual learners depended on the use of Internet and Virtual Television Network of which the broadcasting was promoted by local cable networks. Due to electricity failure they could not continue viewing instructional broadcasting. Social problem (87.5%, mean score 4.0) proved another hindrance in timely submission of the assignments. They reported to be busy in jobs, with their family or

other professional and social commitments which were creating gap between objectives of study and their performance.

Physical separation of virtual learners (90.5%, mean score 4.1) from their fellows and tutors appeared to be developing procrastinating attitude among them. They could not work with due tempo and pace. They were facing segregating attitude from conventional or mainstream higher education students and/ or professionals. Apparently, it was working as one of the de-motivating factors and resulting in dropout in some of the cases. Likewise, majority of virtual learners were employed and related to working cohort, and therefore, they faced time management (90.6%, mean score 4.1) problems in 'learning while earning' situations. They had to sacrifice their semester or course over their official commitments. These problems appeared to be prevailing more over the situations where learners were employed in private sector or on performance based incentives / promotions to high ranks.

CONCLUSION

The Virtual University of Pakistan uses learner-centered instructional paradigm. The Varsity offers informative and innovative courses encompassing self-instructional materials and activities. It appoints experienced and visionary personnel as tutors and academicians. It exploits its Virtual Television Network supplemented by Internet for online instructional delivery. The tutor presenters appear to be good looking having soft voice & clear accent with appropriate pauses and pulses. The learners are involved in learning process through assignments and activities. The Varsity promotes opportunities of collaborative learning in virtual environments. It promotes confidence and intellectual faculties of learners through activity based leaning comprising of case studies, assignments and projects. The instructional paradigm reflects resilience to address diverse intellect but appears to enhance mental faculties of learners. However, they face some problems like electricity failure, isolation, and lack of time management ability which appear to create difficulty in their learning.

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SUPPORTING SELF-REGULATED LEARNING IN WEB 2.0 CONTEXTS

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ABSTRACT
Web-based self-learning (WBSL) provides learners with a powerful means of acquiring knowledge. However, WBSL may disorient learners, especially when their skills are inadequate for regulating their learning. In this paper, a Web 2.0 self-regulated learning (Web2SRL) system based on the theory of self-regulated learning is proposed. Learners use the Web2SRL system to read articles in RSS feeds from blogs of interest. The Web2SRL system provides learners with mechanisms for regulating their learning, including planning, practice, and reflection. The results of pre- and post-tests show that the Web2SRL system supports knowledge acquisition in WBSL contexts, especially for low-achieving learners. The results of a questionnaire indicate that learners perceive the Web2SRL system to be useful in supporting WBSL. The proposed system can thus play an important role in supporting WBSL.

INTRODUCTION
Web-based learning contexts have received a lot of attention in recent years due to the popularity of Web 2.0 technologies (Kiyici, 2010; Lin, Huang, & Cheng, 2010; Tilfarlioğlu, 2011). They can be used to realize web-based self-learning (WBSL) contexts by providing individuals with an efficient means of sharing and acquiring knowledge. Blogs and RSS feeds are popular Web 2.0 technologies. Blogs are publishing platforms that enable individuals to share their knowledge (Kalelioglu & Gulbahar, 2010); they can be viewed as online learning material (Huang, Huang, Liu, Tsai, in press). RSS is an XML (extensible markup language) format that is used to deliver frequently updated content such as blogs (Lan & Sie, 2010). An RSS document is called an RSS feed, which contains a list of recently posted articles in a blog. Individuals can use an RSS reader to subscribe to RSS feeds and read articles from blogs of interest (Huang, Huang, & Fu, 2011).

However, WBSL may disorient learners, particularly those who are insufficiently skilled in regulating their learning (Azevedo, Cromley, Winters, Moos, & Greene, 2005). In WBSL contexts, learners may need to make decisions about how to plan their learning, how to practice what they have learned, and how to examine their process. Few learners are sufficiently skilled in regulating their learning (Azevedo & Cromley, 2004; Kramarski & Gutman, 2006; Kramarski & Mizrachi, 2007). Thus, mechanisms for supporting learners in undertaking WBSL are desirable.

This paper applies the theory of self-regulated learning (SRL) (Zimmerman, 2002) to design a Web 2.0 self-regulated learning (Web2SRL) system. The Web2SRL system is designed to support learners in regulating their self-learning in Web 2.0 contexts. The main idea behind SRL is to enable learners to constantly regulate their learning in order to gradually learn how to manage their learning (Zimmerman, 2000; 2002). SRL refers to self-generated thoughts and actions that are systematically and cyclically oriented towards the achievement of

personal goals (Zimmerman, 2000; 2002). SRL is a goal-oriented learning strategy that is very suitable for self-managed learning for promoting learning effectiveness in a web-based learning environment (Chen, Huang, Li, & Huang, 2007). Accordingly, SRL theory was adopted here to assist learners in undertaking WBSL in Web 2.0 contexts. To fully exploit the benefits of SRL, the Web2SRL system contains planning, practice, and reflection subsystems. The planning subsystem allows learners to plan their learning, the practice subsystem allows learners to practice what they have learned, and the reflection subsystem allows learners to examine their progress. If the reflection subsystem indicates poor progress, the planning subsystem is used to regulate learning in order to ensure that subsequent learning can be improved. Accordingly, learners gradually learn how to regulate their learning in WBSL contexts and further realize meaningful learning (Huang, Chiu, Liu, & Chen, 2011).

An experiment was conducted to evaluate the Web2SRL system. The Web2SRL system was implemented and deployed at a university. Pre- and post-tests were used to investigate the effect of the Web2SRL system on WBSL and a questionnaire was developed to obtain learners' perceptions of the system. Finally, analyses were carried out to examine the applicability of the Web2SRL system.

THEORETICAL BACKGROUND AND RELATED STUDIES

SELF-REGULATED LEARNING THEORY
SRL refers to self-generated thoughts, feelings, and actions that are systematically and cyclically oriented towards the achievement of personal goals (Zimmerman, 2000; 2002). It is a cyclical learning activity that involves three phases, namely forethought, performance, and self-reflection (Zimmerman, 1986; 1989; 2002). In the forethought phase, learners arrange their learning scheme through goal setting and strategic planning. In the performance phase, learners put their learning scheme into action. In the self-reflection phase, learners reflect on their learning process. The SRL process makes learners aware of their strengths and weaknesses and helps them regulate their goals and strategies (Zimmerman, 2002; 2008). The planning, practice, and reflection subsystems in the Web2SRL system correspond to the forethought, performance, and self-reflection phases of SRL, respectively. The Web2SRL system can thus be used to realize the SRL process.

RELATED STUDIES
SRL in web-based environments has received increasing attention (Zimmerman, 2008). Related studies can be roughly divided into three classes: (i) the analysis of online SRL behavior, (ii) the application of the SRL strategy, and (iii) the development of SRL-based systems.

The analysis of online SRL behavior is focused primarily on the behavior of learners. Azevedo and Cromley (2004) used the think aloud method to analyze learners' SRL process in a hypermedia learning environment. The think aloud method is used to understand learners' reports about their thoughts and cognitive processes when performing an action. In their work, learners were asked to think aloud while performing an action. Perry and Winne (2006) argued that self-reported data are not reliable for investigating learners' SRL process, especially when learners are young children. Hence, they designed a log analyzer to unobtrusively record how and when learners performed an action. The trace data provided fine-grained, detailed, time-referenced logs, which were used to investigate young children's SRL process. However, the analysis of such trace data is insufficient for interpreting the thoughts of learners, since it is based on quantitative analysis such as the frequencies of events or the properties of event sequences. Hence, such analysis is only used to explore learners' SRL process rather than learners' thoughts on SRL. Recently, Dettori and Persico (2008) utilized qualitative analysis and interaction analysis to investigate SRL in virtual learning communities. The interaction analysis was based on the detection of phrases and expressions to analyze the messages exchanged by learners. In their study, a set of indicators was designed to spot clues of self-regulated events within the messages. The clues were then used to explore the application of SRL by learners and to understand the thoughts of learners. In general, the interaction analysis is labor-intensive since researchers need to spend a lot of time spotting the clues from the learners' messages. Nevertheless, it provides researchers with an opportunity to observe the evolution of learners' SRL process over time.

The SRL strategy has been applied to online learning activities to determine its impact. Lee et al. (2008) combined problem-based learning (PBL) and SRL to enhance online learning. In their research, a series of quasi-experiments was conducted to examine the effects of PBL and SRL on web-based learning. Their results showed that the implementation of pedagogy was important for online learning, particularly for students with low academic achievement. One explanation is that the SRL strategy is useful in assisting low-achieving students, who are often easily distracted, in concentrating on online learning. Vighnarajah et al. (2009) applied the SRL strategy to an online community discussion platform. In their study, semi-structured interviews were

used to examine the relationship between the SRL strategy and the platform. Their results showed that participation in the online discussion was effective in improving the practice of the SRL strategy. Students can use the online discussion to seek help in practicing SRL. Fox example, students can read forum discussion threads to set their goals and then encourage each other to achieve them.

Assisting learners with monitoring self-learning is the main issue in the development of SRL-based systems. Chen et al. (2007) argued that SRL is very suitable for self-managed learning for promoting learning effectiveness in a web-based learning environment. They proposed a personalized e-learning system with self-regulated learning-assisted mechanisms to help learners improve their self-regulated learning ability. Chen (2009) developed a personalized e-learning system with an SRL indicator to assist learners. The SRL indicator is composed of several indices, including learning time and effort level. By using these indices, learners can monitor their learning performance and reflect on their learning process. However, these studies focused on only the reflection phase of SRL. The present study applies SRL theory to design a Web2SRL system for assisting students in performing systematic SRL.

Although SRL in web-based learning contexts has attracted a lot of attention, SRL in WBSL contexts has not been extensively studied, especially in Web 2.0 contexts. SRL theory has been found to be beneficial in web-based learning contexts, especially for low-achieving learners. However, whether SRL theory has the same benefits in Web 2.0 contexts is still unknown. The Web2SRL system used in this study was developed to investigate this issue. Details of the proposed system are described in the next section.

THE WEB2SRL SYSTEM

The Web2SRL system is designed to support learners when they undertake self-learning in Web 2.0 contexts. Specifically, learners can use the Web2SRL system to read articles in RSS feeds from blogs of interest. Unlike general RSS readers, the Web2SRL system provides learners with a cyclical mechanism for achieving SRL, as shown in Figure 1.
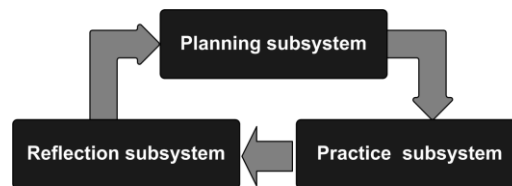
Figure 1.   Cyclical mechanism for achieving SRL.

The planning subsystem is designed to enable learners to arrange a learning scheme that involves goal setting and strategic planning. For goal setting, learners decide the number of articles they wish to read during a certain period. For strategic planning, learners select a reading strategy such as SQ3R (survey, question, read, recite, review) (Robinson, 1961).

The practice subsystem allows learners to practice the learning scheme. Here, a subscribing function is designed to assist learners in subscribing to RSS feeds and reading the articles in RSS feeds. A note-taking function is designed to assist learners in writing down any ideas they have when reading the articles.

The reflection subsystem is designed to enable learners to examine their progress. A reading test function is designed to assist learners with examining their acquired knowledge. In the tests, learners select the appropriate keyword from a given article. A previously developed information retrieval technique, the term frequency-inverse document frequency (TF-IDF) technique (Salton & McGill, 1983), is adopted to select the keywords of an article, which are then used as the answers to the quiz. Learners can use the quizzes to assess their progress. Learners can increase or decrease the number of articles in the next learning scheme based on their quiz results.

RESEARCH DESIGN

A one-group pretest-posttest design was used to examine the effect of the Web2SRL system on WBSL. The design is a pre-experimental design in which one group is subjected to a treatment and observed before and after the treatment (Campbell & Stanley, 1963). In this study, students were observed before and after using the Web2SRL system to undertake a WBSL activity. The observations were used to explore the effect of the Web2SRL system on WBSL.

Research Questions

A previous study indicated that the implementation of SRL theory should be considered for online learning (Lee

et al., 2008). This study investigated the following research questions: (1) what is the effect of the Web2SRL system on high- and low-achieving students and (2) what are students' perceptions of the Web2SRL system?

Participants
A total of 39 undergraduate students from a university in Tainan, Taiwan, participated in the study. The average age of the participants was 20.5 years (standard deviation (sd) = 2.0 years). Their prior experience of Internet usage ranged from 4 to 12 years, with a mean of 8.1 years (sd = 2.2 years), and the amount of time spent on the Internet per day ranged from 1 to 10 hours, with a mean of 5.2 hours (sd = 2.6 hours). The participants were thus experienced and interested in using both computers and the Internet.

System and materials
The ASP.NET (C#) programming language and an SQL Server 2005 database were used to implement the system prototype used in this study. The materials used in the experiment were mainly from the Engadget blog (http://www.engadget.com/), which frequently publishes articles about new computer and Internet technologies. Figure 2 shows the participants performing a WBSL activity using the Web2SRL system.
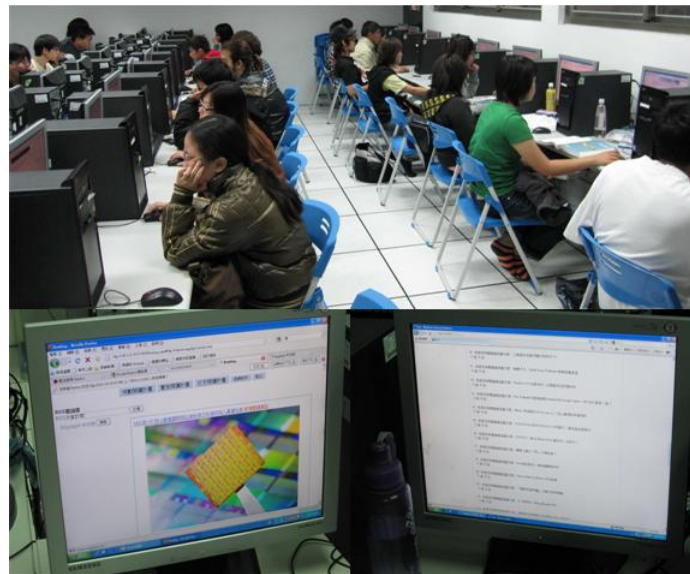
Figure 2.   Participants performing a WBSL activity using the Web2SRL system.

Questionnaire
To determine the students' perceptions of the Web2SRL system, the perceived ease of use (PEU) and perceived usefulness (PUF) constructs were used. These constructs are considered important in determining acceptance and use of information technology (Davis, 1989; Huang, Huang, Huang, & Lin, 2012; Lin, Lin, & Huang, 2011). The perceived WBSL effectiveness (PWE) and perceived WBSL satisfaction (PWS) constructs were used to investigate the students' perceptions of using the Web2SRL system to perform WBSL (Chou & Liu, 2005; Huang & Liu, 2009). Accordingly, a structured questionnaire was developed based on a review of prior studies (Chou & Liu, 2005; Davis, 1989; Huang & Liu, 2009) as well as feedback from two experts. The questionnaire includes PEU, PUF, PWE, and PWS, as shown in Table 1. The questionnaire was distributed to the participants, who were asked to complete it by indicating their level of agreement with a number of statements on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Table 1. Questionnaire

Construct	Items	Reference
PEU	(PEU1) I feel that this system was easy to use.	Davis, 1989;
	(PEU2) I feel that learning to use this system was easy.	Huang et al.,
	(PEU3) I feel that operating this system does not require too much time.	2012
PUF	(PUF1) I feel that this system was a useful learning tool.	Davis, 1989;
	(PUF2) I feel that using this system can promote the efficacy of learning.	Huang et al.,
	(PUF3) I feel that using this system can increase the motivation of learning.	2012;
		Lin et al., 2011
PWE	(PWE1) I can use this system to obtain new knowledge.	Self-developed
	(PWE2) I can use this system to constantly update my knowledge.	
	(PWE3) I can use this system to obtain new knowledge beyond that contained in	

	the textbook.	
PWS	(PWS1) I am satisfied with this way to learn.	Chou & Liu,
	(PWS2) I am satisfied with using this system as a learning tool.	2005; Huang &
	(PWS3) I am satisfied with using this system to learn knowledge.	Liu, 2009

Procedure

The experiment was conducted in a course to introduce computer science, in which the Web2SRL system was used to increase the students' knowledge of new computer and the Internet technology. In this experiment, the learning topic was computer science and the learning objective was to learn about new computer and the Internet technology. At the start of the experiment, all the participants were asked to take a pre-test to evaluate their knowledge about new computer and Internet technologies before using the Web2SRL system. After the pre-test, all the participants performed a WBSL activity using the Web2SRL system. In the WBSL activity, the participants used the system to plan, practice, and reflect on their learning scheme. During the period of the WBSL activity, the participants could use the system to constantly regulate their learning in order to concentrate on WBSL. The WBSL activity was not only performed in the regular curriculum, but also in extracurricular time. When the WBSL activity was completed (one month), the participants were asked to take a post-test to evaluate their knowledge about new computer and Internet technologies after using the Web2SRL system. The pre- and post-tests both consisted of 15 multiple-choice questions designed by two experts (i.e., a total of 30 items). The two tests had the same level of difficulty in order to examine the difference in the participants' knowledge between before and after using the Web2SRL system. Finally, the participants were asked to fill out a questionnaire that explored their perceptions of the Web2SRL system.

RESULTS AND DISCUSSION
Analysis of the effect of the Web2SRL system on WBSL
This analysis examines the effect of the Web2SRL system on all students (AS), low-achieving students (LS), and high-achieving students (HS). The students were classified into LS and HS based on their pre-test scores. Students with pre-test scores lower and higher than the mean score were designated as LS and HS, respectively.

A paired-sample t-test was used to assess the difference in the knowledge of AS, LS, and HS between pre-test and post-test. The results of AS show that there was a significant difference ($t = 7.25$, df $= 38$, $p < 0.001$) between pre-test (mean $= 8.89$, sd $= 1.51$) and post-test (mean $= 11.07$, sd $= 1.78$) performance. The results of LS show that there was a significant difference ($t = 7.00$, df $= 15$, $p < 0.001$) between pre-test (mean $= 7.43$, sd $= 0.81$) and post-test (mean $= 10.43$, sd $= 1.36$) performance. The results of HS show that there was a significant difference ($t = 4.28$, df $= 22$, $p < 0.001$) between pre-test (mean $= 9.91$, sd $= 0.94$) and post-test (mean $= 11.52$, sd $= 1.92$) performance. The students could thus successfully acquire knowledge by using the Web2SRL system regardless of their pre-test achievement level.

An independent sample test was used to compare the difference in pre-test and post-test performance between LS and HS. The results of the pre-test show that there was a significant difference ($t = 8.47$, df $= 37$, $p < 0.001$) between LS (mean $= 7.43$, sd $= 0.81$) and HS (mean $= 9.91$, sd $= 0.94$). That is, LS and HS did not have equivalent levels of knowledge before using the Web2SRL system. The results of the post-test show that there was no significant difference ($t = 1.93$, df $= 37$, $p > 0.05$) between LS (mean $= 10.43$, sd $= 1.36$) and HS (mean $= 11.52$, sd $= 1.92$), though this was a relatively small effect size (eta-squared $= 0.09$). That is, LS and HS had equivalent levels of knowledge after using the Web2SRL system. The level of knowledge of LS improved by an average score of 3 and that of HS improved by an average score of 1.61. The level of knowledge of LS was thus greatly enhanced (to almost the level of HS) by using the Web2SRL system.

The analysis results indicate that the Web2SRL system supports the acquisition of knowledge in WBSL contexts, especially for LS. The Web2SRL system helps LS manage their WBSL. In general, LS are likely to become disoriented in web-based learning contexts since they are easily addicted to the Internet (Lee et al., 2008). The Web2SRL system enables LS to take responsibility for their learning. The Web2SRL system logs show that LS' average number of using planning subsystem was 2.00 (sd $= 1.26$) and HS' average number of using planning subsystem was 1.82 (sd $= 1.02$). This indicates that LS concentrated more on their learning than did HS, and were thus able to keep up with HS. Overall, the findings of this analysis confirm those obtained by Chang (2005) and Lee et al. (2008). Chang (2005) revealed that the SRL strategy enables students to concentrate more on web-based learning. Lee et al. (2008) indicated that the SRL strategy was useful for web-based learning, particularly for students with low academic achievement.

Analysis of students' perceptions of the Web2SRL system
This analysis examines the perceptions of the Web2SRL system of AS, LS, and HS through the questionnaire.

The questionnaire was assessed before the analysis in order to determine its reliability and validity. Cronbach's α was used to assess the reliability and expert validity as well as construct validity were used to examine the validity.

Assessment of questionnaire

The results of the reliability analysis are summarized in Table 2. The table shows that the Cronbach α values for the four constructs are higher than 0.70 (total Cronbach α value in four dimensions=0.97; PEU=0.95, PUF=0.90, PWE=0.95, and PWS=0.90). This implies that the reliability was sufficiently high (Hair, Black, Babin, Anderson, & Tatham, 2006). Furthermore, the minimum value of each corrected item-to-total correlation was above 0.5 (minimum = 0.68), which shows that the questionnaire had strong reliability (Doll & Torkzadeh, 1988).

Table 2. Results of reliability analysis

Construct	Item	Reliability analysis results	
		Corrected item-total correlation	Cronbach's α
PEU	PEU1	0.88	0.95
	PEU2	0.89	
	PEU3	0.88	
PUF	PUF1	0.89	0.90
	PUF2	0.68	
	PUF3	0.91	
PWE	PWE1	0.88	0.95
	PWE2	0.87	
	PWE3	0.85	
PWS	PWS1	0.80	0.90
	PWS2	0.76	
	PWS3	0.84	

Two domain experts examined the domain validity. Some ambiguous or unsuitable items were modified, removed, altered, or arranged in the proper order according to the expert feedback. This rigorous process implies that the questionnaire had good validity.

Construct validity is used to validate that a questionnaire is actually a measure of what it is intended to measure (i.e., the construct) and not a measurement of other variables. It is evaluated by using convergent and discriminant validity (Ong, Day, & Hsu, 2009). The convergent validity is assessed by examining the average variance extracted (AVE), which must exceed the standard minimum level of 0.5 (Hair et al., 2006). The discriminant validity is assessed using the square root of the AVE and the correlation matrix of the construct (Fornell & Larcker, 1981), in which the square root of the AVE of each construct should exceed the correlation shared between one construct and other constructs. The results of the construct validity analysis are summarized in Table 3. The table shows that most criteria exceeded the threshold suggested in previous research and thus indicates that a satisfactory construct validity was obtained. The reliability and validity results prove the adequacy of the questionnaire used in this study.

Table 3. Results of construct validity analysis

Construct	Convergent validity	Discriminant validity			
	AVE	Correlation matrix of constructs			
		PEU	PUF	PWE	PWS
PEU	0.96	0.98			
PUF	0.92	0.87	0.96		
PWE	0.95	0.82	0.80	0.98	
PWS	0.92	0.78	0.77	0.81	0.96

Results of questionnaire

The responses of AS to the questionnaire are summarized in Table 4. The table shows that AS gave positive feedback for all dimensions. The three major results are:

(1) 74% of the students indicated that they could use the Web2SRL system to obtain new knowledge beyond that contained in the textbook.
(2) 69% of the students indicated that their motivation of learning was increased by using the Web2SRL system.

(3)   62% of the students indicated that they were satisfied with this way of learning.

These results show that students thought that they could use the Web2SRL system to acquire knowledge and that the system was useful in promoting their motivation of learning. This finding is similar to those obtained in the studies of Chang (2005), Lee et al. (2008), and responds to the study of Usta (2011). Chang and Lee et al. found that web-based learning with the SRL strategy increases both the learning and motivation of students. Usta showed that the SRL strategy influences the attitude of students towards the Internet.

Table 4. Responses to the questionnaire

Construct	Item	Strongly agree	Agree	Undecided	Disagree	Strongly disagree	Mean
PEU	PEU1	33% (13)	41% (16)	13% (5)	8% (3)	5% (2)	3.9
	PEU2	31% (12)	41% (16)	15% (6)	8% (3)	5% (2)	3.8
	PEU3	36% (14)	33% (13)	23% (9)	5% (2)	3% (1)	3.9
PUF	PUF1	31% (12)	33% (13)	26% (10)	8% (3)	3% (1)	3.8
	PUF2	23% (9)	26% (10)	36% (14)	10% (4)	5% (2)	3.5
	PUF3	33% (13)	36% (14)	15% (6)	13% (5)	3% (1)	3.8
PWE	PWE1	33% (13)	36% (14)	26% (10)	5% (2)	0% (0)	4.0
	PWE2	31% (12)	38% (15)	18% (7)	10% (4)	3% (1)	3.8
	PWE3	31% (12)	44% (17)	15% (6)	8% (3)	3% (1)	3.9
PWS	PWS1	26% (10)	36% (14)	28% (11)	8% (3)	3% (1)	3.7
	PWS2	18% (7)	41% (16)	31% (12)	8% (3)	3% (1)	3.6
	PWS3	21% (8)	38% (15)	33% (13)	5% (2)	3% (1)	3.7

Pearson correlation analysis was used to examine the correlations between constructs and to determine significant intercorrelations between constructs (Huang, Yang, & Liaw, in press). Table 5 shows various highly significant intercorrelations between constructs. The three most significant intercorrelations are between PEU and PUF (0.87), PEU and PWE (0.82), and PWE and PWS (0.81).

The above results show that PEU is highly positively correlated to PUF and PWE, and that PWE is highly positively correlated to PWS. This indicates that when students can easily use the Web2SRL system to acquire knowledge, they find the system useful for learning and are satisfied with using the system to learn. The results are are similar to those obtained in the studies of Davis (1989) and Huang et al. (in press).

Table 5. Results of correlation analysis

Construct	PEU	PUF	PWE	PWS
PEU	1			
PUF	0.87*	1		
PWE	0.82*	0.80*	1	
PWS	0.78*	0.77*	0.81*	1

*$p < 0.01$

An independent sample t-test was used to compare the difference in the perceptions of the Web2SRL system between LS and HS. The results are summarized in Table 6. The table shows that there was no significant difference in the perceptions of the Web2SRL system between LS and HS ($p > 0.05$). Therefore, LS and HS had similar perceptions of the Web2SRL system. Students thought that the Web2SRL system was useful in WBSL, regardless of their pre-test achievement level.

Table 6. Comparison of the perceptions of the Web2SRL system by LS and HS

Construct	Level of knowledge	Mean	Standard deviation	t-value	p-value
PEU	LS	3.66	0.94	1.16	0.25
	HS	4.05	1.09		
PUF	LS	3.47	0.87	1.29	0.20
	HS	3.89	1.06		
PWE	LS	3.66	0.78	1.37	0.17
	HS	4.08	1.02		
PWS	LS	3.52	0.75	0.99	0.32
	HS	3.81	0.98		

CONCLUSION

Web 2.0 technologies have considerable potential for WBSL. This study developed the Web2SRL system, which assists students in engaging in self-learning environments. With the Web2SRL system, students can subscribe to RSS feeds of blogs of interest and read the articles in the feeds. The Web2SRL system is based on SRL theory, and thus has planning, practice, and reflection subsystems. These subsystems enable students to regulate their learning in WBSL contexts. A one-group pretest-posttest design was used to investigate the effect of the Web2SRL system on WBSL, and a questionnaire was used to determine students' perceptions of the Web2SRL system. The experimental results show that all students could successfully acquire knowledge by using the Web2SRL system, particularly the low-achieving students. Moreover, all students found the Web2SRL system useful, regardless of their pre-test achievement level.

Although the proposed system is useful, some problems should be addressed in future research. In this study, the reading goal was to read a set number of articles. However, a more practical goal is not only to read a certain number of articles, but to actually retain a certain amount of knowledge. For example, if students are able to read ten articles in the first week, this does not mean they will be able to read another ten articles in the second week. Various parameters of articles should be considered, such as length and difficulty. A better reading test would be one that assesses whether the students actually comprehend the content of an article, rather than simply asking them to select the correct keywords. In future work, a better way of setting reading goals will be developed. In addition, an automatic method for measuring learning throughout the WBSL process will be explored. Finally, the system logs will be used to analyze the relationship between the students' SRL and their learning effectiveness.

The limitations of this study include the type of experimental design and the relatively small sample size. Specifically, the experimental design of this study is a pre-experimental design rather than a quasi-experimental designs or a true experimental design. Therefore, the improvement in the level of knowledge of students may be affected by some factors rather than the use of the Web2SRL system. Increasing the sample size will provide a stronger evidence of the benefits of the proposed Web2SRL system. Nevertheless, the proposed system was shown to play an important role in supporting WBSL.

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SYSTEM CHARACTERISTICS, SATISFACTION AND E-LEARNING USAGE: A STRUCTURAL EQUATION MODEL (SEM) [1]

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ABSTRACT
With the advent of the Internet, more and more public universities in Malaysia are putting in effort to introduce e-learning in their respective universities. Using a structured questionnaire derived from the literature, data was collected from 250 undergraduate students from a public university in Penang, Malaysia. Data was analyzed using AMOS version 16. The results of the structural equation model indicated that service quality ($\beta = 0.20$, $p < 0.01$), information quality ($\beta = 0.37$, $p < 0.01$) and system quality ($\beta = 0.20$, $p < 0.01$) were positively related to user satisfaction explaining a total of 45% variance. The second regression analysis was to examine the impact of user satisfaction on continuance intention. The results showed that satisfaction ($\beta = 0.31$, $p < 0.01$), system quality ($\beta = 0.18$, $p < 0.01$) and service quality ($\beta = 0.30$, $p < 0.01$) were positively related to continuance intention explaining 44% of the variance. Implications from these findings to e-learning system developers and implementers were further elaborated.
Keywords: information quality, system quality, service quality, user satisfaction, continuous usage, e-learning, structural equation model

1.0 INTRODUCTION
Electronic learning (e-learning) is well documented in the IT literature as according to Roca et al. (2006), it has increasingly provided "an entirely new environment and experience of learning that goes well beyond the classrooms, curricula and text-based formats". E-learning generally involves delivery of course content using the electronic media, such as Internet, Intranets, Extranets, satellite broadcast, audio/video tape, interactive TV, and CD-ROM (Urdan & Weggen, 2000). Khan (2001) describes e-learning as synonymous with web-based learning (WBL), Internet-based training (IBT), advanced distributed learning (ADL), web-based instruction (WBI), online learning (OL) and open/flexible learning (OFL). Ramayah et al. (2010) noted that in Malaysian institutions of higher learning, measures of successful e-learning implementation are users' satisfaction and continuance of usage of the facility for research and teaching and learning purposes.

Wang et al. (2007) argued that it is difficult to capture the full dimensions of the e-learning system success in an organization because many combinations of individual, managerial and organizational measures can be adopted. Furthermore, an examination of successful e-learning systems in the IS context is difficult because different players or stakeholders view differently the benefits of the systems (DeLone & McLean, 2003). This study is from the perspective of students using the e-learning system which is basically web-based in nature and since it is also a communication and information system (IS) phenomenon (Wang et al., 2007), the authors contend that it is appropriate to examine its successful implementation by using the extended DeLone and McLean's (2003) IS Success Model. It has been suggested that "despite the multidimensional and contingent nature of IS success, an attempt should be made to reduce significantly the number of measures used to measure IS success, so that research results can be compared and findings validated" (DeLone & McLean, 2003). This study hence, implements a simplified model of DeLone and McLean's (2003) extended model to examine via structural equation modeling (SEM), the role of quality (service quality, information quality and system quality) in influencing user satisfaction and continuing usage of an e-learning system in a Malaysian public university.

2.0 THEORETICAL BACKGROUND AND THE RESEARCH MODEL
The roles of user's satisfaction in influencing e-learning success (Delone & McLean, 1992; Doll & Torkzadeh, 1988) and its impact on e-learning continuance intention (Chiu, Hsu, Sun, Lin, & Sun, 2005; Roca, Chiu, & Martinez, 2006) have been investigated by researchers using several models. A number of studies on e-learning

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continuance decisions have been examined using the technology acceptance model (TAM) (Davis, 1989), an offshoot of the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975). Studies using TAM attempted to establish the impact of perceptions of usefulness and ease of use on attitudes towards technology adoption and usage (Roca, et al., 2006). Recent models to measure IT usage and success have adopted Oliver's (1980) expectancy disconfirmation theory (EDT) as seen in the works of Bhattacherjee (2001), Chiu, et al. (2005), Hayashi, et al. (2004), McKinney, et al.(2002) and Oliver (1980). The EDT proposes that consumer's perceived performance, perceived disconfirmation, and satisfaction influence repurchase intention.

In addition, extant literature on IT usage also shows that the IS success model of DeLone and McLean (1992) which examines the relationship between system quality and information quality and user satisfaction, and its extended model (DeLone & McLean, 2002, 2003) which incorporates perceived usefulness as a measure of user satisfaction (Delone & McLean, 1992) and perceived ease of use, perceived usefulness and information quality as determinants of user satisfaction have been used to investigate IS usage and success. The recent work of Sharkey et al. (2010) used the DeLone and McLean's (2003) extended model to investigate the influence of quality on E-commerce success. Their study found significant relationships between Information Quality and System Quality and three success dimensions: intention to use, user satisfaction and intention to transact. McKinney et al. (2002) proposed a measurement of Web-customer satisfaction whereby perceived performance was examined in terms of information quality and system quality. Other studies by Parasuraman, et al. (1988) involving the use of quality constructs have included service quality as a measure of user satisfaction   while another study by Pitt, et al. (1995) which included service quality in its success model concluded that SERVQUAL is appropriate in measuring IS service quality. In summary, the empirical studies above imply that TAM, EDT and the DeLone and McLean (1992, 2002, 2003) models are appropriate to examining technology usage and continuance.

The DeLone and McLean's (1992) full model proposes six major dimensions of IS success, namely (1) system quality, (2) information quality, (3) use, (4) user satisfaction, (5) individual impacts, and (6) organizational impacts. The extended model (DeLone & McLean, 2002, 2003) incorporates service quality as the third quality dimension and intention to use and net benefits as the other new dimensions. Therefore, as an adaption of the DeLone and McLean's (2002, 2003) extended model, this paper only examines the impact of perceived quality on user satisfaction and usage continuance of the e-learning system among students in a public university in Malaysia. Fig. 1 represents the theoretical model for this paper. The model indicates the relationship between perceived quality as operationalized by the 3 dimensions of system quality, information quality and service quality, and user satisfaction and usage continuance.

2.1 System quality
System quality measures the functionality of a system which comprises usability, availability and response time (DeLone & McLean, 2004). It is also "concerned with whether or not there are "bugs" in the system, the consistency of the user interface, ease of use, response rates in interactive systems" (Chiu, et al., 2005). The importance of these features are confirmed in a study whereby online users were found to be very particular on issues such as easiness to read and navigate (Smith & Merchant, 2001). It was also established that a responsive web site proves to be highly important to end-users (Robbins & Stylianou, 2003).

2.2 Information quality
Information quality has been associated with nine characteristics, namely, accuracy, precision, currency, output timeliness, reliability, completeness, conciseness, format and relevance (Bailey & Pearson, 1983). The literature on technology usage and user satisfaction has also suggested that information quality has a significant impact on user satisfaction (Delone & McLean, 1992; Seddon, 1997).

2.3 Service quality
The closest definition of service quality in online library systems is perhaps associated with LibQUAL+^{TM} which is derived from Parasuraman's study of service effectiveness, SERVQUAL. LibQUAL+^{TM} is a research and development project undertaken to define and measure library service quality across institutions. Library service quality comprises information access (content/scope and timeliness), personal control (ease of navigation and convenience), affect of service (responsiveness and reliability) and library as a place (utilitarian space) (Heath, Boykin, & Webster, 2002).

2.4 User satisfaction
User satisfaction is widely accepted as a desirable outcome of any product or service experience because it is one of the most significant criteria for measuring IS success. In most studies on IT success, it is a factor to monitor

the product or service quality (Oliver, 1993) and also to predict behavioural consequences (Fullerton & Taylor, 2002).

2.5 System Usage

Usage generally refers to "either the amount of effort expended in interacting with an information system or, less frequently, as the number of reports or other information products generated by the information system per unit time" (Trice & Treacy, 1988). In addition, some authors suggest that usage refers to the nature, quality and appropriateness of the actual system use and not just simply a measure of time spent on the system (DeLone & McLean, 2004).
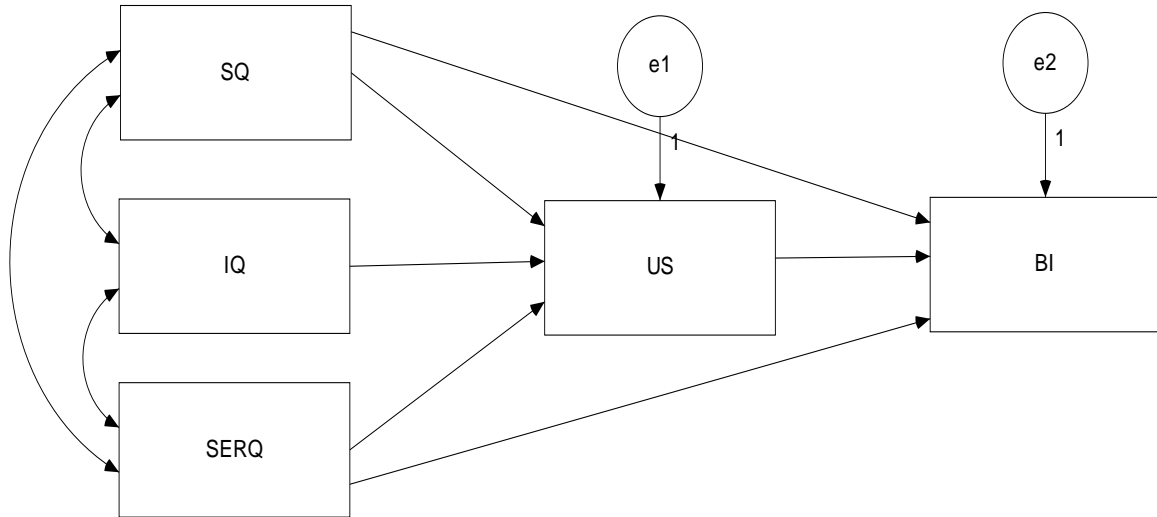
Fig. 1. The research model

The related literature on technology usage has established that users' continued usage intention of IT is determined by usage satisfaction, which in turn is jointly influenced by perceived usability, perceived quality and usability disconfirmation (Roca, et al., 2006). Hsu et al. (2003) and Khalifa and Liu (2002) noted that information quality, system quality and service quality are conceptualized as three different constructs for operationalizing perceived performance. DeLone and McLean (1992) noted that system quality and information quality are directly related to user satisfaction and IS use. Their findings were supported by Bharatia and Chaudhury (2004) and McGill et al. (2003) who found that information quality and system quality as separate constructs, are related to satisfaction. Negash et al. (2003) concluded that information and system quality impact on satisfaction while service quality has no significant relationship with satisfaction and in contrast, service quality was found to be a significant predictor of satisfaction (Lai, 2004) while Rai et al. (2002) have established that information quality influences satisfaction. A recent study by Ozkan and Koseler (2009) used the hexagonal e-learning assessment model (HELAM) which consists of six dimensions, namely, (1) system quality, (2) service quality, (3) content quality, (4) learner perspective, (5) instructor attitudes, and (6) supportive issues to evaluate a web-based learning system. Results show that each of the six dimensions of the model had a significant effect on the learners' perceived satisfaction. The literature suggests that various models using perceived quality either as a composite or separate constructs generally has an impact on user satisfaction. Hence, based on the above literature review, this paper proposes the following hypotheses:

H1: System quality has a positive relationship with user satisfaction.

H2: Information quality has a positive relationship with user satisfaction.

H3: Service quality has a positive relationship with user satisfaction.

User satisfaction is often regarded as an individual's feelings of pleasure or disappointment resulting from comparing a product's performance (or outcome) in relation to his or her expectations (Chiu, et al., 2005). Previous research has suggested strongly that satisfaction has a positive impact on future intentions to repurchase (Oliver, 1980). A study on usage of online banking services established the significance of satisfaction as a predictor of IS continuance (Bhattacherjee, 2001) while Van Riel et al. (2001) found that satisfaction has a strong impact on intention to continue using a portal site, and users' continuance intention is determined by satisfaction (Roca et al., 2006). Hence, based on the above findings, the following hypothesis is proposed:

H4: User satisfaction is positively related to usage continuance.

A recent study by Sharkey, Scott, and Acton, (2010) using DeLone and McLean's IS Success Model (DeLone & McLean, 2002, 2003) in an e-commerce environment found that information quality and system quality are significantly related to user satisfaction, intention to use and intention to transact. In another study by Ramayah et al. (2010) in an e-learning environment in Malaysia, the impact of information quality on intention to use was found to be fully mediated by user satisfaction. Roca et al. (2006), based on the expectancy disconfirmation theory, used a decomposed technology acceptance model in the context of an e-learning service to examine the determinants of user satisfaction and users' continuance intention. The perceived performance component was decomposed into perceived quality and perceived usability. Results from a sample of 172 respondents suggest that users' continuance intention is determined by satisfaction which in turn is jointly influenced by perceived usefulness, information quality, confirmation, service quality, system quality, perceived ease of use and cognitive absorption.

A revised conceptual model which was derived from the technology acceptance model, expectation-confirmation theory and IS success theory was tested and validated using data gathered from 166 online consumers in South Africa (Brown & Jayakody, 2008). The study found that 7 interrelated dimensions of B2C e-commerce success, namely service quality, system quality, information quality, trust, perceived usefulness, user satisfaction and continuance intentions were confirmed. Findings indicate that user intentions to continue using an online retail site are directly influenced by perceived usefulness, user satisfaction and system quality. User satisfaction is directly influenced by service quality and perceived usefulness, whilst perceived usefulness is directly influenced by trust and information quality. Trust in the online retailer is directly influenced by service quality and system quality. The literature suggests that perceived quality are positively related to users' intention to use an e-learning system. Hence, based on the findings described above, the following hypotheses are proposed:

H5: System quality is positively related to intention to use.

H6: Service quality is positively related to intention to use.

3.0 RESEARCH METHOD
3.1 Data Collection
Data was collected from 250 students from a public university in Penang, Malaysia using a structured questionnaire which was derived from the literature. The questionnaire consisted of 4 sections. The first section collected the demographic data, the second section elicited information about information quality, service quality and system quality, section three measured user satisfaction and the last section measured continuance intention. Since there was no list available, non-probability convenient purposive sampling method was used. The sample selected were students who have used the e-learning system as the measures required them to rate the system, information and service quality as well as the satisfaction and continuance intention.

3.2 Measures
The measures were all adapted from published literature. The measures for service quality, information quality and system quality were from Lee and Lee (2008). Satisfaction measures were adapted from Spreng et al. (1996) whereas intention to use was adapted from Venkatesh et al. (2003).

3.3 Sample Profile
The demographics of the respondents tabulated in Table 1 were derived from descriptive analysis. Females (69.6%) outnumber males (30.4) in this study which somewhat reflects the gender ratio of undergraduates for public universities in Malaysia. About 70% of the students were from the Arts stream while 30% were from Science. More than 66% of students stayed in the campus and the rest outside the campus. About 50% of students used the e-learning system for between 1-5 hours per day while about a quarter used the system for less than an hour per day. Twenty-eight percent of students claimed they belonged to the slightly frequent to extremely frequent user group of the system.

Table 1: Demographics of respondents

Gender	Frequency	Percent
Male	76	30.4
Female	174	69.6
Ethnicity		

Malay	72	28.8
Indian	24	9.6
Chinese	148	59.2
Others	6	2.4
Stream		
Arts	174	69.6
Science	76	30.4
Residence		
In campus	166	66.4
Outside campus	84	33.6
Hours	Frequency	Percent
Almost never	6	2.4
< 1 hour	62	24.8
1-5 hours	124	49.6
6-10 hours	38	15.2
11-15 hours	14	5.6
More than 20 hours	6	2.4
Frequency of use		
Extremely infrequent	16	6.4
Quite infrequent	50	20.0
Slightly infrequent	64	25.6
Neither infrequent nor frequent	50	20.0
Slightly frequent	46	18.4
Quite frequent	14	5.6
Extremely frequent	10	4.0

4.0 DATA ANALYSIS

AMOS version 16.0 was used to analyze the hypotheses generated. AMOS and LISREL are the most widely used Structural Equation Modeling (SEM) software available in the market. Since we considered AMOS 16.0 to be more user friendly this software was adopted. We followed the 2-step analytical procedure suggested by Hair et al.(2010) whereby the measurement model was evaluated first and then the structural model was assessed next.

4.1 Measurement Model

Convergent validity measures the extent to which the items of a scale that are theoretically related are correlated. According to Hair et al. (2010) a composite reliability of 0.70 or above and an average variance extracted of more than 0.50 are deemed acceptable. As can be seen from Table 2, all the composite reliability values are above 0.70 except for intention which is acceptable as there are only 2 measurement items. The average variance extracted is all above 0.50. Therefore, we can conclude that convergent validity has been established.

Next, we assessed the discriminant validity which is the extent to which a measure is not a reflection of some other variable. This can be established by low correlations between the all the measure of interest and the measure of other constructs. Also according to Fornell and Larcker (1981) when the square root of the average variance extracted is greater than its correlations with all other constructs then discriminant validity has been established. (see Table 3)

Table 2: Result of CFA for measurement model

Construct	Item	Internal reliability Cronbach alpha	Convergent validity		
			Factor loading	Composite reliability[a]	Average variance extracted[b]
Information Quality	IQ1	0.896	0.66	0.78	0.54
	IQ2		0.80		
	IQ3		0.74		
System Quality	SQ1	0.901	0.73	0.75	0.51
	SQ2		0.64		
	SQ3		0.76		
Service Quality	SERQ1		0.68	0.77	0.53
	SERQ2		0.74		
	SERQ3		0.77		
User Satisfaction	US1	0.911	0.67	0.76	0.76
	US2		0.79		
	US3		0.71		
Intention to Use	BI1	0.837	0.71	0.68	0.52
	BI2		0.73		

Note:

[a] Composite reliability = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square of the summation of the error variances)}

[b] Composite reliability = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of the error variances)}

Table 3: Discriminant validity of constructs

Constructs	(1)	(2)	(3)	(4)	(5)
(1) Information Quality	**0.734**				
(2) System Quality	0.250	**0.714**			
(3) Service Quality	0.146	0.166	**0.728**		
(4) User Satisfaction	0.130	0.232	0.090	**0.872**	
(5) Intention	0.082	0.104	0.063	0.229	**0.721**

Note: Diagonals represent the square root of the average variance extracted while the other entries represent the squared correlations

4.2 Structural Model

The structural model was estimated using the maximum likelihood method (MLE). Fig. 2 presents the results. The fit statistics are presented in Table 3. All the fit measures from this study are above the recommended values suggesting a good model fit. The model accounts for 45% of the variance explained in user satisfaction and 44% of the variance in user intention. All the paths are significant at the 0.01 level. Information quality has the strongest effect on user satisfaction whereas user satisfaction has the strongest effect on user intention. Thus the results of the structural model have established support for H1, H2, H3, H4, H5 and H6 (See Table 4).

Table 3: Fit indices

Fit Measures	Study	Recommended values
df	1	
χ^2	2.595	
χ^2/df	2.595	≤ 3.00
GFI	0.996	≥ 0.90
AGFI	0.978	≥ 0.80
CFI	0.997	≥ 0.90
RMSEA	0.080	≤ 0.08
NNFI (TLI)	0.972	≥ 0.90
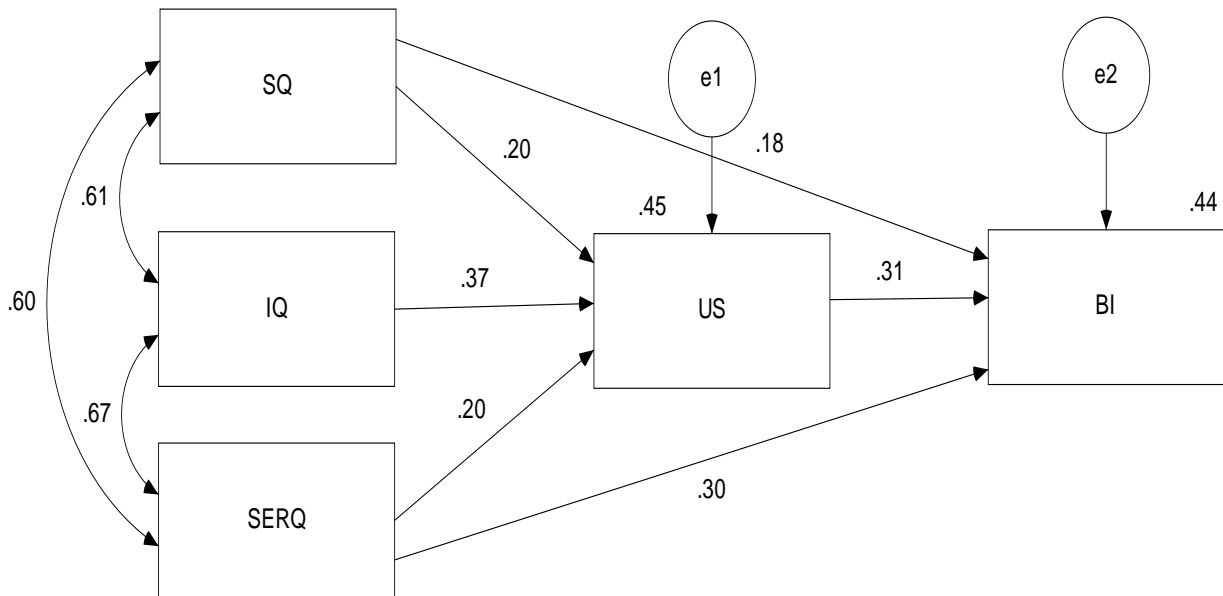
Fig. 2. Structural model

Table 4 summarizes the results of hypotheses testing in this study.

Table 4: Hypotheses testing

Hypothesis	Critical ratios (CR)	p-value	Decision
H1: System quality has a positive relationship with user satisfaction.	3.256	0.001	Supported
H2: Information quality has a positive relationship with user satisfaction.	5.399	0.000	Supported
H3: Service quality has a positive relationship with user satisfaction.	2.948	0.003	Supported
H4: User satisfaction is positively related to usage continuance.	5.069	0.000	Supported
H5: System quality is positively related to intention to use.	2.837	0.005	Supported
H6: Service quality is positively related to intention to use.	4.697	0.000	Supported

5.0 DISCUSSION AND IMPLICATIONS

The purpose of this study was to test DeLone and McLean's (2003) IS success model in a public university in Malaysia. The study also examined the relationships between perceived quality (in terms of system quality, information quality and service quality) and user satisfaction, and the impact of user satisfaction on usage continuance.

The results of the multiple regression analysis corroborate with those found in a similar study by Roca et al.,(2006) where all the 3 dimensions of perceived quality were positively related to user satisfaction. In addition, the findings of this study are consistent with Chiu et al.'s (2005) findings which used a composite construct of perceived quality comprising the dimensions of service quality, information quality and system quality. Results of this study are also consistent with earlier findings where Rai et al. (2002) and Seddon (1997) have established that system quality positively affected user satisfaction while Zhu et al. (2002) found that service quality had a significant impact on customer satisfaction. Roca et al.'s (2006) study also found that user satisfaction has a direct impact on system continuance intention which is consistent with the findings of this study. Another study has also established the strong positive effect of satisfaction on the intention to continue using a portal site (Van Riel, et al., 2001) which further support the findings in this study.

The model adopted in this study shows that system quality, information quality and service quality can account for 45% of the variance in user satisfaction while user satisfaction, system quality and service quality can explain about 44% of the variance in usage continuance. These results suggest that the simplified model of DeLone and McLean's IS success model has relatively good predictive power on user satisfaction and usage.

The implications of the findings in this study is that e-learning system developers and implementers need to ensure the availability of quality, relevant and complete information to meet the needs of students to ensure user satisfaction without sidelining the importance of a reliable and accessible system. If systems usage continuance intention is low because of low user satisfaction, e-learning system implementation is deemed unsuccessful in public universities in view of the high investment costs involved in developing and maintaining the e-learning systems. Completeness of information provided by the e-learning system seems to bring a greater sense of satisfaction among the users. If sources of information are not complete and hence not available to the students, this may affect their perceived quality of the system which in turn affects user satisfaction and hence affects successful implementation of the system. The demographic data in Table 1 indicate that less than 30% of the students belong to the slightly frequent to extremely frequent group of users of the e-learning system in the university. This suggests that about 70% of the students are infrequent users of the system, implying that the existing e-learning system may not have met the expected level of satisfaction among the users.

Perhaps future research on critical success factors of e-learning systems should examine the prospects and roles of institutional funding as well as integration and sharing of multiple e-learning systems nationwide for public universities. In addition, it should be interesting to make a comparison of e-learning usage continuance intention between public and private universities considering the fact that tuition fees in public universities are heavily subsidized by the government and hence are much lower than those in the private universities where students fork out much higher fees. In this respect, it can be assumed that private university students should expect more out of the e-learning system in terms of perceived quality and user satisfaction than those in the public universities.

6.0 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This study developed a theoretical rationale for, and empirically tested the effect of system quality, information quality, service quality, on satisfaction and intention to use. Despite the useful findings of this study there are several limitations that need to be acknowledged. Firstly, when generalizing the results of the study, the researcher should take into account the sample size that has been used in this study, although this study found significant relationships between the independent variables and dependent variable. Secondly, due to time and resource constraints the study is limited as it consists of a small sample size of 250 respondents. Thirdly, the findings cannot be generalized extensively in Malaysia, as the scope of the study is confined to individuals who study in USM, Penang; there might be potential moderators such as gender and demographic factors. Therefore, caution may be needed before generalizing the findings to the whole country. Fourthly, the data were collected from the user's side only. Since relationships involve two participants groups, the creators who create the online learning system and the users, collecting data from both would allow a deeper insight between creator and user relationships. Such a study would require a sampling from both sides in order to make the obtained data match the particular relationship. Lastly, our study only focused on testing the effect of system quality, information quality, service quality, satisfaction and intention to use. Thus, the finding might be limited in its potential when generalizing the results toward other systems.

Future research can expand this study by (1) including the effect of different users' experience on the adoption of e-learning in Malaysia, (2) improving the model by incorporating other relevant independent variables and dependant variables based on new findings from latest literature at the time and, (3) further research is needed to determine whether this study can be replicated in other systems.

7.0 CONCLUSION

In this study, we found that system quality, information quality and service quality are significant factors influencing user satisfaction in using an e-learning system. User satisfaction is also found to be significant in affecting user's intention to use. The findings provided by the study may enable the creators of e-learning systems to think seriously on these factors that will affect user satisfaction. In addition, this study may provide a direction as to how satisfaction can be cultivated among users in order to encourage them to use the e-learning system. The findings provided by the study may give empirically justified foundation for the creators to develop strategies to enhance their e-learning system's quality by focusing on the user satisfaction. By understanding the determinants of user satisfaction, appropriate actions can be taken to increase the users' perceptions of their experience on adoption of the e-learning system. In short, continued research is needed to improve this study and to address its limitations. It is hoped that this study will give a preliminary insight and understanding on user satisfaction and behavioral intention in order to maximize the actual use of the e-learning system.

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TECHNOLOGY AND TECHNIQUE: AN EDUCATIONAL PERSPECTIVE

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ABSTRACT
Today, technology is developing very fast around the world. This technological development (hardware and software) affects our life. There is a relationship among technology, society, culture, organization, machines, technical operation, and technical phenomenon. Educators should know this relationship because technology begins to affect teaching and learning facilities. For this reason educators are increasingly using technology in all aspects of their profession (e.g., creating curricula, classroom instruction, work assignments) This trend can be enhanced by educating the educator about cultural and cognitive aspects of technology and technikos, as well as the associated advantages and disadvantages related to educational and human development goals.

1. DEFINITIONS AND CONCEPTUAL MODELS OF TECHNOLOGY

When people think of "technology," they tend to think of human artifacts such as machines, electronic devices, scientific hardware, or industrial manufacturing systems. However, a formal definition (College Dictionary) of technology indicates that it has a more general meaning which includes any "practical application of knowledge" or "manner of accomplishing a task".

DEFINITION OF "TECHNOLOGY":
1 : *the practical application of knowledge* especially in a particular area…
2 : *a manner of accomplishing a task* especially using technical processes, methods, or knowledge…
3 : the specialized aspects of a particular field of endeavor <educational technology>

Human's use of technology involves not only machines (e.g., computer hardware) and instruments, but also includes structured relations with other humans, machines, and the environment. In short, technology is more than a collection of machines and devices. To go beyond simplistic intuitions about technology requires investigation of the human mind and socio-cultural environment as well as interactions with technological artifacts.

 Note that the word "technical" came into use around 1617 A.D., four hundred years before the term *technology* was coined. A dictionary definition[1] of the term *technical* includes the following:

DEFINITION OF "TECHNICAL":
1 a: **having special and usually practical knowledge** especially of a mechanical or scientific subject…
2 a: of or relating to a particular subject b: of or relating to a practical subject organized on scientific principles…

This indicates that the most general sense of the word technical is having *any* special knowledge on a particular subject. In other words, *technical* knowledge is "especially" but not necessarily associated with mechanical or scientific subjects.
Philosophies of science have developed definitions of technology that go beyond formal dictionary definitions or people's "everyday" intuitions. For example, Teich (1977) asserts that technology includes linguistic and intellectual tools as well as scientific and mathematical techniques. In general, he defines technology as the *organization of knowledge for practical purposes*. This expanded view of technology helps in understanding the extent and variety of its effects on both our institutions and values.

Another scientist, Ihde ("Philosophy of Technology," 1993), constructed a broad definition of technology that consists of three concepts. First, technology must have some material elements. Secondly, technology must enter into some set of *praxes*—uses which humans may make of these components. Last, people must be included in the definition: We must focus on the *relationships* between the technologies and the humans who use, design, make, or modify them (İhde, p.47, 1993).

Another model of technology in human culture, described by Ellul in his book on *Technological Society* (1964), describes *technique* as a group of movements and actions that are for the most part manual, organized, and traditional, all of which unite to reach a known end (i.e., an end reached through a technique associated with a physical, chemical or organic process). Sociologists who are interested in anthropology often prefer this

definition because it offers a conceptual structure for thinking about technology that avoids *philosophical or subjective questions* in religion or art.

Feenberg (1991) proposes yet another way of modeling technology. He asserts that technology is "neutral," without any content value of its own. Feenberg's analysis consists of four points.

1. Technology, as pure instrumentality, is indifferent to the variety of ends it can be employed to achieve. Thus, the neutrality of technology is merely a special case of the neutrality of instrumental means, which are only contingently related to the substantive values they serve.
2. Technology also appears to be indifferent with respect to politics at least in the modern world, and especially with respect to capitalist and socialist societies.
3. The sociopolitical neutrality of technology is usually attributed to its rational character and the universality of the truth it embodies. Technology, in other words, is based on verifiable causal propositions.
4. The universality of technology also means that the same standards of measurement can be applied in different settings.

Thus, technology is said to routinely increase the productivity of labor in different countries, different eras, and different civilizations. Feenberg's model defines technology as "neutral" on the assumption that technologies are essentially under the very same norm of efficiency in any and every context.

2. BRIEF SURVEY—HISTORICAL CONCEPTS OF TECHNOLOGY
The modern philosophies of technology discussed above draw from a framework of Western philosophic ideas. This does not imply that ancient forms of technology and technique appeared earlier in other cultures. Ellul (1964) asserted that was principally in the Near East that nontrivial techniques for manipulating the environment first developed. However, Ellul suggests that the oriental technology/techniques had very little in the way of scientific foundation, and considers the Greeks to be first to engage in coherent scientific activity and construct scientific conceptual systems.

İhde (1993) remarks that although the classical Greeks were not strong in technological advances, they produced numerous inventions, often in the field of warfare (e.g., solar mirrors that focused sunlight for starting fires on enemy ships, and machines for elevating or lowering gods on a theater stage). Note that the etymological root of the word *technology*, (i.e., *technologia*—the systematic treatment of an art), is in accord with the ancient Greek's use of technologies primarily for their aesthetics.

Subsequently, a phenomenon occurred which still astonishes historians—a philosophical approach that sought to separate human mental skills/attributes (i.e., *technique*) from the physical objects involved in the ancient technologies. Plato and Aristotle's interest in the nature of knowledge is reflected by the etymological roots of the word technology: *technologia* (*techne*–"art, craft or skill" + *ology*–"study of"). First, Plato posited that knowledge of reality comes through the unaided, inner reason of rationalism. Second, Aristotle posited that knowledge also comes through information about the outside world (Nichols, 1987). Historical trends developing around Aristotle's philosophy facilitated thinking in terms of cause and effect. This cause-effect approach to life promoted human cognitive orientations and thinking which viewed the physical environment, everything outside the mind, to be manipulable.

Cultural acquisition of this cause-effect orientation led to manipulation of the environment and development of technologies that had desirable material benefits and facilitated overall quality of people's lives. Given these obvious benefits, the Renaissance culture freely accepted and used new technologies, although their scientific grounding remained somewhat implicit (Ihde, 1993). The leading precursors of modern science focused on the external world—fascinated by technology's power over nature. (e.g., Leonardo da Vinci's ingenious designs of machines for warfare, for flying, and for travel underwater).

A contemporary manifestation of people's fascination with the power of technology is what Teich (1977) refers to as "pure technology," which is related to the building of machines for their own sake and for the pride or pleasure of accomplishment. Teich describes people's pursuit of "pure technology" to be a creative art somewhere between art and science:

"…the record-breaking vehicle, built purely to see if it will behave as intended; the chess-playing computer program, devised for the sheer entertainment of seeing how well it plays; and that masterpiece in miniature, scientific American's Great International Paper Airplane Competition."
Teich (1977)

Recall that the technology is defined in the dictionary as the _practical_ _application of knowledge especially in a particular area_, and it is debatable whether people who are engaged in such "pure technology" activities are engaged in the practical application of knowledge. Certainly they are involved in _acquiring_ knowledge and technical skills that could in other circumstances be considered practical.

Similarly, professors who acquire and apply skills used in writing articles "for their own sake and for the pride or pleasure of accomplishment" may also be pursuing a type of "pure technology." On the other hand, writing an academic article often fits the basic definition of technology since in most instances there is a _practical application_ of the systematic knowledge: career advancement. In any case, why do we tend to view the professor's work as something different from technology? Probably, because we associate technology with hardware. We have no difficulty in thinking of the professor is _using_ technology, but it is not as easily perceived that such work is intrinsically technological.

In summary, people tend not to think of technology in terms of its historical meaning (i.e., technologia—the systematic treatment of an art) or its general dictionary definition (i.e., "the practical application of knowledge" or "a manner of accomplishing a task"). This is in part due to the historical separation of _technology_ and skills associated with systematic knowledge—what in the next section we well describe as _technique_.

3. TECHNIQUE: ACTIVITY THAT IMPLEMENTS SYSTEMATIC KNOWLEDGE

The etymological root of the words _technique_ and _technical_ is the same, from the Greek _technikos_: "skillful in an art." A typical dictionary definition[1] of technique includes the following:

DEFINITION: "TECHNIQUE":
1. The manner in which technical details are treated… or basic physical movements are used…
2.   Also the ability to treat such details or use such movements: a) A body of technical methods <as in a craft or scientific research> b) a method of accomplishing a desired aim.

Thus, in contrast to the word technology which implies systematic treatment (i.e., from Greek _technologia_: "systematic treatment of an art"), technique signifies manners, ways, and capabilities involved in _implementing_ systematic technical knowledge. Thus in a general sense, technique can be any manner in which basic physical movements are used, and is sometimes associated with non-scientific activities (e.g., dance technique, flower arranging technique).

In general then, we can think of technique as a method or style of implementing systematic technological knowledge. This general definition of technique includes cultural behaviors as well as human interactions with tools and products associated with human arts, crafts, and skills.

Awareness of fast-changing techniques associated with technological change is important in maintaining effective, successful, and competitive educational systems. People with limited vision only focus on technological hardware is isolation from cognitive/behavioral techniques and associated cultural patterns. This simplistic view of technology as hardware may stem from the fact that as the functions and devices of technology increase in complexity, their internal operation becomes a marvel in itself, separate from their use and socio-cultural context. Historically, most technology and related techniques were experienced in direct connection with the goal or product of the technological process (e.g., a traditional artist learning how to construct and use different types of paint brushes understands, appreciates, and sees the connection of the paint brush technology to the finished product). However, as technology became more complex and indirect in its contribution to the goal or product, people had less direct knowledge and ability to with unexpected technical problems. For example, a university staff is given a computer database system scheduling courses and meetings, yet they are resistant and revert to word-of-mouth arrangements because they are not fully trained or aware of how to interact with the database—it's weaknesses and potentials.

Thus, instead of techniques related to understanding technical systems and their direct relationship with the environment or goal, a whole new level of human technique evolves which consists of interacting and dealing with constraints of technology (symbolic manipulations like the keyboard interactions that a graphic artist learns to use a computer art application). These kind of technical skills (i.e., techniques) have often been negative and less meaningful to people because human-machine interactions are often structured by inherent technological limitations or nonhuman aspects of the technology. Additionally, technology and related techniques involve new sociocultural structures which can be problematic in themselves.

In summary, whereas in ancient Greece technology was considered to be the study of knowledge and skills involved in specialized arts (i.e. technologia), technology and associated techniques have now permeated human culture, experience, and cognition. Strangely enough, the nature of such profound changes in human experience is difficult to be aware of and define. Nonetheless, understanding the impacts of technology and its relationship to human learning is an important factor in pursuing liberal ideals associated with a fully functioning educational system. The next section discusses how technology and technique have been ignored or misunderstood as having a compartmentalized relationship with science and machines. This superficial view of technology and technique inhibits understanding major determinants of human thinking, learning, and culture.

4. TECHNOLOGY: TECHNIQUE, SCIENCE, AND MACHINES

Techniques—Mothers of Invention
As noted above, relationships between technique (skillful thought and behavior), science (systematic knowledge), and machines were studied at least as far back as the classic Greek philosophies. A diagram showing how these concepts and relationships are viewed for the purposes of this paper is shown in Figure 1.

Pre-Modern Techniques and Technology
(systematic human behavior and tools in "natural" or primitive environments)

Scientific Knowledge
(systematic knowledge based on rationality, observation or experimentation)

Technological Instruments, Tools, Machines & Products

Modern Technique—Scientific, Sociocultural, Personal
(styles of skilled behavior involved in implementing systematic knowledge)

TECHNOLOGY IN MODERN CULTURE

Sciences—Mothers of Technology
In contrast with its Greek origins, early modern science was experimental. In the context of early modern science, an experiment: 1) used technological tools, and 2) was performed in a situation in which the natural phenomenon was controlled or put under certain constraints (Ihde, 1993). This scientific curiosity and manipulation of the environment produced technologies which can be conceived of as products of science (Fellows 1995). Thus technologies, technique, and associated products are often viewed as essentially scientific—in the sense that they are divorced from any human-oriented or socio-cultural values. This leads to the intuition that modern technology threatens humanistic ideals: "high" culture, liberal education, community, and spiritual values.

However, this view of technology as a neutral scientific force is inadequate if people want to understand and control effects on the contemporary conditions of humanity. Recall Feenberg's (1991) model which characterizes technology as a politically and culturally neutral but progressive-positive force; a "universality of truth" that is innate to instrumentality. This view is optimistic, but does not account for negative aspects of technology. For example, consider the technology of transportation. In the past transportation has utilized technology such as animal drawn vehicles, and now we have the much improved fuel consuming automobiles. We cannot, however, characterize the automobile as being "indifferent with respect to politics" or "indifferent to the variety of ends it can be employed to achieve." People who drive their car seventy-five meters to buy

something from a nearby store may be choosing an inefficient and irrational means of achieving their end (e.g., walking might take less time and be better for one's health). Similarly, use of individual automobiles instead of constructing much more efficient mass transportation systems may be relatively destructive in a sociocultural sense. The technology of war, drugs, invasion of privacy, etc. provide plenty of examples that contradict the view that technology evolves in association with inherently rational goals and means. In sum, technology and technique are often not representative of a "sociopolitical neutrality of technology" having some inherent "rational character and the universality of the truth that it [technology] embodies."

Machines—Mothers of Modern Culture

The strong connection between machines and technology reflects the fact that without machines, normal/everyday connotations of the word "technical" would not exist. For example, people are likely to include knowledge and skills connected with the use of *machines* that control fire in their concept of technology. However they are less likely to view general knowledge about controlling fire as technology (Cotrell, 1972). Nonetheless, Ellul (1964) asserts that techniques (i.e., methods for applying technical knowledge) have now become almost completely independent of machines, which lag far behind humanity's ability to implement and utilize systematic bodies of knowledge. Obviously, many techniques involving our use of systematic knowledge are implemented outside the scientific and industrial use of machines (e.g., advertising techniques, self-help techniques, negotiation techniques, and so on). Moreover, machines as well as science-oriented tools and processes are often conceived from and *depend* upon these systematic bodies of knowledge and techniques. In short, machines are now the result of technical knowledge rather than determining it. Not only are machines representative of a particular type of technical methodology, but the social and economic applications of machines are made possible by the advantages of various other types of technical methodology. Technology can be viewed as comprising heterogeneous bodies of knowledge and techniques by which, in addition to devices, man progressively masters his natural environment (Fellows, 1995). For better or worse, technical knowledge and techniques seem to have taken over most of man's activities, not just his productive activity.

This pervasive use of technical knowledge may be deeply symptomatic—a socio-cultural imperative resulting from a principle inherent in machines—due to the fact that replication of machines across culture requires human activity involving a particular set behaviors and techniques. Ellul (1964) suggested that the relationship between machine and technique penetrates to the very core of the problem of our civilization. His philosophical analysis suggests that the pervasive use techniques, born from but not necessarily directly connected to machines, results in transferring characteristics of the machine into society. In other words, the machine has influenced human culture to become more "mechanical" in some sense, because almost all things in culture (e.g., transportation, entertainment, health, sport, education, and so on) would cease to exist as we know them without the machine. Mechanization of culture is viewed negatively in part because machines are antisocial objects—they do not explicitly engage in social activities.

5. TECHNOLOGY, CULTURE, AND SOCIETY

Technology and Social Organization

Next we discuss the connection between organization and technikos (i.e., technique, technical methodology). Organization has been defined in several ways. First, Ellul (1064) describes organization as *technique applied to social, economic, or administrative life* Organization in this sense is used by almost all people to successfully accomplish their organizational or personnel goals in life.

Second, the primary *goal* of organization is to manage and accomplish objectives in an efficient and economic way. In other words, people implement organization in order to save time, money, and work.

Ideally, organization establishes standardization and the rationalization of economic and administrative life. Standardization means resolving in advance all the problems that might possibly impede the functioning of an organization (Ellul, 1964). It aids people to develop specific rules which must be applied to efficiently and effectively solve their problems in their life by people. In addition, standardization is interested in more methods and instructions than individuals. It means that people can not create their personal standardization. To be organized means to be used in a general way by a group of people. Of course, as we all know, individuals learn to use organized systems to implement their personal goals and emotional needs. Further, a culture may insert its own practices which co-opt or overlay what are nominally the system's organizational standards. In short, technikos and human nature may clash, which is a source of cultural differences: Which types of organization and technique will individuals and groups within a culture accept and participate in?

Organization is something other than technique, organized people have in a way discovered a new field of action and new methods, and that people must study organization as a new phenomenon, when it is nothing of the sort

(Ellul, 1964). On the other hand, he refuses to change his ideas about the continuity of the technical process. He believes that it is this process which is taking on a new aspect and is developing on a world-wide scale.

There are two kinds of consequences. First, mechanical technique produced the problems at the end of the application of technique. This organization which is succeeding technique is in some way a counterbalance to it, and a remedy (Ellul, 1964). It is mentioned that exactly the opposite is true. This development adds to the technical problems by offering a partial solution to old problems, itself based on the very methods that created the problems in the first place.

Second, organization as a phenomenon whose effects can not yet be seen. However, the final results is that technique will assimilate everything to the machine; the ideal for which technique strives is the mechanization of everything it encounters (Ellul, 1964). It can be said that the technical age continues to help people successfully organize their lives. For this reason, people should think of technique and organization together in an appropriate way in order to solve their problems. Thus, people must receive the advantages of organization and technique to successfully accomplish their goals in their life.

Technology and Culture

Technikos is a mental process that is associated with real world activities involving techniques or technical methodologies. Technikos as a mental trait is an aspect of culture, and the associated techniques/technical methodologies affect people's lives, behavior, communication style, and so on. Technologies can be embedded so deeply in culture that people have not acquired knowledge of the technikos and technological methodology that produced them. However, in with a deeply embedded technology, new technikos are created along with new human-technology interactions at a higher a simpler level. These new human-technology processes entail "ways of seeing"—whether or not the actual technology equals the metaphysical way of seeing—that comprise essential characteristics of a culture.

Like science, technology—which is the application of knowledge or discovery for practical use—is also a feature or product of culture (Fellows, 1995). Technology contributes to, and is determined by, its cultural environment.

Technology and Society

According to Teich (1977), the close relationship between technological and social change itself helps to explain why any given technological development is likely to have both positive and negative effects. These effects are as follows:

1. Technological advance creates a new opportunity to achieve some desired goal.
2. This requires alterations in social organization if advantage is to be taken of the new opportunity.
3. Which means that the functions of existing social structures will be interfered with.
4. With the result that other goals which were served by the older structures are now only inadequately achieved (Teich, 1977).

Consider three views on the role of technology in society. First, technology is an unalloyed blessing for man and society. Technology is seen as the mother of all progress, as holding the solution to most our social problems, as helping to liberate the individual from the clutches of a complex and highly organized society, and as the source of permanent prosperity; in short, as the promise of utopia in our time (Teich, 1977). Second, technology is an unmitigated curse. Technology is said to rob people of their jobs, their privacy, their participation in democratic government, and even, in the end, their dignity as human beings. Teich also notes that technology is seen autonomous and uncontrollable, as fostering materialistic values and as destructive of religion, as bringing about a technocratic society and bureaucratic state in which the individual is increasingly submerged, and as treating, ultimately, to position nature and blow up the world (Teich, 1977).

A third view of technology differs from the previous characterizations as ultimately good or bad. It argues that technology as such is not worthy of special notice, because it has been well organized as a factor in social change at least since the Industrial Revolution. It is unlikely that the social effects of computers will be nearly so traumatic as the introduction of the factory system in 18th-century England, because 1) research has shown that there has been no significant change in recent decades in the time period between invention and widespread adoption of new technology, and 2) improved communications and higher levels of education make people much more adaptable to new ideas and to new social reforms required by technology (Teich, 1977).

A society should respond to the opportunities produced by technology for productive and positive development. Unfortunately, societies sometimes hinder people from developing or utilizing a particular technology. For example, high level decision makers may think that the cost of a technological development is too high, or companies may conclude that some technologies will not be favorable for maximum profits.

Therefore, there is an interaction between technology or technique and society. We can see this effect anywhere in our society. For example, computer development aids society to organize work, association, company, and others to save time and money. It means that technology provides society with new opportunities to design all things well.

6. CONCLUSION

Definition and analysis of technology, it's history as well as its role in human life… to us that there is a relationship among technology, society, culture, organization, machines, technical operation, and technical phenomenon.

Educators are increasingly using technology in all aspects of their profession (e.g., creating curricula, classroom instruction, work assignments) This trend can be enhanced by educating the educator about cultural and cognitive aspects of technology and technikos, as well as the associated advantages and disadvantages related to educational and human development goals.

Since the Renaissance, modern everyday attitudes tend to freely accept and use new technologies. Technology is usually comprehended in terms of hardware and the end experiences it produces (good or bad) or its material benefits (profitable or unprofitable), rather than understanding deeper relationships between technology, human nature, and culture. What produces technology—cultural organization, human values, research and development, and so on—is less obvious and less interesting than experiencing it's products and benefits.

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THE CONSTRUCTION OF AN ONLINE COMPETITIVE GAME-BASED LEARNING SYSTEM FOR JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT
The purpose of this study aimed to construct an online competitive game-based learning system by using freeware for junior high school students and to assess its effectiveness. From the learning standpoints, game mechanisms including learning points, competition mechanism, training room mechanism, questioning & answering mechanism, tips, and feedback mechanism are taken into consideration while constructing the system. The system contains screens of Log-in, Game lobby, Waiting room, Player's room, Question & Answer, and Scoring. After the system was established, it was implemented in a 10 week teaching experiment. A total of 35 junior high school students participated in this teaching experiment. Both pre-test and post-test were administered and analyzed. A 5-point Likert scale questionnaire, containing domains of system operation, learning effectiveness, competition and incentive, and training room learning was also included to assess user's satisfaction. Descriptive analysis and independent t test were used to analyze the collected data. The findings of the study show that most students are satisfied with the four domains of the freeware constructed online competitive game-based learning system. Meanwhile, the online competitive game-based learning system is effective for junior high school students' learning.
Keywords: freeware, online competitive game-based learning, junior high school student

INTRODUCTION
In recent years, online games have grown rapidly and received an increasing attention from the educators and game-related industry (Chiang et al, 2011). Some studies indicate that online game playing has expanded its segment of media usage in our daily life. In addition, the positive effects of online game playing have been concerned and explored (Robert, 2000; Chiang et al, 2011). Game-Based Learning (GBL) is an increasingly popular learning mode in recent years (Gendron, Carron, & Marty ,2008; Jarmon et al.,2009; Johnson et al., 2009; Proberta, 2009; Şendağa & Odabaşıb, 2009), as the game-based multimedia elements, such as characters, voice and images, are combined to enhance the attention of students and foster their concentration, interest, creativity and social skills (Raessens & Goldstein, 2003). It is commonly observed that students often become addicted to computer games, especially to Internet-Based games. One major reason behind the phenomenon is that Internet-Based games are usually characterized by a communicative mode that produces a unique kind of social relationships. Given the interaction, cooperation and competition amongst individuals in the game context, people are often called upon to form virtual communities, thereby giving rise to an instant sense of belonging. In this way, suppose teaching materials are woven into the role play or cooperative tasks of the online games, with students given access to the Internet, they might make impressive progress and even achieve higher educational goals (Tuzan, 2004).

Game-Based learning (GBL) is a type of serious games that lead to positive learning performance. Its effectiveness and education potential have been confirmed in research. GBL is designed to reach a balance between game-play and teaching, and enable the players to apply their knowledge to a real environment. Different stages in the games target the single or multiple learning objectives in natural settings. Therefore, the players are learning while playing. By the time they complete the missions in the games, they also acquire the targeted skills. Despite the potential of its acousto-optic effect as an educational tool, games have a high elimination rate. If not put to proper use, they will disappear quickly from the market. Therefore, it is important to pay equal attention to education and fun in game-based learning (Kiili, 2005).

However, this study aimed to develop a competitive gaming and learning system suitable for junior high school students, by working in collaboration with education experts who are in charge of designing the teaching

materials, and with art designers that create characters and scenarios. The proposed system is similar to a commercial game system which is characterized by online multi-player competition, though eliminating problems arising from the intrinsic novel effects of GBL. Finally, in accordance with the spirit of freeware, this system will be shared with the frontline teachers of all subjects, in hopes of enhancing motivation and promoting a cooperative way of learning through GBL games.

LITERATURE REVIEW

Many scholars (Jenkins, 2002; Squire et al., 2003) suggest that the challenging, unpredictable and competitive nature of digital games is the driving force behind game-playing. A player's curiosity and motivation are stirred by their determination to challenge the various levels and prevail (Tsai et al., 2010). Interestingly, Vandale and Bingham (2000) also found that educational methods include brief lectures or discussions, video clips, and interactive activities ("hands-on" exercises) involving case studies, games, and role-playing. Students learn from their errors, and there is a high degree of interaction. In fact, a game can provide a meaningful environment for problem-based learning in so far as problem-solving in games involves striving for a remote and not immediately attainable goal. In this way, game-based learning, when it incorporates problem-solving as part of its natural environment, is deemed to have the power to improve students' abilities in this area (Kim, Park, and Baek, 2009). After all, the ability to solve problems is one of the most important of human skills (Holyoak, 1991). Prensky (2001) mentioned that a good Game-Based Learning program should include at least three components:

1. the fusion of learning activities and games;
2. a variety of interactive processes;
3. the integration of multiple teaching approaches, of which highly contextual learning is preferred.

Due to the implicit educational function, games with narrative scenarios or stories enable players to absorb knowledge unconsciously during the gaming process. Young students, attracted to these educational computer games, will develop their cognition and experience as the games unfold (Barab et al., 2005). In view of the wide-ranging social relationships built in at different levels of the games, the students could improve their social skills; for example, the children can share and help to solve the learning problems encountered by themselves or their groups. Youth often join Internet-based communities or groups during the games (Lenhart et al., 2008), and experience the interaction. Additionally, Yien et al (2011) addressed that games have been recognized as good means to promote learners' active participation in learning activities and game-based learning could be the best way to trigger students' learning motivation by many researchers. Furthermore, many studies indicate that games can help learners develop their problem-solving skills and games are easily to be accepted and closer to children (Yien et al, 2011; Lee & Chen, 2009).

Recent GBL (Game-based Learning) studies probe hitherto uncharted dimensions such as development cost and framework, integration of complex game features, quantified assessment and continuing education (Michael & Chen, 2006). The design framework (Raybourn, 2007) proposed by Raybourn is shown in Figure 1, wherein this framework is composed of four dimensions, each of which includes two interactive layers. In the internal layer, the game level is associated with the development of the scenarios and presentation of contents. The interaction of the games relies on dynamic contents and roles. Generally, stories are a major part of the common games along with scenarios and a series of challenges, which constitute the specific gaming objectives, helping the players indulge themselves quickly into the digital gaming environment. In these games, sound/visual effects, interactive objects, environment and lighting are added to strengthen the sensory input of the players (Lee & Chen, 2009). Computer Aided Instruction (CAI) is produced in such a manner that sound effects, characters, diagrams and pictures (Lee & Chen, 2007) or even cartoons are used to represent the teaching contents (Dalacostaa et al., 2009). An efficient game is designed to stimulate the players taking part in the games proactively. Through real-time assessment of feedback and after action review (AAR), it is believed that the players could gradually pick up new concepts and attitudes (Raybourn, 2007; Annetta et al., 2009).
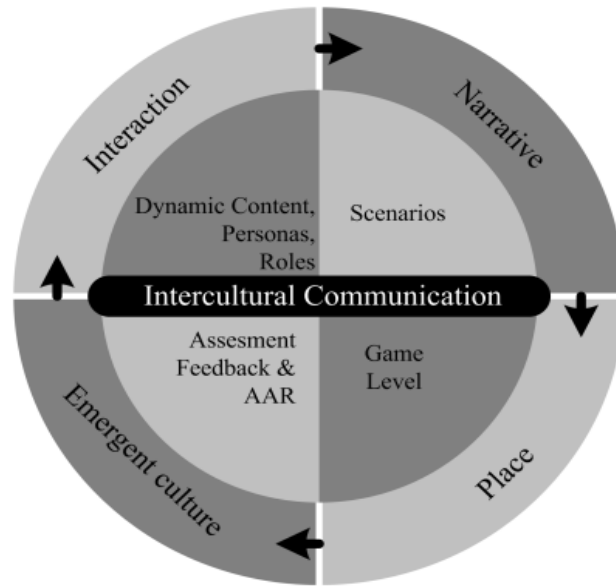
Figure 1: Design Framework of Simulated Experience

In summary, online gaming environment with educational components provides students with more in-depth and meaningful knowledge acquisition. Unlike traditional teaching methods, a successful GBL program features an ingenious design to translate the gaming experience into learning, a user-friendly graphical interface, and an effective strategy to promote participation and interaction. Actually such educational tools are already popular among well-educated elite, who are often observed to indulge themselves in games with similar features (Johnson et al., 2009).

RESEARCH METHOD

The research method of this study contained two phrases: (1) the construction of an online competitive game-based learning system for junior high school students and (2) the implementation of a teaching experiment for exploring the effect of the online competitive game-based learning system. After the construction and validation of the online competitive game-based learning system was completed, a survey questionnaire was developed and validated for assessing the students' learning effect after the experimental study was completed. SPSS statistical analyses were employed to analyze the responses to the survey questionnaire, such as descriptive analysis and independent t test.

1. The Construction of an Online Competitive Game-Based Learning System

Game Development

Two major problems are likely to arise during system development; one is mapping while the other involves Internet connection and multithreads processing. Take Windows for example, textures must be processed in conjunction with the game programming interface (DirectX) developed by Microsoft, if the development is conducted without game engines. However, the establishment of the entire window and the development of user's graphical interface must be considered as well. The game engines offered by free software online provide some very useful tools to develop games in a short time, such as 3D images, collision detection and user's graphical interface modules.

Game Engines

Table 1 shows the three widely-used and well-known game engines based on the support language C/C++ and Windows OS.

Table 1 Comparison of Game Engines

Name	Graphical API	Support language	Efficacy	Stability	Ease-of-use	Support
OGRE	OpenGL, DirectX	C/C++	80	80	70	80
Irrlicht	OpenGL, DirectX, Software	C/C++,C#, VB.NET	80	80	90	80
Crystal Space	OpenGL, Software	C/C++	90	80	70	90

Devmaster is an exchange platform of international game engines, onto which an extremely powerful retrieval system is established. When the game engines of the top three open sources are compared, it is discovered that, regardless of their respective advantages and disadvantages, they are all developed with the major purpose of saving the development time and cost. Besides, they all make great effort to be user-friendly. Due to the constraint of budget, the computer classrooms of most schools are generally equipped with all-in-one embedded devices. In the absence of independent display cards and sufficient computer capacity, the graphical API delivered by the game engines is of utmost significance. Without this support, the games cannot run smoothly, because of poor display capacity, inability to support Alpha Channel or lower FPS (Frames per second).

Internet engines
The games are often networked by 2 modes: Peer-to-Peer and Client/Server. However, no matter which mode is chosen, they can be implemented via many methods (including the RakNet network engine). Generally, the servers are equipped with computers of the quickest processing and networking speed, while the clients with other kinds of computers. Today, the files are transferred by either UDP or TCP. TCP is very efficient in file transfer, but often yields numerous transfer delays in games because of streaming (not packeting).The RakNet network engine (http://www.jenkinssoftware.com/index.html) plays the basic roles of providing a complete UDP transfer environment and helping the developers in solving problems. In such a case, the developers are only required to put their focus on the games. The RakNet network engine can provide the following assistance in game development: (1) automatically re-sending packets not successfully delivered; (2) automatically sending the packets in sequence or in order to increase transfer efficiency; (3) automatically notifying the programmer any time when the packets are tampered externally during the sending   process; (4) providing a quick and simply interface, as well as restricting unauthorized transfer; and (5) efficiently solving network problems, such as control and collection of streams.

It is time-consuming both to enable the bit streams and packets in an effective bandwidth and to provide a great number of network control functions. The RakNet network engine guarantees easier and more efficient networking with its many functions, such as remote functional calling, bit stream types, and automatic object synchronization. The network engine not only saves the development time, but also offers such functions as encryption, resources management, packet transfer and multithread management, making it possible to bring the functions of network elements into full play.

Based on the mapping and environment establishment functions offered by the Irrlicht game engine (http://irrlicht.sourceforge.net/) and the networking control functions offered by the RakNet network engine, this paper attempts to build an online competitive gaming and learning system to reduce the time and resources required for game development.

System analysis and framework
This system is an online multi-player competitive gaming and learning system. After successful logging, players can enter the gaming room, or activate a new game at their own discretion. Every game can be accommodated with 2 to 4 persons. For instance, in the Monopoly puzzle game, the chief of the gaming room can select a map, and every participant can select a role at the waiting room. The game starts after the chief and all participants press the OK button. When the game begins, every participant rolls the dice in turn. All participants must answer a question in every round. Every player is provided with coins and points. Coins are deducted only when, in order to buy land or build a house, the player chooses to answer the questions. The amount of the payment depends on the deduction resulting from performance at the Q&A session. Parameters can be set by the system administrator through a database. When walking into the premise of a competitor, the player must first answer questions as well. The payment of tolls also requires parameter setting by the system administrator through a database. When answering the questions, users can use points to call the tips in order to obtain the prompts for the item, as shown in Figure 2.
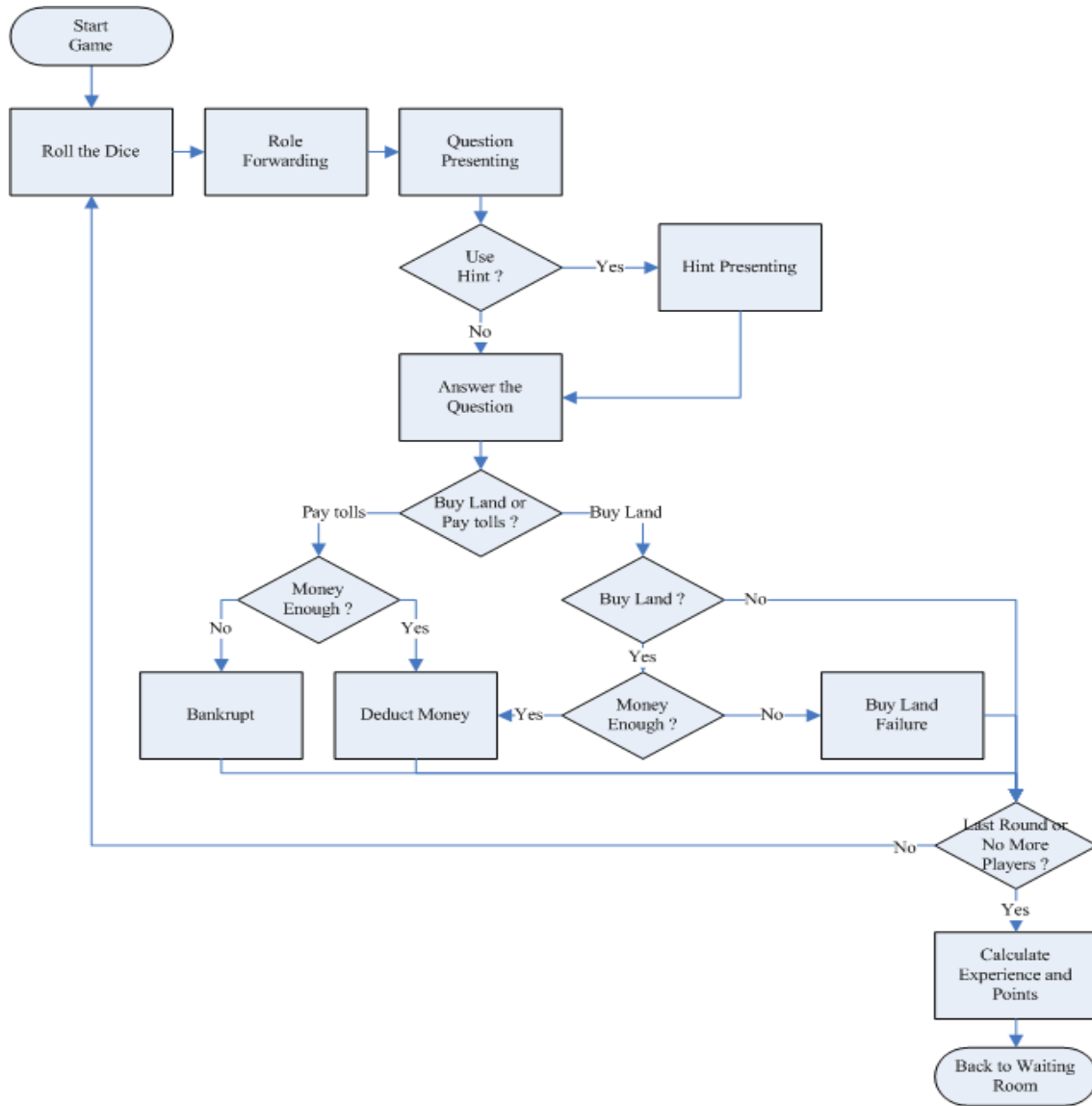
Figure 2: Flow Diagram of Games

Finally, when the preset rounds are reached, or only a single person survives as the others are bankrupt (this round is terminated forcibly), the system will calculate the number of coins or the bankruptcy sequence, and then assign the final points. This game is characterized by (1) research on learning materials: the teaching staff design and analyze the teaching items and tips to establish a large question bank, and assist the arts and program designers in planning suitable learning materials; (2) increased player interaction: the players could use points to call the tips, thus increasing the interaction of players for the fun of "learning through play"; and (3) personal training: the players may enter the personal study room if they fail to correctly answer the questions in the games. The items in the personal study room are designed by the teaching experts to ensure the credibility and effectiveness.

System framework
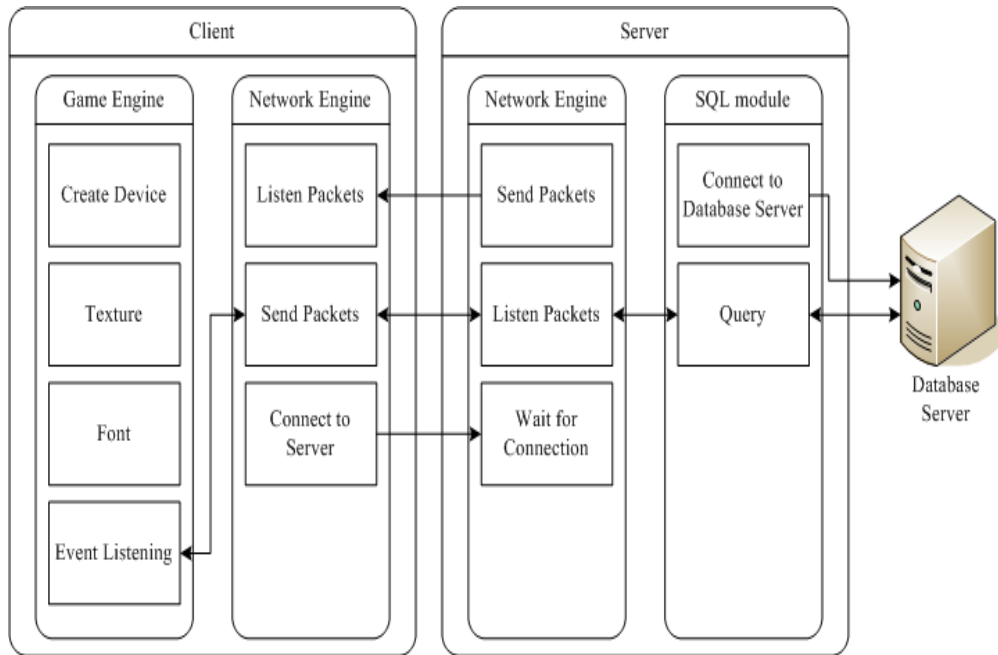
Figure 3: System Framework

The system framework is shown in Figure 3, wherein the game engine of freeware Irrlicht and the network engine of another freeware Raknet are combined integrally to build the entire system. At the user end, the game engine is responsible for creating the system window, font, texture and listening events at the user interface, while the network engine connects the user to the server and sends the packets. At the server, the network engine is responsible for transferring messages among users. In addition, the SQL module is employed to connect to the database server and query.
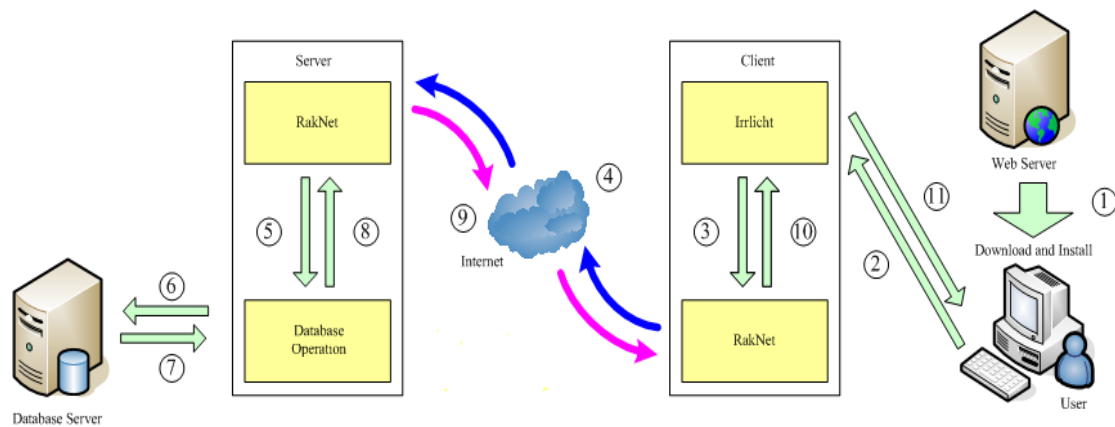
Figure 4: Flow Diagram of System Operation

Figure 4 shows the flow diagram of the game engine and the network engine in the system. Firstly, the player downloads the user system (item 1) from the website delivered by the web server, then installs it and triggers various actions (item 2) through the graphical interface presented by the Irrlicht game engine. If login verification is required, for instance, Irrlicht game engine will transfer the account and password entered by the players to the RakNet network engine for packeting (item 3), and then send the data via Internet to the server (item 4).

The packets of the server are transferred by the RakNet network engine which converts them into the corresponding format and calls the respective services. After the RakNet network engine calls the log-in verification program, the program will call the SQL module, and send a request for the player's account and password (item 5), while the SQL module is linked to the back-end database to fetch the player's account and

password (items 6, 7). After verifying and comparing the player's account and password obtained from the database with those entered by the player, the results are transferred to the RakNet network engine for packeting (item 8), when the RakNet network engine also sends the packets to the user (item 9) via the Internet. After receiving the packets, the RakNet network engine of the user converts the packets into a corresponding format, and transfers the verification results to the Irrlicht game engine (item 10), which will display the results at the graphical interface accessible to the players (item 11), thus finishing an entire verification process.

Game mechanism
(1) Learning points
In the games, every player has exclusive learning points, which can be used to call the tips during multiplayer competition. Every player can have 10 points when the account is set up for the first time. The points are obtained only through multiplayer competition, where the more competitors, the more points after the competition. The number of points obtained from competition and offered initially when setting up a new account is determined by the system administrators or the teachers through modification of parameters in the database.

(2) Competition mechanism
A multiplayer competition mechanism is added to address the dilemma created by the novel effects and raise the motivation and performance of students. After login, the players can create a gaming room for the competition among 2 to 4 persons, or join a gaming room already created by other players. In the gaming room, different representative roles can be selected and the competition is conducted by means of Monopoly. During the gaming process, every player has his/her own coins and points, of which the coins are only used to buy land, build houses and pay tolls in the games. The objects specific to every player are marked by flags of different colors. The points can be used to call the tips. The deducted number of coins and points is determined by the system administrators or the teachers through changing the variables in the database.

(3) Training room mechanism
The training room is designed for the players who are not familiar with the game interface, operating modes and gaming mechanism. A single-player gaming mode allows the player to simulate the real competition. In addition, the training room, as the name implies, highlights the exercise of individual items and acquaints the users with the learning contents. Prior to the competition, the players could do some exercises to become familiar with the contents, by means of which they will have advantage over others in the competition for the final rewards.

(4) Questioning & questioning & answering mechanism
When a player rolls dice in the game process, the system will present simultaneously the points and the animated cartoons to every player in the game room. After the cartoons come to an end, the players in this round must answer the questions extracted randomly from the database in a real-time manner. When the questions are presented, all players in the gaming room can see the contents as well as the answer given by a certain player, but cannot help him/her with it. However, the players can discuss the questions through a session system due to lack of time limitation.

(5) Tips mechanism
According to the scaffolding theory, a hint system is included to provide tips or strategies to the players when they are not familiar with the questions or need further assistance. To give the students timely assistance and fun in the games, they can call the tips if they meet difficult questions either in the training room or in multiplayer competition. Every question comes with 1 to 3 tips; the harder the question, the more tips are provided in a progressive way. In the same game room, non-players can be allowed to see the contents of and answers to the questions, but not the tips. In multiplayer competition, points of the players shall be deducted to prevent players from abusing the system to win rewards. The system is preset to deduct one point when a tip is used in a multiplayer competition. Point deduction can be determined by the system administrators or the teachers by adjusting the variables in the database, but points will not be deducted if the tips are used in the training room.

(6) Feedback mechanism
A feedback mechanism is added to this GBL system in accordance with the design framework introduced in Section 2. A round refers to a process in which every player attends the game in turn. 30 rounds are preset for every game, and the number of rounds can be altered by changing the parameters in the database. In the end of a round, a scoreboard will be presented showing the final ranking order, which is decided by the coins held by every player in the gaming room. The ranking order is also determined by the player's points and experience, which are calculated by the following formula:
Points = (total number of persons–ranking of its own) × multiplying factor of points

EXP = (total number of persons–ranking of its own) × multiplying factor of experience.

The multiplying factors of points and experience can be adjusted by the system administrators or the teachers through changing the variables in the database.

Figure 5: Screen of Game Lobby

After successful verification by the server, the player can enter the screen of the game lobby, and then select a new game (i.e., create a new multiplayer competition waiting room), or join the waiting room already established by other players (Figure 5). The newcomers may also select the training room for personal training. If the player wants to inquire about his/her accumulative online hours, number of points and experience, he/she may select personal learning information. The list of players at upper right corner of the screen shows the names and positions of all online players, of which red names represent female students whereas blue names represent male students.

Figure 6: Screen of the waiting room

In the waiting room, the upper left corner of the screen shows the current chief of the room, the lower part is a session system enabling conversation with other players in the waiting room, and the right-hand field shows the

map preview, role selection, map selection, persons selection, the "ready" button and the "back to lobby" button from top to down (Figure 6):

●   Map preview: the upper right corner shows a preview of the map selected by the chief.
●   Role selection: several roles are available for the players.
●   Person selection: in a multiplayer game, the chief may select 2 to 4 persons for the games, but the personal training room is limited to individuals.
● "Ready" button: the players must press this button after getting ready. The game will begin after all players press this button.
● "Back to lobby" button: the players can exit the waiting room and enter the game lobby by pressing this button.
●

Figure 7: Single-/Multi-player Game Screen

Figure 7 shows a game screen in operation, wherein the upper right corner displays the color of flags, nicknames, coins and points of all players; the lower right corner displays the dice rolls and rolling button, of which the rolling button can be clicked only by the player in turn.

Figure 8: Questioning & answering Screen

When the player rolls the dice and then specifies the steps, the game screen will immediately display the questions and options. The questions and options are selected randomly from the database of the server by the

teachers or administrators from the specified subjects and chapters, and then transferred to the players. At the same time, other players in the same game room can see these questions and options, though without the right to answer the questions. The questions are generally categorized into textual and multi-media ones. Figure 8 is a multimedia screen. The players can answer questions by clicking the options below. After verification by the server, the circles and cross dots below the options will show whether the answers are correct.

Figure 9: Calculation Screen

As shown in Figure 9, when the number of rounds displayed on the rounds billboard is reset to zero, the system will decide the ranking and points based on the remaining coins of every player. After confirming the result, the player presses the OK button and returns to the waiting room.

2. The Implementation of Teaching Experiment
Participants & research instruments
The participants of this study were 35 junior high school freshman students (17 males and 18 females). The online competitive game-based learning system was employed for 10 week teaching experiment. The pretest and posttest were conducted in the beginning and the end of the teaching experiment in order to assess students' learning performance. Descriptive analysis, independent t-test, and paired t-test were performed to analyze the collected data.

Development of the Game-based learning Survey Questionnaire
The initial questionnaire contains 21 questions and the content of the questionnaire was constructed and revised based on the literature review and Csikszentmihalyi's Flow theory (1975). Five-point Likert scale was used in the questionnaire (5=strongly agree, 4=agree, 3=neutral, 2=disagree, and 1=strongly disagree). The content validity of the survey questionnaire was established by five scholars and experts in the game-based learning related fields. After the content validity was established, the questionnaire was sent to 30 students for pilot study. The responses to the questionnaire were analyzed by item analysis and factor analysis. As a result, the formal questionnaire contains 19 questions with 4 categories of "System operation," "Learning interest and performance," "Competition and incentive," and "Training Room." The questionnaire obtained .925 of Cronbach alpha value, indicating a high reliability of the questionnaire.

RESULTS AND DISCUSSIONS
Results of descriptive statistics of the questionnaire
Table 2 shows the statistical results of descriptive analysis of the survey questionnaire. A total of 35 students with 17 males and 18 females responded to the survey questionnaire. The results also show that 23 students (65.7%) had prior online game playing experience.

Table 2: Results of descriptive analysis of the questionnaire

Variable	Category	Number	Percentage
Sex	Male	17	48.6%
	Female	18	51.4%
Prior online game playing experience	Yes	23	65.7%
	No	12	34.3%

Statistical results of independent t-test of the survey questionnaire
The statistical results of independent t-test show that there are no significant differences between the gender and the effectiveness of game-based learning on the whole questionnaire and the four categories of the questionnaire (t=1.586, p=.122> .05; t=1.556, p=.129>.05; t=1.434 p=.161>.05; t=1.461, p=.154>.05 respectively).

Table 3: Results of independent t-test of the survey questionnaire

Variable	Male (n=17)		Female (n=18)		t	p	95% CI	
	M	SD	M	SD			LL	UL
The whole	79.12	6.14	75.78	6.30	1.586	.122	-.944	7.623
I. System operation	20.41	1.58	19.61	1.46	1.556	.129	-.246	1.848
II. Learning interest and performance	25.88	3.04	24.50	2.66	1.434	.161	-.579	3.344
III. Competition and incentive	17.76	1.56	17.00	1.53	1.461	.154	-.300	1.830
IV. Training room learning	15.06	1.89	14.67	1.97	.601	.552	-.936	1.720

Table 4 shows that results of t-test on the prior online game playing experience, indicating the effect of game-based learning would not be affected by the factor of prior online game playing experience.

Table 4: Results of t-test on the prior online game playing experience on the survey questionnaire

Variable	YES (n=23)		NO (n=12)		t	p	95% CI	
	M	SD	M	SD			LL	UL
The whole	77.83	6.79	76.58	5.63	.991	.329	-1.076	3.120
I. System operation	20.04	1.82	19.92	0.90	.991	.329	-1.076	3.120
II. Learning interest and performance	25.52	3.15	24.50	2.32	.778	.442	-.708	1.585
III. Competition and incentive	17.52	1.56	17.08	1.62	-.500	.620	-1.745	1.057
IV. Training room learning	14.74	1.89	15.08	2.02	.543	.591	-3.416	5.901

Statistical results of paired t-test of the survey questionnaire
Table 5 shows the statistical results of paired t-test of the survey questionnaire, indicating the scores of the posttest were significantly higher than the pretest on the four categories of the survey questionnaire. In other words, the students made significant progress after the 10-week teaching with using the online competitive game-based learning system.

Table 5: Results of paired t-test of the online competitive game-based learning survey questionnaire

Statement	Pre Test (n=35)		Post Test (n=35)		Sig. (2-tailed)
	M	SD	M	SD	t-test
The whole questionnaire	59.77	3.62	77.40	6.36	-15.99[***]
I. System Operation	16.03	1.36	20.00	1.55	-13.37[***]
1. I know how to play this game very quickly.	3.37	0.60	4.17	0.51	-8.10[***]
2. I find this game software very interesting.	3.06	0.34	4.03	0.30	-15.03[***]

3. I find it is easy to operate this game.	3.09	0.45	4.06	0.42	-12.69***
4. The game displays and steps are clear and easy to understand.	3.34	0.54	3.91	0.37	-6.06***
5. The tips are helpful.	3.17	0.62	3.83	0.45	-6.58***
II. Learning Interest and Performance	19.29	1.98	25.17	2.90	-11.36***
6. I find I like "Comprehensive Subjects" better when learning through online games.	3.14	0.49	4.17	0.51	-10.71***
7. I'm expecting such online competitive game-based materials in the next unit of "Comprehensive Subjects."	3.40	0.55	4.20	0.47	-7.48***
8. I'm eager to attend this online competitive game-based course after class or school.	3.17	0.45	4.11	0.72	-8.16***
9. I hope to learn other subjects through the same kind of online games.	3.17	0.45	4.29	0.46	-11.31***
10. I will recommend such online competitive game-based courses to my friends.	3.14	0.43	4.17	0.71	-8.61***
11. I think online competitive game-based learning can improve my performance.	3.26	0.51	4.23	0.49	-8.66***
III. Competition and Incentive	12.00	1.21	17.37	1.57	-15.88***
12. I find it more interesting to learn the subjects through online competitive games	3.09	0.37	4.29	0.46	-13.36***
13. I feel stressful because I'm afraid that I might have poor performance in the games.	2.66	0.54	4.31	0.47	-12.82***
14. Online competitive games enable continuous learning.	3.11	0.53	4.43	0.56	-11.50***
15. The points-based incentive system is also a contributing factor to continuous learning.	3.14	0.43	4.34	0.48	-10.48***
IV. Training Room	12.46	1.40	14.86	1.91	-8.52***
16. The training room provides me with diversified learning methods.	3.09	0.51	3.71	0.52	-6.80***
17. The training room is helpful to my learning.	3.09	0.45	3.74	0.56	-8.07***
18. I will often use the training room to win the games.	3.17	0.51	3.69	0.53	-5.41***
19. The training room is a contributing factor to my success in learning.	3.11	0.47	3.71	0.57	-5.88***

Note: *df*=34. ***$p<.001$.

According to the statistical results in Table 5, the 5 items in the category of System operation obtained mean scores ranging from 3.83 to 4.17, indicating the students are satisfied with the system operation of the online competitive game-based learning system and are interested in the interface of the system. In the category of Learning interest and performance, the 6 items obtained mean scores ranging from 4.11 to 4.29, indicating the students expect that other subjects can be learned through the online competitive game-based learning system and agree that their learning interest and performance are enhanced and improved by using the online competitive game-based learning system. In the category of Competition and incentive, the four items obtained mean scores ranging from 4.29 to 4.34, indicating the competition mechanism in the online competitive game-based learning system can effectively motivate the students' continuing learning willingness. Finally, the four items in the category of Training room learning obtained mean scores ranging from 3.69 to 3.71, indicating the training room mechanism can effectively assist the students in learning through online competitive game-based learning system and is helpful for learning other subjects.

In summary, easy-operating interface of the online competitive game-based learning system can influence the students' motivation of use. Additionally, a game with competition and incentives can increase the students' learning interests and effect. In particular, the Training room is helpful for the students in subject learning. As a result, an online competitive game-based learning system can effectively enhance the students' learning motivation and effectiveness.

CONCLUSION AND SUGGESTIONS

CONCLUSION

This study primarily aimed to establish an online competitive game-based learning (GBL) system for junior high school students as well as to verify its effectiveness. The online competitive game-based learning system was constructed through a series of sound technical process, including game engine, internet engine, and SQL module. The features of the game mechanism of this online system contain learning points, competition mechanism, training room mechanism, questioning & answering mechanism, tips mechanism, and feedback mechanism. Particularly, the competition mechanism can effectively enhance the students' learning interests, performance, and willingness to learn continuously as supported by Tsai et al, 2010). Additionally, according to the students' responses to the survey, the questioning & answering, tips, training room, and feedback mechanisms also important and effective for students to practice, gain problem-solving skills and improve their knowledge and skills (Kim, Park, & Baek, 2009). Regarding the operation of the online game-based learning system, an easy-operating and user-friendly interface influences the users' learning motivation and willingness. As a result, a sound and effective online competitive game-based learning system should contain functions or mechanisms of training room, tips, questioning and answering, and feedback in order to improve the user's learning interests and performance.

SUGGESTIONS

A qualitative approach with in-depth interviews should be employed to the online competitive game-based learning system in order to understand the user's opinions and suggestions in details and for further improvement of the online learning system. Additionally, the results of the survey cannot be generalized because there were only 35 junior high school students participated in this study, which is also the limitation for the study. Thus, more students may be invited to participate in future studies or teaching experiments may be conducted in order to validate and confirm the findings of this study.

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THE EFFECT OF BLENDED LEARNING MODEL ON HIGH SCHOOL STUDENTS' BIOLOGY ACHIEVEMENT AND ON THEIR ATTITUDES TOWARDS THE INTERNET

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ABSTRACT
The present study aims to determine the effect of the blended learning model on high school students' biology achievement and on their attitudes towards the Internet. Among the experimental models, the pretest-posttest control group model was used in the study. The study was carried out with 107 students (47 of whom were in the experimental group, and 60 of whom were in the control group) attending Nevzat Ayaz Anatolian High School in Diyarbakır in Spring Term of the academic year of 2009-2010. In the experimental group, the courses were taught based on the blended learning model via a website (www.e-biyoloji.net), while in the control group, the courses were taught based on traditional teaching methods. An Internet Attitude Scale ($\square$=0,97) and an achievement test of 40 questions (KR-20=0.88) were used as the data collection tools. For the analysis of the data, mean scores, independent t-test and paired samples t-test were used. The research results revealed that the blended learning model contributed more to the students' biology achievement than traditional teaching methods did and that the students' attitudes towards the Internet developed statistically significantly.

INTRODUCTION

In this information age, it is inevitable to witness technology use in educational settings. Teachers working in educational environments show great efforts to provide students with information by using effective technology-based methods. Parallel to these efforts, students become more qualified. In this way, students are supposed to be Internet literate or computer literate to obtain the information they need. Students can reach the necessary information not in traditional classrooms – used since Aristotle – but in their houses and even on holiday. In other words, with the use of educational technologies, learning becomes constant. Thus, most schools in developed or developing countries try to adapt their education systems to communication technologies. Therefore, educational technologies are used effectively by instructors in educational settings and will continue to be used in future as well (İşman, 2008).

Since the moment information and communication technologies were used for the first time, there have been great developments in this field. Education given via tools such as letters, videos, cassettes and television is called "distance education". In other words, distant education is defined as a type of education in which the distance between the learner and the instructor is emphasized and in which technology is intensely used (Kaya, 2002). In recent years, the spread of computer use, developing Internet technologies and faster Internet connections have all allowed a great deal of distance education to be given in educational settings via the Internet. Therefore, while naming such educational settings, instead of the concept of distant education that rather defines a larger area, the concept of "e-learning" that defines distant learning environments in which Internet and network technologies are used for the presenting and receiving the content is used (Horton, 2002). The development and spread of Internet technologies accelerated the process in education, and in recent years, with the increasing number of schools and institutions giving education via the Internet, the concept of e-learning has entered in our lives (Çallı, Torkul and Taşbaş, 2003).

Despite all these rapid developments, face-to-face instruction has never lost its popularity. In addition, distant education and e-learning methods have never taken the place of face-to-face instruction. One of the reasons for this the student-teacher interaction achieved in face-to-face instruction can not be achieved in distant education or in e-learning applications. Such an interaction seems to be a must for permanent learning and for the teacher's control over this activity (Şimşek, 2009). On the other hand, in face-to-face instruction, individualization has stayed in the background (Bonk and Graham, 2004). Similar to traditional face-to-face learning environments, there are several limitations of e-learning environments. This fact led to the idea of the blended learning approach, which brings two teaching approaches together correcting their deficiencies: one has been used for ages and the other has a history of quarter century long (Balcı, 2008).

There are a number of definitions of blended learning. These definitions were gathered by Graham, Allen and Ure (2003) under the following three headings:

1. Combining instructional modalities,
2. Combining instructional methods,
3. Combining online and face-to-face learning (cited by Graham 2006).

Because the first two of these definitions are tools quite comprehensive, they cover almost all the teaching systems. The third definition, which draws researchers' attention to blended learning, brings two such different learning models together as online learning and face-to-face learning (Graham 2006).

One of the widely-accepted definitions of blended learning was proved by Singh and Reed (2001). According to their definition, blended learning is the transfer of "right" skills to the "right" person at the "right" time by matching the "right" learning technologies with the "right" learning style for the purpose of achieving the learning objectives. According to another definition, blended learning means combining the strong and advantageous aspects of web-based learning with those of face-to-face learning (Horton, 2002; Osguthorpe and Graham, 2003).

Use of the blended learning approach is based on the following assumption: along with the benefits of face-to-face interaction between student-student and of face-to-face interaction between student-teacher, there are a number of benefits of online learning as well. In blended learning, the purpose is to establish a balance between online learning and face-to-face learning. The balance between face-to-face learning and online learning may change from one course to another. Due to the basic features of some courses, face-to-face learning is used more, while in other courses online learning is used more. Still in another course, both learning methods are equally used (Osguthorpe and Graham, 2003).

There is no simple formula for establishing a well-blended learning environment. The point to consider is to find a combination of the most effective and sufficient methods appropriate to the content and to the individual learning objectives. The important thing is not to choose the newest method according to the traditional method but to create a learning environment functioning as a whole (Neumeier, 2005).

Mc Campell (2001) emphasized that blended learning is a good approach for those who will include online applications in their current curriculum for the first time and that some parts of the course could be transferred into the online environment without executing the course fully on online basis. By avoiding complexity in online environment as much as possible, activities appropriate to students' computer skills should be included in the curriculum. Otherwise, students may get confused and demoralized (Silwerwood, 2007).

There should be a clear relationship between the methods used in blended learning. The course should not seem like different activities forced together. Different methods used should complement one another without ruining the whole. For instance, theoretical parts of a course could be presented on face-to-face basis, while visual elements could be presented on online basis (Silwerwood, 2007; Precel, Alakalai and Alberton, 2009).

Presenting the course content via the Internet could be effective in terms of the transfer of information, yet this can not assure that students will participate in the course and learn in this way. Therefore, importance should be given more to interaction than to the transfer of information in online environment. By assigning simple academic tasks (summary, analysis) to be carried out by students and by creating discussion forums via which they can discuss with each other and with their teachers, interaction can be achieved in online environment (Sands, 2002).

Researchers stated that blended learning has certain advantages such as flexibility and comfort in the learning environment, increase in the level of learning, increase in permanence in learning, increase in interest in learning, good-quality interaction and low cost (Garnham and Kaleta, 2002; Young, 2002; Collins, 2003).

The importance of blended learning has increased in recent years due to its advantages. The American Society for Education and Development defined blended learning as one of the top ten trends in the knowledge delivery industry (Rooney, 2003; cited by Graham, 2006). Young (2002) stated that the blended learning model has been the best and unique trend so far in higher education and that in near future, the number of blended courses executed in higher education will increase in a way to cover 80-90% of all the courses.

The ability of computers to present information visually is especially important for biology course. Well-developed pictures, three-dimensional models, animations and interactive environments allow easily understanding the learning objectives (Çömlekçioğlu and Bayraktaroğlu, 2001). The importance of using the Internet and computers is gradually increasing in terms of the course of biology. Activities carried out during the usual course hour are not sufficiently effective because of time constraints. With the blended learning model, students are able to carry out multimedia applications – which can not be sufficiently taught during lessons - via the Internet. In addition, ability to see the course content before coming to the class enables students to learn the research subjects and thus to come to the class as prepared for the lesson. Students can discuss important subjects in the Internet environment (in forums) and establish communication both with their teachers and with other students.

With the use of the blended learning model in a biology course, students' academic achievement levels and their attitudes are expected to develop. When related literature is reviewed, it is seen that there studies demonstrating that students trained in the blended learning environment are more successful than those trained in the traditional face-to-face teaching environment. In one study designed with the pretest and posttest control group model and carried out with a total of 312 teacher candidates from 3 different universities, Aladejena (2009) applied the blended learning model in teaching the subject of evolution. The results obtained revealed that there was no significant difference between pretest scores; on the other hand, the results also revealed that there was a significant difference between the posttest scores in favor of the experimental group. In another study conducted by EL-Deghaidy and Nouby (2008), a cooperative-based blended e-learning environment was used. In the study carried out with 26 teacher candidates, there was an experimental group and a control group. The findings obtained demonstrated that the post-test mean scores of the teacher candidates in the experimental group were higher than those of the teacher candidates in the control group. Another study carried out by Pereira et. al. (2007), the blended learning model was used for teaching the course of human anatomy. The study was carried out with 1st grade biology students from Pompeu Fabra University (Barcelona). There were 69 students in the experimental group and 65 students in the control group. In the experimental group, the blended learning model was used, while in the control group, the traditional teaching method was applied. At the end of the study, it was revealed that there was a significant difference (6.3 - 5.0; $p < 0.0001$) between the mean scores of the two groups in favor of the experimental group and that the rate of passing the course was higher in the experimental group (%87.9 - %71.4; $p < 0.02$). In another study conducted by Eşgi (2005), the students in the first group were provided only with the website designed, those in the second group with a printed material besides the website designed, and those in the third group with the printed material, the website designed and a face-to-face instructional support. At the end of the study, the third group covering the features of the blended learning model was the most successful group.

Researchers stated that in web-based applications, students' Internet attitudes and self-efficacies were important variables that are likely to effect the application process (Hill and Hannafin, 1997; Joo, Bong and Choi, 2000; Tsai and Tsai, 2003; Yi and Hwang, 2003). In one study, Şimşek (2009) examined the influence of the blended learning model on physics teacher candidates' attitudes towards web-based, computer-based and Internet-based instruction. The study was carried out within the scope of the course of Modern Physics Instruction. In order to determine students' attitudes towards web-based, computer-based and Internet-based instruction, a pretest was applied to the students before the application, while after the application, a posttest was applied to determine where there was a change in the students' attitudes. The study was conducted twice in the academic years of 2007–2008 and 2008–2009 by using the same scales. In the first application, the study group included 21 students, while the study group in the second application employed 29 students. The results of the study revealed that in both applications, the blended learning model significantly and positively influenced the physics teacher candidates' attitudes towards web-based, computer-based and Internet-based instruction.

In recent years, the number of blended learning applications has increased in America and Europe. In our country, there are only a few studies conducted in this field. It is seen that studies carried out were carried out mostly in higher education. This study is important since it tries to demonstrate that blended learning is effective in secondary education as well. As a result of the review of the related literature, no blended learning application carried out in the field of biology teaching in secondary education was seen. The present study is believed to be leading one in the field. In this respect, the study conducted tried to determine the effect of the blended learning model on students' biology achievement and on their attitudes towards the Internet.

METHOD
In the study, among the experimental models, the pretest-posttest control-group model was used. The study was carried out with 107 students attending Nevzat Ayaz Anatolian High School in different classrooms (9-A, 9-C, 9-D, 9-E) in the Spring Term of the academic year of 2009-2010. The classrooms constituting the study group

were determined on random basis. The classrooms to constitute the experimental group and those to constitute the control group were determined randomly as well. Thus, the classrooms of 9-A and 9-C constituted the experimental group, and the classrooms of 9-D and 9- E constituted the control group. In the experimental group, a total of 13 students who did not participate either in the data collection process or in the activities carried out via the Internet were not included in the data analysis process. As a result, there were 47 participants in the experimental group 60 participants in the control group. In the experimental group, the lessons were taught via the blended learning model, while in the control group, the lessons were given via the traditional method.

Data Collection
Biology Achievement Test
In order to measure the students' achievement in the lesson unit of "Classification of Living Things and Biodiversity" in the 9th grade biology course, an achievement test appropriate to the knowledge and comprehension steps in the cognitive domain was developed considering the gains within the Biology Course Curriculum prepared by the Ministry of National Education. For the purpose of developing the achievement test, a trial pretest including 50 questions was developed by referring to related studies in literature (Yıldırım, 2000; Çardak, 2002; Akaya et. al., 2009). This trial pretest was applied to 120 10th grade students attending Nevzat AYAZ Anatolian High School. Following this application, the items of the achievement test were analyzed. As a result of the analysis of the items, 4 items with the item discrimination index of 0,18 were used by make corrections within the question roots and choices, while those with the item discrimination index lower than 0,2 were excluded. Eventually, the achievement test included 40 items. The average difficulty of the test was calculated as 0.503. In addition, the achievement test was examined by 2 biology teachers and 2 faculty members in the department of biology education at a university. In line with the suggestions of the 2 biology teachers and 2 faculty members, the necessary corrections were made, and the achievement test was finalized. The KR-20 reliability coefficient of the achievement test was calculated as 0,88. For the evaluation of the multiple-choice questions prepared, no point was given to the wrong responses, while the correct responses received a point of 1.

Internet Attitude Scale
The Internet Use Attitude Scale (IUAS) developed by Tavşancıl and Keser (2002) was made up of six sub-dimensions. There were 7 items in the sub-dimension of Internet Use in Education ($= 0.77$), 7 items in the sub-dimension of Internet Use for Research ($= 0.76$), 4 items in the sub-dimension of Internet Use for Social Interactions ($= 0.73$), 4 items in the sub-dimension of Enjoying Internet Use in Education ($= 0.77$), 4 items in the sub-dimension of Internet Use for Communication ($= 0.64$) and 4 items in the sub-dimension of Internet Use for Information Sharing ($= 0.70$). The Cronbach-alpha value for the scale in general was found as 0.89. The scale included a total of 31 items. Among these 31 items, 6 of them were negative, and 25 of them were positive items. The scale was a 5-point likert-type scale. The responses to be given to the items regarding Internet Use Attitudes in the scale would receive scores as 5 points referring to 'I completely agree', 4 points referring to 'I agree', 3 points referring to 'I am not certain', 2 points referring to 'I disagree' and 1 point referring to 'I completely disagree'. In the present study, the Cronbach-alpha value calculated for the whole scale was found as 0,97. The Cronbach-alpha values for the sub-dimensions of the scale were calculated as follows: 0,95 for the sub-dimension of Internet Use in Education; 0,89 for the sub-dimension of Internet Use for Research; 0,85 for the sub-dimension of Internet Use for Social Interactions; 0,84 for the sub-dimension of Enjoying Internet Use in Education; 0,83 for the sub-dimension of Internet Use for Communication; and 0,87 for the sub-dimension of Internet Use for Information Sharing.

Application
The application was carried out in the biology course for the lesson unit of "Classification of Living Things and Biodiversity" in the Spring Term of the academic year of 2009-2010. The application process lasted 11 weeks. In order to create the online dimension of the blended learning environment, a web site was designed by using Moodle LMS (www.e-biyoloji.net). Before the applications started, the pretest was applied to both groups. Before the application, the students in the experimental group were trained in two-course hours. During this training, first, the students in the experimental group were informed about the blended learning model and about what they were expected to do. Secondly, the website was introduced to the experimental-group students via the Internet with the help of a computer connected to a projector in the classroom. They were demonstrated in practice how to sign up the website and what to pay attention to while following up the activities. In the experimental group, while teaching the lessons, a balance between the face-to-face and online environments was established as appropriate to the objectives of the lesson. Before coming to the classroom, the students prepared themselves for the lesson by examining the summary of the subject, the visual presentation (in video format), the videos and animations related to the subject, the dictionary and the other related links via the Internet. In addition, for each subject, they were given an assignment (homework) that they were supposed to search for before coming to the classroom. The students were asked to bring the research assignments to the classroom.

Also, they were allowed to send their homework online. It was announced to them that they were expected to allocate at least 1 hour a week to carry out the activities presented via the Internet. The research assignments were presented and the subject was taught in the face-to-face setting via the question and answer, discussion methods. The teacher evaluated the activities carried out via the Internet with the help of a computer in the classroom and clarified the points that were not understood by the students. Furthermore, at the end of each subject, a quiz to be responded to by the students regarding that subject was included, and a forum environment for discussing the points that the students did not understand was designed. Without first completing one subject, access to another one was not allowed.

In the control group, the lessons were taught via the face-to-face learning in the classroom environment. Following the application, posttests were applied to both groups.

Table 1. The Application Schedule

Week	Application	
	Experimental Group	**Control Group**
1	Training for introducing blended learning	-
2	Application of the Internet Attitude Scale and the Biology Achievement Test as a pretest	
3	Via the website designed as appropriate to the blended learning model, the subjects of Classification of Living Things – Classification Steps – Binominal Nomenclatur were taught.	With the help of the traditional teaching methods (presentation, question-answer, and discussion), the subjects of Classification of Living Things – Classification Steps – Binominal Nomenclatur were taught.
4	The subject of Bacteria and Archaea was taught via the blended learning model.	The subject of Bacteria and Archaea was taught via the traditional teaching method.
5	The subject of Protista was taught via the blended learning model.	The subject of Protista was taught via the traditional teaching method.
6	The subject of Fungi was taught via the blended learning model.	The subject of Fungi was taught via the traditional teaching method.
7	The subject of Plants was taught via the blended learning model.	The subject of Plants was taught via the traditional teaching method.
8	The subject of Animals-Invertebrates-Chordata was taught via the blended learning model.	The subject of Animals-Invertebrates-Chordata was taught via the traditional teaching method.
9	The subject of Animals-Vertebrates was taught via the blended learning model.	The subject of Animals-Vertebrates was taught via the traditional teaching method.
10	The subject of Biodiversity was taught via the blended learning model.	The subject of Biodiversity was taught via the traditional teaching method.
11	Application of the Internet Attitude Scale and the Biology Achievement Test as a posttest	

The features of the website used in the application were as follows:

1. All the students signed up the website by providing the necessary information and were given a user name and a password. They used their own user names and passwords to sign in the system. After they signed in the website, they saw the home page (Figure 1). The home page included the unit headings and the list of the active courses. On the right bottom side of the home page was a list of active online users. In addition, the home page also included a calendar and contact information about the researcher.

2. After the students started the course on the website, they met the course screen made up of a number of parts (Figure 2). The lesson page was designed as appropriate to the weekly outline. Thus, before coming to the classroom, in line with the curriculum of the course, the students were able to examine the content related to the subject to be taught that week. On the course screen, the students were given information about the attitudes they were expected to show during the application and the method used. In addition, the course screen included a forum for the announcements made about the lesson. The students were able to see these announcements on the right side of the course screen under the heading of latest news. In order to create a more permanent and effective learning environment while presenting the subjects, techniques appropriate to different learning styles were used. The students were able to follow up the subjects via the summary page, presentations in video format, animations and different websites related to the subjects (Tubitak, Wikipedia and so on). In addition, there were parts for image galleries, a dictionary, quizzes, research subjects and a forum.

3. The system allowed determining the students' sign in and sign out time for the website, the activities they carried out and the duration of the time the students spent on the activities. Such information provided the teacher with the opportunity to warn the students about applications that need to be made.
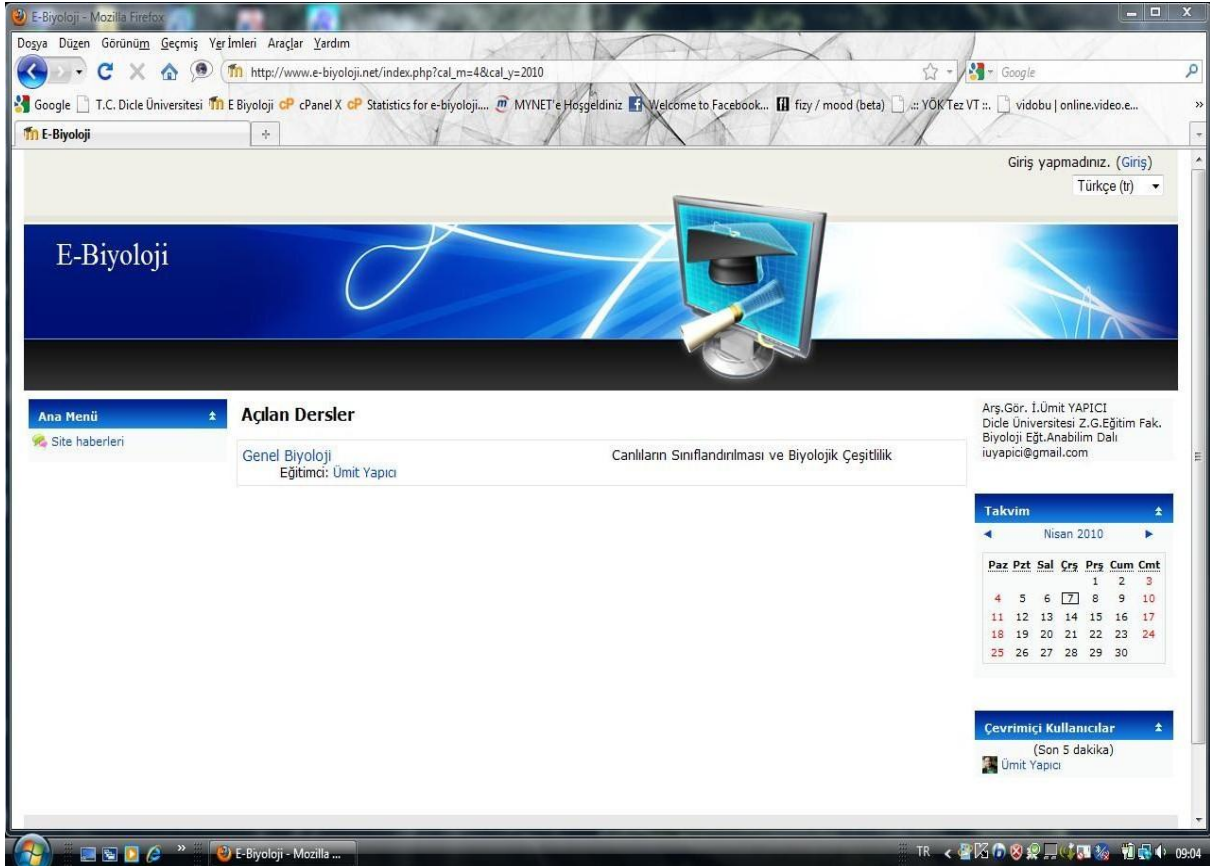

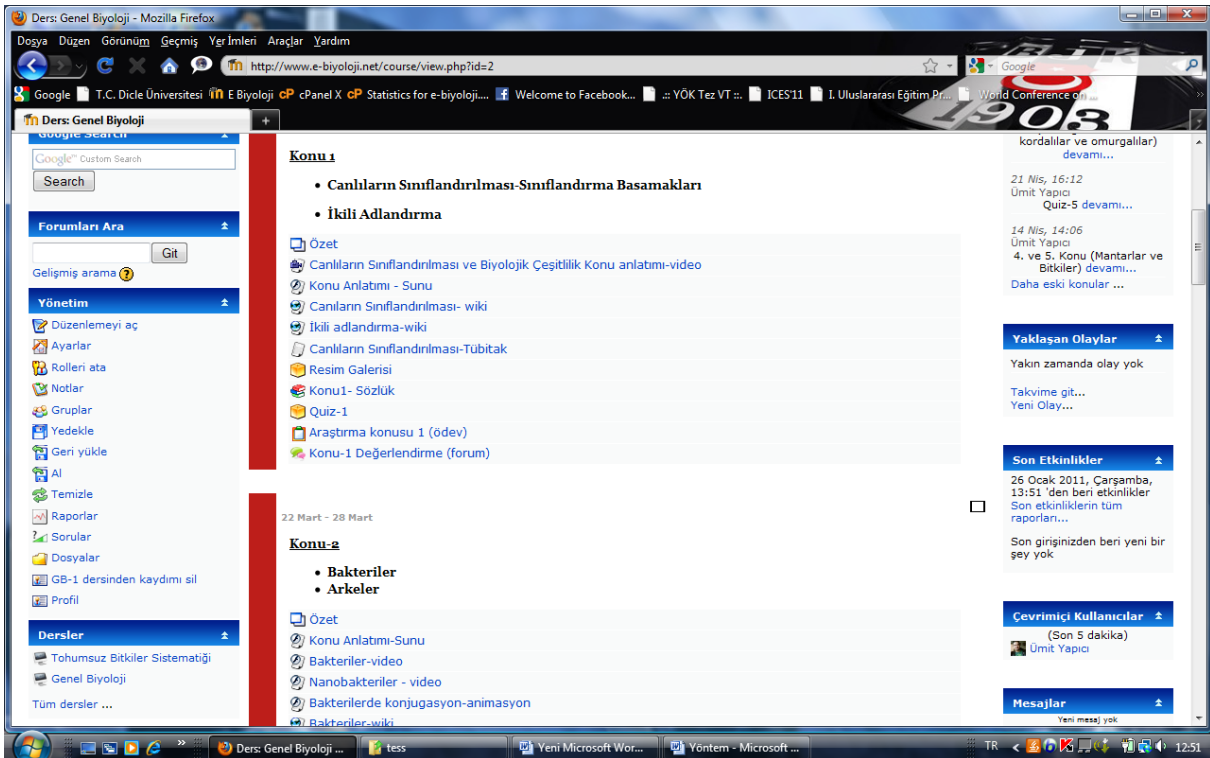**Figure 1.** Homepage Screen of Website

Figure 2. Course Screen

FINDINGS
1. Findings Regarding Biology Achievement
1.1. Findings Regarding the Achievement Test Pretest Scores of the Experimental and Control Groups
In order to find out whether there was a difference between the knowledge levels of both groups during the application, the pretest scores of the two groups were analyzed via the independent groups t-test. The findings obtained are presented in Table 2 below.

Table 2. Comparison of the Achievement Test Pretest Scores of the Students in the Experimental and Control Groups via the Independent Groups T-test

Groups	N	$\overline{X}$	sd	df	t	p
Experimental	47	11.77	3,957	105	0.445	0.657
Control	60	11.47	3,005			

When Table 2 is examined, it is seen that there was no significant difference ($t_{(105)}$ = 0.445, p >.05) between the achievement test pretest score of the experimental group ($\overline{X}$ = 11.77) and that of the control group ($\overline{X}$ = 11.47). Depending on this, it could be stated that the students in the experimental and control groups had similar levels of knowledge before the application was started.

1.2. Findings Regarding the Achievement Test Posttest Scores of the Experimental and Control Groups
At the end of the application, in order to find out whether there was a difference between the achievement levels of the two groups, the posttest scores of the groups were analyzed via the independent groups t-test. The findings obtained are presented in Table 3 below.

Table 3. Comparison of the Achievement Test Posttest Scores of the Students in the Experimental and Control Groups via the Independent Groups T-test

Groups	N	$\overline{X}$	sd	df	t	p
Experimental	47	25.11	5,040	105	7.958	**.000**
Control	60	19.08	2,657			

When Table 3 is examined, it is seen that there was a significant difference ($t_{(105)}$ = 7.958, p <.05) between the achievement test posttest score of the experimental group ($\overline{X}$ = 25.11) and that of the control group ($\overline{X}$ = 19.08) in favor of the experimental group. Depending on this result, it could be stated that the activities carried out on the basis of blended learning were more effective on students' achievement than the traditional teaching method.

2. Findings Regarding Students' Attitudes towards the Internet
2.1. Findings Regarding the Experimental Group Students' Pre-Application and Post-Application Scores in the Internet Attitude Scale
In order to determine whether there was a difference between the experimental group students' scores regarding their Internet attitudes before and after the application, paired samples t-test was applied to the pre-application and post-application scores of the Internet attitude scale. The findings obtained are presented in Table 4 below.

Table 4. Comparison of Experimental Group Students' Pre-application and Post-application Scores of the Internet Attitude Scale via the Paired Samples t-test

Experimental Group	N	$\overline{X}$	sd	df	t	p
Pre-application	47	3.60	1.054	46	-2.560	**0.014**
Post-application		3.97	0.929			

When Table 4 is examined, it is seen that there was a significant difference ($t_{(46)}$ = -2.560, p <.05) between the experimental group students' pre-application scores ($\overline{X}$ = 3.60) and their post-application scores ($\overline{X}$ = 3.97). Depending on this result, it could be stated that there was a positive change in the Internet use attitudes of the students in the experimental group.

In order to see whether there was a statistically significant difference between such sub-dimensions of the Internet Attitude Scale as "Internet Use in Education (D1), Internet Use for Research (D2), Internet Use for Social Interactions (D3), Enjoying Internet Use in Education (D4), Internet Use for Communication (D5) and

Internet Use for Information Sharing (D6)", paired samples t-test was applied to the experimental group students' pre-application and post-application scores. The findings obtained are presented in Table 5 below.

Table 5. Comparison of the Experimental Group Students' Pre-application and Post-application Scores Regarding the Sub-dimensions of the Internet Attitude Scale via the Paired Samples t-test

Dimensions	Experimental Group	N	$\overline{X}$	sd	df	t	p
D1	Pre-application	47	3.61	1.226	46	-3.061	**0.004**
	Post-application		4.16	1.078			
D2	Pre-application	47	3.71	1.113	46	-2.674	**0.010**
	Post-application		4.12	0.969			
D3	Pre-application	47	3.37	1.143	46	-0.470	0.640
	Post-application		3.47	1.163			
D4	Pre-application	47	3.54	1.111	46	-1.710	0.094
	Post-application		3.84	1.062			
D5	Pre-application	47	3.63	1.226	46	-1.789	0.080
	Post-application		3.91	1.098			
D6	Pre-application	47	3.61	1.220	46	-2.502	**0.016**
	Post-application		4.02	1.043			

When Table 5.20 is examined, it is seen that there was a significant difference ($t_{(46)}$ = -3.061, p <.05) between the experimental group students' pre-application scores regarding the sub-dimension of Internet Use in Education ($\overline{X}$ = 3.61) and their post-application scores ($\overline{X}$ = 4.16). It is also seen that there was a significant difference ($t_{(46)}$ = -2.674, p <.05) between the experimental group students' pre-application scores regarding the sub-dimension of Internet Use for Research ($\overline{X}$ = 3.71) and their pos-application scores ($\overline{X}$ = 4.12). On the other hand, no significant difference ($t_{(46)}$ = -0.470, p >.05) was found between the experimental group students' pre-application scores regarding the sub-dimension of Internet Use for Social Interactions ($\overline{X}$ = 3.37) and their post-application scores ($\overline{X}$ = 3.47). Furthermore, there was no significant difference ($t_{(46)}$ = -1.710, p >.05) between the experimental group students' pre-application scores regarding the sub-dimension of Enjoying Internet Use in Education ($\overline{X}$ = 3.54) and their post-application scores ($\overline{X}$ = 3.84). Similarly, the results revealed no significant difference ($t_{(46)}$ = -1.789, p >.05) between the experimental group students' pre-application scores regarding the sub-dimension of Internet Use in Communication ($\overline{X}$ = 3.63) and their post-application scores ($\overline{X}$ = 3.91). However, there was a significant difference ($t_{(46)}$ = -2.502, p <.05) between the experimental group students' pre-application scores regarding the sub-dimension of Internet Use for Information Sharing ($\overline{X}$ = 3.61) and their post-application scores ($\overline{X}$ = 4.02). Depending on these results, it could be stated that activities carried out on the basis of the blended learning method contributed positively to the experimental group students' attitudes towards the use of the Internet in for education, research and information sharing.

CONCLUSION AND DISCUSSION

The aim of this study was to determine the effect of the blended learning model on high school students' biology achievement and on their attitudes towards the Internet. To this end, the scores obtained from the "Biology Achievement Test" and "Intenet Attitude Scale" applied to the experimental and control groups were compared. The research results revealed that the blended learning model contributed more to the students' biology achievement than traditional teaching methods did and that the students' attitudes towards the Internet developed statistically significantly. Thanks to blended learning model;

- The students get prepared for the course before coming to the class.
- They found the opportunity to make revision at any time as much as they wanted and understood the subject better via such activities as videos and animations.
- They were allowed to test themselves and to determine the subjects they were inefficient in via the quizzes in the web site.
- They tried to overcome their inefficiencies by directing questions via the web site that they could not ask to the teacher during the lesson and by discussing with their friends.
- They found the opportunity to learn on their own pace.

It can be stated that all of these opportunities increased the achievements of the students. In a number of studies (Tuckman, 2002; Boyle et. al., 2003; Dowling, Godfrey and Gyles, 2003; O'Toole and Absalom, 2003; Garrison and Kanuka, 2004; Eşgi, 2005; Cüez, 2006; Usta, 2007; Pereira et. al., 2007; EL-Deghaidy and Nouby, 2008; Uluyol and Karadeniz, 2009; Aladejena, 2009) similar findings were obtained. It can also be stated that blended learning environment has positive effect on the students' attitudes towards the Internet; especially use of the Internet for education, research and information sharing. Şimşek (2009) emphasized that the blended learning model significantly and positively influenced the physics teacher candidates' attitudes towards the internet.

This study is important since it demonstrates that blended learning is effective in secondary education as well. An effective teaching can be achieved by blending the advantages of the web environment with face to face interaction in the courses which have more visual elements such as biology course. Also; the following suggestions could be put forward:

- The teachers who will use the blended learning model should develop their computer and internet literacy rate. For this, in-service training courses can be held on such web-supported applications.
- Web page content should include multimedia applications.
- Web page content should be made ready before the start of applications and the activities such as video, animation etc. should be controlled whether functioning properly.
- The present study was carried out within the biology course in the lesson unit of "Classification of Living Things and Biodiversity". In different subjects of the course of biology or in different other courses, the blended learning model could be applied.
- Qualitative studies reflecting the views and experiences of practitioners of blended learning can be applied.

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THE EFFECTS OF ONLINE DISCUSSION FORUM AGGRESSIVE MESSAGES AND COGNITIVE DISTORTION ON USERS' NEGATIVE AFFECT AND AGGRESSION

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ABSTRACT
This research is comprised of two studies designed to explore the effects of online discussion forum aggressive messages and Internet cognitive distortion on users' negative affect and aggression. The results of study 1 revealed 69 users could perceive both disgust and hostility feelings toward aggressive messages conducted by the authors, and classify them into three levels: direct aggression, indirect aggression, and disagreement. Study 2 focused on whether three aggressive messages and Internet cognitive distortion had effects on users' negative affect and online aggression. 359 users read one of messages conducted in study 1, and then finished online questionnaires. The results indicated that there were no significant differences in aggression across interaction between aggressive messages and cognitive distortion. However, in users with high cognitive distortion there was significant reported higher aggression than users with low cognitive distortion. Though users could classify the aggressive level of messages and their negative affect be aroused during the treatment, their aggression was not evoked after reading aggressive messages. High cognitive distortion users' aggression and negative affect were triggered without reading aggressive messages.
Keywords: aggression, cognitive distortion, computer mediated communication (CMC), online discussion forum, bulletin board system

INTRODUCTION
In the information era, more and more people communicate via online channels (Lin, Liu, & Yuan, 2001; Liu & Chang, 2007; Liu & Ko, 2007; Liu & Lin, 2010). People read information shared by others and in turn post their opinions in the online discussion forum (Liu, 2007). Educators have also developed online courses with online discussion forums based on Computer mediated communication (CMC) theory, and provided their empirical utility and educational implication (e.g., Hou, 2010; Liu, 2007; Yukselturk, 2010). However, Hou (2010) indicated that students often lack in-depth analysis processes and result in inappropriate inferences and discussions in online discussion forum in a sample of Taiwanese college students. The intense arguments (a long and hot thread of articles) on the online discussion forum tend to become online conflict. Previous researchers (e.g., Garbasz, 1996; Liu, Ho, & Song, 2011; Thompen, & Foulger, 1996) regard verbal aggression or hostile verbal behavior as a form of online aggression. When people use verbal aggression to attack others directly or indirectly, the verbal aggression message posted on the online discussion forum may arouse a negative affect (e.g. anger) and online verbal aggression (Johnson, Cooper, & Chin, 2009). The disagreement message posted by different groups may easily arouse Internet users' negative affect and online verbal aggression (Johnson, Cooper, & Chin, 2009). Analyzing six Taiwan online discussion forums, and collecting verbal aggression threads/messages, Ni (2003) found that the average time lasted sixty-five hours, and the intense level of verbal aggression scored 4.38 points (above the midpoint 4). However, as far as we know, few studies had attempted to examine empirically whether reading online verbal aggression messages may evoke users' psychological arousal (e.g., positive or negative affect and online aggression).

A previous study (Lin & Hwang, 2005) examined Internet use and Internet hostility with the structural equation modeling technique and found that Internet cognitive distortion had effects on Internet aggression. To extend the

results, the current research conducted two studies to explore whether after Internet users with different levels of Internet cognitive distortion read different online aggressive messages, their negative affect and online aggression would be aroused. Studies related to aggression, cognitive distortions and negative affect are described in the following section.

RELATED STUDIES

Aggression

Webster's Ninth Collegiate Dictionary (1989) defines aggression "as a forceful action or procedure," and the Google Online Dictionary (searched at March, 2010, http://www.google.com.tw/dictionary?hl=zh-TW) defines aggression as "feelings of anger and hatred that may result in threatening or violent behavior." Berkowitz (1993) describes aggression as any behavior intended to injure someone physically or psychologically. Aggression is expressed in many forms, some of which are physical and some not. For instance, Berkowitz (1993) and Buss (1961) classify aggression into active and passive aggression. Bjorkqvist, Lagerspetz, and Kaukiainen (1992) classified the aggression into three types: direct physical (e.g., hits and kicks, etc.), direct verbal (e.g., yells and calling the other names, etc.), and indirect (a kind of social manipulation; e.g., gossips and planning secretly to bother the other). Thompsen and Fouler (1996) and Turnage (2007) propose dimensions of online aggression messages, such as divergence, disagreement, tension, antagonism, profane antagonism, intimidation, insults, offensive language or tone, and unfriendliness.

Internet Cognitive Distortions

Cognitive behavior theorists believe that individuals in frustrated and anger-provoking situations tend to use maladaptive information processes such as cognitive distortions and hostility attribution bias, both of which usually result in increasing levels of aggressive behavior (Crick & Dodge, 1994). Along with Berkowitz (1993), Crick and Dodge (1994) note that cognitive distortions increase people's aggressive behaviors and encourage them to rationalize their negative cognitive thinking. Ten examples of cognitive distortions are all-or-nothing thinking, overgeneralization, selective abstraction, disqualifying the positive, mind-reading as fortune-telling, magnification or minimization, reasoning from how we feel, should and shouldn't, labeling, and personalization (Mass, 1997). Barriga and Gibbs (1996) identify four kinds of cognitive distortions that are directly related to aggressive behaviors, including self-centeredness, mislabeling, assuming the worst, and blaming others. Lin and Hwang (2005) found Internet cognitive distortions had impacts on Internet aggression in a sample of Taiwanese university Internet users.

Negative Affect

Affect is an emotion or subjectively experienced feeling which is a mental state that arises spontaneously instead of through conscious effort and that are often accompanied by physiological changes (Ekman, 2003). Tomkins (1963) proposed nine affects with a low/high intensity level: positive (enjoyment/joy and interest/excitement), neutral (surprise/startle), and negative (anger/rage, disgust, dismal, distress/Anguish, fear/terror, and shame/humiliation). Researchers (e.g., Berkowitz, 1993; Huesmann, 1994) have approved the relationship between aggression and negative affect. Huesmann (1994) found negative affect usually causes angry feelings and aggressive inclination and also tends to arouse hostile feelings and memories to mind. Baron and Bell (1976) found an inverted U curvilinear relationship between negative affect and aggression. That is, moderate degree of negative affect increases aggression, but more extreme of discomfort actually reduces aggression. In terms of expressing emotions on CMC, Derks et al. (2007) assumed that it was different from face-to-face communication for two reasons. First, because CMC was slower and less spontaneous, as all other information exchange had to be typed, and second, because an important aspect, the nonverbal part, of the emotional information was not available. Although expressing emotions on the Internet is not as direct as face-to-face communication, we believe users' affect may still be aroused by some online activities. Johnson, Cooper, and Chin (2009), examining online verbal aggression messages and 148 undergraduate students' anger in a laboratory, found that the behavior of students posted online verbal aggression messages was associated with anger directed toward the negotiating context and negotiator's partners.

OVERVIEW CURRENT RESEARCH

The authors conducted two studies to examine whether online aggressive messages would arouse users' aggression and negative affect. Study1 aimed at testing whether online discussion forum users reading three aggressive messages written by authors posted on campus online discussion forum could rate them as different levels of aggression and disgust. Study 2 aimed at examining online forum users' negative affect before and after reading online aggressive messages in study 2.

Study 1

The purpose of study was to examine whether online discussion forum users reading aggressive messages posted

on campus discussion forum rated them as various disgust and hostile levels. We also supposed that aggressive messages conducted by the researchers be classified into three levels: direct aggression, indirect aggression, and disagreement.

Questionnaires

The authors conducted three aggressive messages based on the aggression theory (Bjiirkqvist, Osterman, & Lagerspetz, 1992; Thompson & Fouler, 1996). The authors used the scenario which frequently appeared on the college campus and caused great impacts on students: the argument of pro or con of protecting stray dogs on the campus. The operative definition and sentences used in three levels of aggressive messages were described as following.

The direct aggressive messages were compiled to show users attacking each others, exchanging insults, insults, opinions showing over-confidence, and messages indicating that the original topic or cause of a specific dispute had been set aside or forgotten. The exemplar sentences were "Damn it, I am going to beat up those who protect stray dogs," "Dogs are barking…When the dogs are barking all night where are shitty stupid dog savers now? Which hell are they in?"

The indirect aggressive messages were to look down on others, teases, expressed sarcasm and used cutting sentences. The messages consisted of "Your magnificent do-gooder kindness is getting on my nerves." "Do you think you are Buddha, Mr. Savior?"

Disagreement messages expressed opposing opinions but also offered evidence in support of individual views with no overtly aggressive opinions. The messages consisted of "The dormitory rules state that pets are not allowed. Did someone give you special permission to keep so many pets?" and "When taking care of the dogs' health and diet, please think about our sanitation and well-being."

Participants and Procedure

Sixty-nine (53 male and 16 Female) online discussion forum users (college students) were recruited from a campus online discussion forum in a Taiwan college. At the beginning of procedure, they were induced to involve in the argument of pro or con of protecting stray dogs on the campus. Then, they were allocated randomly to read one of the three flaming messages. After reading the messages, they were asked to appraise the hostility and disgust level toward messages per se (both from 1 to 7). At the end of the procedure, they were thanked for their participation and received a NT$100 coupon to a chain convenient store. The direct aggression messages were read by 31 users, the indirect aggression messages were read by 13 users and the disagreement messages were read by 25 users.

Result

The results of descriptive statistics (Table 1) indicated the hostility scores of three aggressive messages all exceeded the midpoints (4.0), from 4.68 to 5.87. Users reading the direct aggression message reported the highest hostility scores (5.87) among three messages. However, the reported disgust means were lower than the midpoint (4.0) of a 7-point scale, from 2.68 to 3.80. Users reading direct aggression message reported the highest disgust scores (3.80) among three messages.

Table1. Descriptive statistics and ANOVA results for hostility and disgust scores of messages

Variables	Messages	N	Mean	SD	F	Post hoc
Hostility	Direct aggression	31	5.87	1.60	4.11*	
	Indirect aggression	13	4.76	1.92		Direct>
	Disagreement	25	4.68	1.62		Disagreement
	Sum	69	5.23	1.75		
Disgust	Direct	31	3.80	1.74	3.31*	
	Indirect	13	3.31	1.93		Direct>
	Disagreement	25	2.68	1.28		Disagreement
	Sum	69	3.30	1.68		

*p<.05

The results of ANOVA analysis revealed that there were significant differences in hostility scores (F=4.11, p<.05) and disgust scores (F=3.31, p<.05) across three aggressive messages. The post hoc comparison using Scheffé test indicated users reading direct aggression message (Mean=5.87, SD=1.60) reported significantly higher hostility scores than users reading disagreement message (Mean=4.68, SD=1.62). Users reading direct aggression message (Mean=3.80, SD=1.74) reported significantly higher disgust scores than users reading

disagreement message (Mean=2.68, SD=1.68) as well. There was a middle relationship (r=0.49, p<.01) between hostility (Mean=5.23, SD=1.75) and disgust scores (Mean=3.30, SD=1.68). The result showed that users' hostility and disgust was significantly correlated.

Although the reported disgust means of three messages were lower than the midpoint, the reported hostility means of three messages were higher than the midpoint. The relationship between hostility scores and disgust scores further yielded users' hostility and disgust feelings were aroused simultaneously. The result also indicated users could discriminate direct aggression message from disagreement message in hostility and disgust. That is, after users read messages (especially direct aggression message), their hostility and disgust feelings could be evoked. However, users' hostility and disgust feelings after reading indirect aggression message were similar to those reading direct aggression message and disagreement message. The results supported the messages written by the authors could be categorized by users into three levels: direct aggression, indirect aggression, and disagreement. Based on the results, the authors used three aggressive messages and online questionnaires to conduct Study 2.

Study 2
The purpose of the study was to examine whether three online discussion forum messages and Internet cognitive distortion influence users' negative affect and online aggression. The authors supposed that users with high levels of Internet cognitive distortion reported higher aggression after reading aggressive messages than users with low levels of Internet cognitive distortion. Users with high level Internet cognitive distortion would report higher negative affect after reading messages than those with low levels.

Participants and Procedure
359 online discussion forum users (college students) were recruited. Users were first asked to answer the online questionnaires of Internet cognitive distortion and affect. Then the system assigned randomly three messages to users to read. Users were bystanders of aggressive messages. After reading the message, they were asked to answer the scales of online aggression and affect.

Questionnaires
The online questionnaires consisted of several parts: affect, Internet cognitive distortion, online aggression, and three aggressive messages adopted from Study 1. The messages were posited on online discussion forum article interface. Other scales were validated by factor analyses using principle component method and varimax rotation.

The affect scale was revised from the scale by Levine, Wyer, and Schwarz (1994). The original purpose of the scale was to measure a person's emotion state by adjectives with responses given along a 5-point checklist. Analyzing the data from the 359 respondents, the scale consisted of 14 items, 2 factors: 1) negative emotion, 2) positive emotion, explaining 69.50% of the total variances. The reliability coefficients (Cronbach alpha) were .93 and .92 of two factors and .85 for the whole scale.

The scale of Internet cognitive distortion was revised from the scale "inventory of Hostility Cognitive Distortions (IHCD)"by Lin& Hwang (2005). The original purpose of the scale IHCD was to measure a person's mental state and process which were extreme self-central and dogmatic, radical, and to rationalize the negative cognitive thinking. The researchers operated it as the Internet cognitive distortion scale with responses given along a 4-point checklist. The scale consisted of 17 items, three factors: 1) negative thinking, 2) self-central, 3) blaming others, 4) mislabeling, and explaining 59.93% of the total variances. The reliability coefficients (Cronbach alpha) were from .73 to .77 of four factors and .87 for the whole scale. The results accorded with the IHCD as well.

The online aggression scale was modified from the scale "Internet Hostility Questionnaire (IHQ)" by Lin and Hwang (2005). The original purpose of the scale IHQ was to measure a person's online aggressive behaviors and hostility feelings with responses given along a 4-point checklist. The scale consisted of 25 items, six factors: 1)other internet aggressive means, 2)ignoring others' right , 3)expressing angry behaviors , 4) direct verbal aggression , 5) internet cynical, and 6) attacking by group force, explaining 67.77% of the total variances. Analyzing the 359 data, the reliability coefficients (Cronbach alpha) were from .76 to .93 of 6 factors and .86 for the whole scale. The results also corresponded to the IHQ.

Measurement
The experiment was between-subject factorial design. The subjects were divided into high and low cognitive distortion, based on their scores of inventory of Hostility Cognitive Distortions (IHCD) scale and the cut-off

point was the mean. Then they were assigned to read one of the three messages at random. Therefore, the subjects were assigned into six groups (see the Table 2).

Table2. The between subject factorial design in study 2

Messages	Internet cognitive distortion		Sum
	high	low	
Direct aggression	H1(N=86)	L1(N=59)	145
Indirect aggression	H2(N=60)	L2(N=52)	112
Disagreement	H3(N=63)	L3(N=39)	102
Sum	209	150	359

The first independent variable "aggressive messages" was composed of three levels, and the classification of these three levels was proofed valid in study 1. The second independent variable "Internet cognitive distortion" was between subjects, personality attribute, and divided into two groups: high/low based on their scores of inventory of Hostility Cognitive Distortions (IHCD) scale and the cut-off point was the mean. The third independent variable "timing" was within subjects, the affect scale were measured before and after reading the messages. The dependent variables were measurements of the negative affect and online aggression scale.

Result

The research group adopted three messages of study1 and online questionnaires to conduct the study. The descriptive statistics of variables presented on Table 3.

Table 3. The descriptive statistics of variables on negative affect and online aggression

Messages	Cognitive distortion	N	Affect pretest		Affect post-test		Aggression	
			Mean	SD	Mean	SD	Mean	SD
Direct aggression	High	86	2.75	0.53	2.88	0.49	2.26	0.24
	Low	59	2.64	0.75	2.72	0.71	1.92	0.32
	Sum	145	2.70	0.63	2.81	0.59	2.12	0.32
Indirect aggression	High	60	2.64	0.59	2.81	0.54	2.21	0.31
	Low	52	2.59	0.63	2.74	0.58	1.98	0.25
	Sum	112	2.61	0.60	2.77	0.56	2.10	0.31
Disagreement aggression	High	63	2.76	0.54	2.92	0.48	2.22	0.37
	Low	39	2.60	0.52	2.73	0.52	1.94	0.30
	Sum	102	2.70	0.53	2.85	0.50	2.11	0.36
	High	209	2.72	0.55	2.87	0.50	2.23	0.30
	Low	150	2.61	0.65	2.73	0.61	1.95	0.29
	Sum	359	2.67	0.59	2.81	0.56	2.11	0.33

The descriptive statistics of pretest negative affect (Mean=2.67, SD=0.59; 5-point scale), post test negative affect scores (Mean=2.81, SD=0.56; 5-point scale) and online aggression scores (Mean=2.11, SD=0.33; 4-point scale) did not exceeded the midpoints of the scales. The pretest negative affect total scores were from 2.60 to 2.75 (Mean=2.67, SD=0.59), and post-test negative affect total scores were from 2.72 to 2.92 (Mean=2.81, SD=0.56). It seemed that users' reported higher negative affect in the post test affect scale than in the pretest affect scale. Users reading three messages seemed to report similar online aggression scores (2.12, 2.10, and 2.11, Mean=2.11, SD=0.33). Among scores of post test negative affect, users with high cognitive distortion reading disagreement messages reported highest negative affect (Mean=2.92, SD=0.48) but users with low cognitive distortion reading direct aggression messages reported lowest negative affect (Mean=2.72, SD=0.71). Among online aggression scores, users with high cognitive distortion reading direct aggression message reported highest online aggression (Mean=2.26, SD=0.24) but users with low cognitive distortion reading direct aggression message reported lowest online aggression (Mean=1.92, SD=0.32). That is, users with low cognitive distortion reading direct aggression message reported lowest online aggression and negative affect protest. Zero-order correlation coefficients between aggression and negative affect scores (N=359) indicated that there were relationships between pretest and post test negative affect (r=0.75, p<.01), relationships between online aggression and pretest negative affect scores (r=0.19, p<.01), relationships between online aggression and post test negative affect scores (r=0.20, p<.01).

The three-way analysis of variance displayed that there was not a significant difference in aggression across interaction between three aggressive messages and Internet cognitive distortion (F=1.160, p>.05). There was not a significant difference in online aggression across users reading three messages (F=.044, p>.05). However, there

was a significant difference in online aggression across the Internet cognitive distortion (F=76.222, p<.001). The authors further compared online aggression scores for users with high/low Internet cognitive distortion. The descriptive statistics of variables and t-test results were presented on Table 4.

Table4. The comparison of online aggression means for high/low Internet cognitive distortion

	Cognitive distortion	Numbers	Means	SD	T Value
Online aggression	High	209	2.23	0.30	9.01***
	Low	150	1.95	0.29	
	sum	359	2.11	0.33	

*p<.001

The result displayed that users with high Internet cognitive distortion (Mean=2.23, SD=0.30) reported higher online aggression (T=9.01, p<.001) than users with low Internet cognitive distortion (Mean=1.95, SD=0.29). The mix design three-way analysis of variance displayed that there was not a significant difference in twice negative affect across interaction among the aggressive messages, Internet cognitive distortion. (F=.064, p>.05). However, the twice negative affects (measurement timing) were different significantly (F=640.923, p<.001). Moreover, there was a significant difference in negative affect across the group high and low cognitive distortion (F=76.222, p<.05).

CONCLUSION AND DISCUSSION
This study investigated the effects of online discussion forum messages and Internet cognitive distortion on negative affect and aggression. The results of Study 1 yielded that the reported disgust means of three messages were lower than the midpoint; the reported hostility means of three aggressive messages were higher than the midpoint. In the research procedure, the participants were induced to involve themselves in the aggressive messages conducted by authors, so they can perceive the hostility of messages per se. However, as bystanders of those aggressive messages, their disgust feelings were little aroused. The relationship between hostility and disgust further yielded users' hostility and disgust feelings were aroused simultaneously. Three messages conducted by the authors could be classified by users into three levels: direct aggression, indirect aggression, and disagreement. The classification was similar to the flaming strength of Thompsen and Fouler (1996), and the aggression levels of Buss (1961), Bjiirkqvist, Osterman, and Lagerspetz (1992). The results revealed that users reading direct aggression messages than users reading disagreement messages reported higher hostility and disgust levels. This evidence corresponded to the assertion of online aggression strength of Thompsen and Fouler (1996), and that the phase profane antagonism (similar to direct aggressive) was more aggressive than the phase disagreement. Since the online discussion forum was not a face-to-face situation, the online aggression behaviors were only presented by verbal information or other limited means. In this case, the hostility and disgust feeling between direct and indirect aggression messages were too similar to make their differentiation.

The results of Study 2 indicated the descriptive statistics of pretest negative affect, post test negative affect scores and online aggression scores did not exceeded the midpoints of the scales. It seemed that users' negative affect and online aggression were little evoked. The possible explanation is that users' did not involve in the messages. As a bystander of messages, their negative affect and aggression were hard to be aroused. There was no interaction between messages and Internet cognitive distortion in aggression. There was not a significant difference in aggression after participants read three messages as well. Users with high Internet cognitive distortion than low Internet cognitive distortion reported significantly higher online aggression. The results suggested that although the messages may contain various extents of verbal aggression, they could not trigger bystander users' aggression. However, users with high Internet cognitive distortion tend to be aggressive on the Internet without reading messages. The results accorded with previous researcher's results that cognitive distortions would increase people's aggression (Crick & Dodge, 1994; Berkowitz, 1993). Looking back to our previous findings, the participants could recognize the hostility and disgust feelings from the three aggressive messages, and only the Internet cognitive distortion had impact on aggression. Accordingly, most users, bystanders, had rational views on the messages, but users with high Internet cognitive distortions tend to behavior more aggressively online than other users without messages evoked.

Moreover, there was no interaction between messages and Internet cognitive distortion in twice negative affect. There was a significant difference in twice negative affect scores. There was also a significant difference in twice negative affect across the Internet cognitive distortion. The results explained that participants' negative affect was evoked by the treatment. The negative affect of Internet cognitive distortion was influenced by times. Accordingly, the messages could not arouse BBS users' negative affect to change, but the twice negative affect between group high/ low cognitive distortion change. The result is the assertion of theories of Crick and Dodge

(1994), and Lazarus and Lazarus (1994), indicating that cognitive distortions were untruthful, false attitudes and dogmatic, radical thinking. The Internet cognitive distortion evoked one's negative affect.

In Conclusion, the results indicate that the aggressive messages could not arouse online aggression and negative affect. In addition, although online discussion forum users could classify the messages and their negative be aroused during the treatment, they did not become aggressive after reading the message. However, users with high Internet cognitive distortion behaved aggressively and negative affect aroused violently without reading messages. As a result, the results confirm that although aggressive messages are phenomenal on online discussion forum, the arousal of users' negative affect and aggression are limited. Users' psychological state (e.g., mood) and trait (e.g., personality or cognitive distortion) deserve to further investigate, because they may have more effects on user' behaviors.

At last, the authors suggested that some limitations of the messages failing to significantly evoke user' negative and online aggression. According to Berkowitz (1993) and Buss (1961), aggression was both active and passive. The aggressive messages conducted by the authors were not users' active behaviors. They were bystanders, hard to involve in the aggressive messages, passive to read the messages, and had no target to aggress or submit feedbacks. In addition, they were bystanders and not threatened to reactive. Although the users' negative affect were aroused after the treatment, their aggression was hard to trigger. Users' with high Internet cognitive distortion had extreme character and intended to aggress without reasons, and for them, our aggressive messages was nothing. The future study could investigate further follow the results.

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THE INFLUENCES OF SOCIAL SELF-EFFICACY ON SOCIAL TRUST AND SOCIAL CAPITAL – A CASE STUDY OF FACEBOOK

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ABSTRACT
Facebook is currently the most popular social networking service in the world. With such tremendous influence on community networks, Facebook has been attracting considerable attention both from the media and academia. A review of the literature indicates that most researchers are concerned primarily with the influence of personal traits on online interactive behavior. This study began from the premise that self-efficacy, the confidence of individuals to function in an online-community, is a key element influencing participation in on-line social networks. This study attempted to establish a model of the social traits of Facebook users, and our results indicate that social self-efficacy has a positive influence on social trust; social trust has a positive influence on social capital, and social trust mediates the relationship between social self-efficacy and social capital.
Keywords: Facebook, Social self-efficacy, Social trust, Social capital, Web 2.0

INTRODUCTION
Since the introduction of Web 2.0, Internet applications of joint-creation and sharing such as blogs, forums, and social networks have fundamentally altered the way that information is collected and had a profound influence on learning and life-styles (Chen et al., 2011; Cheng, Liu, & Shieh, 2012; Hou, 2010; Liu & Chang, 2010; Liu, Ho, & Song, 2011; Liu, Lin, Jian, & Liou, 2012; Liu, Shih, & Tsai, 2011; Tilfarlioglu, 2011). The evolution of information and communications technology and its influence on the development of social communities and interpersonal interaction have become a popular domain of research in recent years (Chang et al., 2011; Liu, 2007; Liu & Lin, 2007; Liu et al., 2011; Isman, 2011).

Online interpersonal interaction becomes an important aspect of social activities, and its influence on the social life of individuals continues to grow. The most comprehensive integrated online interpersonal platform is the so-called "social network service," or SNS. In addition to providing an integrated platform on which to make friends, SNSs also allow users to display personal information in an open or semi-open manner, and seek out friends known from social settings in the real world. These "networks" focus on the fact that users also maintain a social life beyond the internet, and join networks not only to make new acquaintances but to remain in touch with current friends. This is the fundamental difference between SNSs and previous social websites (Boyd & Ellison, 2007). SNS websites establish an online interpersonal platform by combining user content with a larger community. On the one hand, SNSs maintain the characteristics of online media, including synchronous and

asynchronous communication; on the other hand, they cannot be criticized for hindering the development of normal social relationships resulting from excessive time spent on the internet.

Facebook, which emerged in 2004, is currently the most popular SNS in the world. According to published statistics, Facebook has more than 800 million active users, each of whom has an average of 130 friends (Facebook, 2012). According to CheckFacebook.com, more than 800 million people have Facebook accounts, accounting for roughly 1/10 of the global population. It should come as no surprise that many researchers look to Facebook for the subject of community studies (Mazman & Usluel, 2011).

Due to the immense influence of Facebook on community networks, related coverage and studies in the media and academia cover a broad range of topics, including privacy (Dwyer, Hiltz, & Passerini, 2007; Jones & Soltren, 2005) social networks and interpersonal relationships (Ellison, Steinfield, & Lampe, 2007; Gangadharbatla, 2008; Hewitt & Forte, 2006; Lampe, Ellison, & Steinfield, 2006), motives and experiences with regard to access (Hart et al., 2008; Joinson, 2008; Lampe et al., 2008), e-portfolios (Back et al., 2010; Barbera, 2009), and educational applications (Mazman & Usluel, 2010; Valenzuela, Park, & Lee, 2008).

A review of the literature indicates that most studies are concerned with the influence of personal traits on online behavior. Mehdizadeh (2010) studied 100 college students and discovered that those with a higher level of narcissism and lower self-esteem have more self-promotional content. In a study of 237 college students, Gangadharbatla (2008) investigated how personal factors influence SNSs, discovering that those factors with stronger internet self-efficacy, a need to belong, and collective self-esteem have a more positive attitude towards SNS. Ross et al., (2009) studied 97 college students, discovering that the "Five-factor Model of Personality" is not as influential with regard to the use of Facebook as indicated in other studies. Despite disparities in the findings, most research has clearly indicated that the use of Facebook is positively correlated with the motivation to communicate. However, research into the influence of social traits on the use of Facebook is somewhat lacking.

Facebook users function as an online community, in which the models of interpersonal interaction influence the behavior of others. In the present study, we believe that a key issue is whether individuals in an online-community are confident in their ability to interact in this environment, referring to this trait as social self-efficacy. Social capital can be used as an indicator with which to evaluate personal power or resources in an online-community. Lin (2001) believes social capital is a resource embedded in the social network, and a user can access and use this resource through personal actions. Factors such as friendship and respect also empower individuals to take advantage of social privileges and acquire personal resources. In such relationships, Inkpen and Tsang (2005), Nahapiet and Ghoshal (1998), and Tov and Diener (2008) pointed out the significance of the relationship linking enhanced social capital and social trust. The most important and fundamental condition for interpersonal interaction is trust, and this applies both in the real world and in virtual interactions. Therefore, in this study, we treat social trust as a potential mediating factor.

In summary, this study is an attempt to establish a model of the social traits exhibited by Facebook users, assuming that social self-efficacy has a positive influence on social trust, and social trust has a positive influence on social capital. The framework of this study is shown in Figure 1.

Figure 1. Hypothesized model of this study

LITERATURE REVIEW
Social Self-Efficacy
Bandura (1977) was the first to propose the theory of self-efficacy, in which the belief of individuals in their ability to organize and implement actions is known as self-efficacy. According to this theory, self-efficacy indicates the level of self-confidence possessed by an individual enabling them to deal with stressors. As such, self-efficacy can be treated as a resource for coping with stress (Jerusalem & Schwarzr, 1992).

The self-efficacy theory is ubiquitous in research today, having been modified and applied in a wide range of domains, such as teacher efficacy (Topkaya, 2010; Tschannen-Moran, Hoy, & Hoy, 1998) or student

self-efficacy in different learning subjects (Liu & Lin, 2010; Liu et al., 2010). The interpretation of social self-efficacy adopted in this study is based on the self-efficacy scale by Gecas (1989), which was modified from the scale proposed by Sherer et al., (1982). Social self-efficacy is the belief of an individual in their ability to initiate social contact and develop new friendships. It is commonly applied in domains such as adult social interaction, counseling for college students, health psychology, and social interaction among students studying abroad (Fan et al., 2010; Hagedoorn & Molleman, 2006; Lin & Betz, 2009; Wei et al., 2005).

We believe that the confidence of individuals to interact with one another and make new friends (Gecas, 1989) in an online environment influences their attitude towards the community and the means by which they behave in such an environment, such as Facebook.

Social Trust
Many scholars believe that trust may reduce interpersonal tension and conflict and promote intra-community collaboration, cohesiveness, and identification (Gambetta, 1988; Mistzal, 1996); as well as enhance interpersonal harmony and cooperation (Coleman, 2000; Fukuyama, 1995; Leana & Van Vurenn, 1999). Newton (1997) indicated that social trust can be divided into "individuals" and "the whole": researchers on individuals are mostly social-psychologists who treat social trust as a "core personality trait of individuals," related to other personality traits such as optimism, belief in cooperation and confidence in the belief that individuals can resolve their differences and live harmoniously together. Researchers on "the whole" treat social trust as a social trait instead of a personal attribute (Fukuyama, 1995; Putnam, 1993); the fact that an individual participates in a culture of trust or social system, in which attitudes or behaviors related to trust spread throughout the entire society.

Regardless of whether a study is concerned with "individuals" or "the whole," there is no doubt that social trust influences communities, establishing a bridge for interpersonal interaction (Wu et al., 2010). Hsu et al. (2007) also pointed out that trust is correlated with the self-efficacy in knowledge-sharing. Based on the above, we propose the following hypothesis:

H1: Social self-efficacy has a positive influence on social trust.

Social Capital
The term "social capital" was first coined in a study of community, in which it was believed that social capital may enhance interpersonal networks, by providing a foundation for trust, collaboration, and group activities (Jacobs, 1965). Putnam (2000) believes that social capital focuses on the interactions of intra-community members, mutual assistance, mutual trust, and behavior norms, improving the overall development and performance of a community. In an online-community, individuals share interests or related objectives with others (Ellison, Heino, & Gibbs, 2006; Horrigan, 2002). These new connections may lead to increased social capital.

Putnam (2000) proposed two types of social capital: bridging and bonding. "Bridging social capital" is accommodative. It occurs in social networks linking individuals of different backgrounds, providing opportunities for the exchange of new information or resources. In contrast, "bonding social capital" can be monopolized. It occurs among personal acquaintances such as family members or close friends who provide mutual support for one another, both emotionally and physically. The diversity of these social bonds and social capital is the result of strong interpersonal connections, even when they do not have a strong common background.

In this study we treat social capital as the overall outcome of one's interactions with others on Facebook, manifesting itself in the ability of individuals to exploit the resources available on Facebook and develop relationships. Social capital is influenced by many factors (Decker, 2007; Ellison, Steinfield, & Lampe, 2007), among which, the effect of social trust on social capital has been addressed in related studies. Huang (2003) pointed out that trust provides a solid foundation for cooperation, as observed in the mutual trust exhibited by team members. The need to cooperate elicits human capital and maximizes the strength of the team. In an educational research report, Yamamura (2010) suggested that social trust can raise social capital, which in turn, enhances the quality of education. We believe that social trust is one condition of social capital, and thus propose the following hypotheses:

H2a: Social trust has a positive influence on bonding social capital.
H2b: Social trust has a positive influence on bridging social capital.

Finally, under the above-mentioned conditions, we believe that there may be a mediating effect between social self-efficacy and bonding social capital, and between social self-efficacy and bridging social capital, and therefore formulate the following hypotheses:

H3a: Social self-efficacy has a mediating effect on bonding social capital.
H3b: Social self-efficacy has a mediating effect on bridging social capital.

RESEARCH METHOD
Sample
We adopted an online-questionnaire survey, stating on the first page that a person may only fill out the questionnaire if he/she has been accessing Facebook for at least 3 months. Our survey was conducted from May to July, 2010; 453 scales were distributed, and 415 valid samples were returned (response rate was 92.16 %), 152 respondents were males (36.5%) and 263 were females (63.2 %). As for education, most respondents were at the college level (52.4 %), and the fewest were in junior high school (3.4 %); in terms of experience with Facebook, most had been accessing it for 7 to 12 months (38.2 %), and 14.7 % had been accessing it for 13 to 18 months. Finally, most participants spent 1 to 5 hours on Facebook per week (36.8 %), while only 1.7 % spent 26 to 30 hours per week.

Measures
Social Self-efficacy Subscale (SSES). We measured social self-efficacy using six-items from the scale modified by Sherer et al. (1982), to evaluate the belief of individuals in their own social competence with regard to Facebook. One sample item was "I quickly understand how to interact with others through Facebook." We employed a 5-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree) to answer these questions. In Sherer et al. (1982), SSES' coefficient alpha was .71, and we adopted the four items with the highest factor loading, with Cronbach's α of .71. The questionnaire is listed in appendix.

Social Trust. Six items from Rosenberg's (1956) Faith in People scale were used to measure the degree of interpersonal trust exhibited on Facebook. One sample item, "Generally speaking, would you say that people with whom you intereact on Facebook can be trusted?" We employed a 5-point Likert-type scale ranging from 1 (never) to 5 (all of the time). In Rosenberg's study (1956), the Cronbach's alpha was .74, and we adopted the three items with the highest factor loading, with Cronbach's α of .66.

Social Capital. Social capital was assessed using the scale developed by Williams (2006), with a Cronbach's alpha of .87. Bridging social capital was used to evaluate how individuals of different backgrounds access social networks, and bonding social capital was used to evaluate whether individuals who provide mutual support have stronger interpersonal relationships. Originally, bridging social capital and bonding social capital comprised 10-items. In our study, we adopted the five items for bridging social capital and four items for bonding social capital with the highest factor loadings and Cronbach's α of .81 and .75, respectively. We employed a 5-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree) for these questions.

RESULTS
Reliability and Validity
Confirmatory factor analysis (CFA) was conducted on the four constructs. Results showed a reasonable fit for the model, GFI= 0.93; AGFI=0.90; CFI=0.97 (Bagozzi & Yi, 1988). Composite reliability (CR) was between .70~.78, indicating good composite reliability (Bagozzi & Yi, 1988). In addition, the factor loading of all items was higher than .5, reaching the level of significant for social trust (0.58-0.67), social self-efficacy (0.62-0.65), bonding social capital (0.57-0.79), and bridging social capital (0.65-0.72), indicating that each construct had convergent validity (Anderson & Gerbing, 1988).

To assess discriminate validity, we conducted a series of χ^2 difference tests on the factor correlations among all constructs (Anderson & Gerbing, 1998). This was done for one pair of variables at a time by constraining the estimated correlation parameter between them to 1.0 and performing an χ^2 difference test on the values obtained for the constrained and unconstrained models (Anderson & Gerbing, 1998). The resulting significant difference in χ^2 indicates that the two constructs were not perfectly correlated and that discriminate validity was achieved.

A Chi-square difference test shows that our $\Delta\chi^2$ was between 288.08 and 26150.92, indicating a significance difference between the value of the unconstrained model and that of the constrained model, indicating good discriminant validity between each construct.

Correlation Analysis

Table 1 presents the mean, standard deviation, covariance and correlations among the study variables. The mean of social-efficacy was the highest of the four constructs. This indicates that our test subjects had a high degree social-efficacy on Facebook. Further, in terms of the correlation between each construct: social-efficacy and other constructs all showed a significant positive correlation, indicating a higher level of social-efficacy on Facebook leads to a higher level of social trust, bonding social capital, and bridging social capital; secondly, social trust had a significantly positive correlation with bonding social capital and bridging social capital, indicating a higher level of social trust leads to better bonding social capital and bridging social capital; lastly, bonding social capital and bridging social capital were significantly and positively correlated, indicating that with more bonding social capital are better able to improve bridging social capital.

Table 1. Covariance coefficient matrix of construct and correlation coefficient matrix

Construct	Mean	SD	1	2	3	4
Social trust	3.271	0.775	1.000	0.246	0.268	0.416
Social self-efficacy	3.939	0.718	0.442***	1.000	0.118	0.237
Bonding social capital	3.015	0.659	0.525***	0.249***	1.000	0.304
Bridging social capital	3.230	0.789	0.681***	0.418***	0.585***	1.000

*** p < .001; The lower diagonal is the correlation coefficient; the upper diagonal is the covariance coefficient.

Hypotheses Test

We analyzed the data using structural equation modeling with maximum likelihood (ML), utilizing LISREL 8.80. For our analytical strategy, we assessed the overall model fit, and then conducted an internal model test when all fit indices were passed. Following Bagozzi and Yi (1988), we evaluated the theory models from basic fit indices, overall model fit, and structural fit. In basic fit indices: the factor-loading of each latent construct's measure index reached the level of significance exceeding 0.5. Further, there was no negative error variance in any of the observed variables. Therefore, this model met the basic fit standard. In overall model fit: We adopted the sorting method proposed by Hair, Tatham, Anderson and Black (1998), including absolute fit measures, incremental Fit Index (IFI) and parsimonious fit measures. The results were: GFI = 0.91, AGFI = 0.89 (close to .90), RMSEA = 0.066 (lower than 0.08), SRMR = 0.073 (lower than 0.08), CFI = 0.96 (greater than 0.95), NNFI = 0.96 (greater than 0.90), PNFI = 0.81, PGFI = 0.69, all greater than 0.50, and Normed Chi-Square=2.79, which was lower than the standard value of 3 (Anderson & Gerbing, 1988), indicating that our model met the overall model fit. Internal structural fitness of the model: The above shows that the individual reliability of social trust, social self-efficacy, bonding social capital and bridging social capital was greater than 0.5, and composite reliability of the latent variable was between 0.57 and 0.82.

As shown in Figure 2, social self-efficacy was positively associated with social trust r ($\gamma11$ = .13; p < .05), supporting H1. Hypothesis 2a predicted that social trust would have a positive impact on bonding social capital h ($\beta21$= .94; p < .0001), supporting H2a; Hypothesis2b stated that social trust would be positively related to bridging social capital ($\beta22$= .92; p < .0001), supporting H2b.
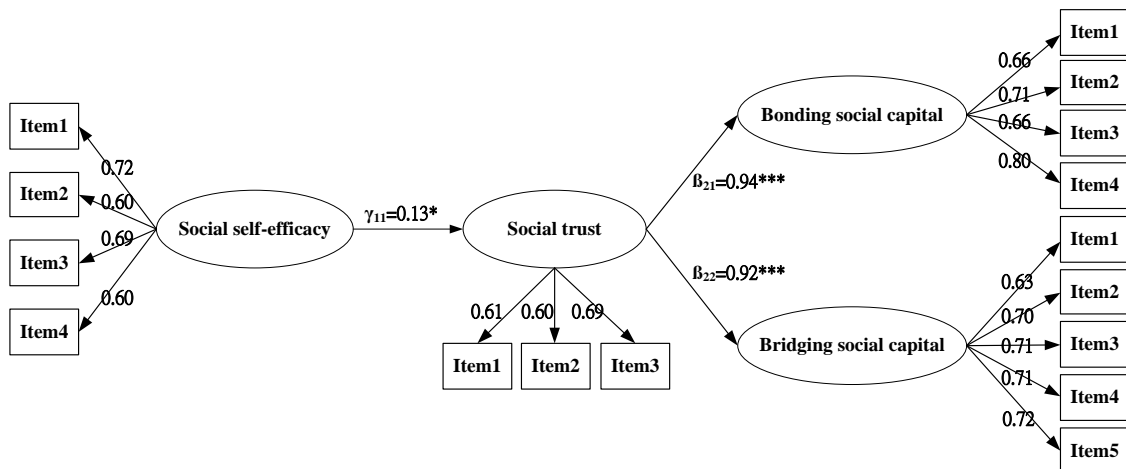

Figure 2. Path analysis

The total effect of social self-efficacy on bonding social capital was .12 (p<.05) (derived entirely from indirect

effect). Results indicate that social trust mediates the relationship between social self-efficacy and bonding social capital, supporting hypothesis 3a. Meanwhile, social self-efficacy to bridging social capital was .12 (p<.05) (derived entirely from indirect effect), supporting hypothesis 3b. This means that social trust mediates the relationship between social self-efficacy and bridging social capital. From this model, it illustrates that the individual's social self-efficacy affects their social trusts, thereby influencing their social capital on Facebook environment.

DISCUSSIONS

Facebook is currently the most popular social website in the world. Many studies have been conducted on Facebook, and some researchers have even discussed how personal traits influence user habits and perspectives with regard to Facebook (Gangadharbatla, 2008; Mehdizadeh, 2010; Ross et al., 2009). In this study, we believe that social traits are more important than individual internal traits, for their influence on interpersonal interactions within a community such as Facebook. Following a review of past literature, we hypothesized that social self-efficacy has a positive influence on social trust, and social trust has a positive influence on social capital.

From the results of our analysis, it is clear that social self-efficacy has a positive influence on social trust, indicating that in an online community, individuals possess the confidence to interact with others, make new friends, and establish a good sense of social trust among those with whom they interact. Social trust is the most fundamental requirement for interpersonal interactions, and particularly so in an online-community because deception is so much easier where people do not meet face-to-face. Therefore, an important question is how to improve social self-efficacy in online communities. Further, in this hypothesis, social self-efficacy was treated as the cause and social trust as the result; however, other studies on causality obtained results different from ours (eg. Hsu et al., 2007). Therefore, the relationship between the two variables of social self-efficacy and social trust deserves further discussion.

Further, social trust has a positive influence on social capital, indicating that in an online community, social trust is an important issue, allowing interpersonal interaction because relationships and power can only be acquired through trust. As indicated by Putnam (2000), social capital focuses on the interactions of members within a community, mutual assistance, mutual trust, and behavior norms improving the overall development and performance of the community. Therefore, those with greater social capital in the online community of Facebook not only have more friends, but also more mutual interactions, thus enjoying the ability to influence others.

This paper continues the exploration of social capital, further examining the theory that social trust mediates the relationship between social self-efficacy and social capital. From the perspective of social interaction and computer mediated communication, this implies that, in a virtual community, mutual social trust is essential. Revealing the social self-efficacy of an individual will produce positive feedback in a virtual internet community particularly for emotional connectedness and intellectual exchange. In other words, when an individual reveals their social self-efficacy, they gain social capital from the interactions in which they participate.

CONCLUSIONS

A highly interactive online-community is actually an extension of the social interactions taking place in the real world. As Facebook is now the most popular social network service, it is important to discuss and analyze its specific social interaction models. In this study we have shown that social self-efficacy has a positive influence on social trust, and social trust has a positive influence on social capital. The conclusions of the study show also that either a rational model construction or a consequential application to teaching could provide relevant references to researchers and teaching/education or media practitioners.

In addition, the research further explored several additional dimensions. First, this study features the Facebook social utility as a sample survey, indicating that all interviewees have social networking experience; therefore, a thought-provoking issue targeted the comparison of community between the study results and practical life. Second, this research concluded social characteristics influence the fact that students use Facebook to learn and guide relative studies. On the other hand, according to the motivation for the research as well as the literature review, several researches have been conducted to explore whether the individual factor does affect such interaction. Further discussion is worth highlighting that those individual and social factors that can be included to determine their interactive relationship. Third, comparing this study to other studies of social capital, it would be a benefit to re-define social capital as either a "social network environment" or an "education-driven social network". Fourth, in terms of raising the issue of privacy on Facebook, it might be thought provoking to value such interaction in terms of its individual and social influence. Fifth, there can indeed be more than one factor that influences social trust and social capital. This is a limitation of the current research that can definitely

benefit from future study.

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APPENDIX

Social Efficacy
1. I feel completely capable of using almost all currently available Facebook. (Negative)
2. I am confident I will learn how to use Facebook that are due to come out.
3. I find changes in technologies very frustrating. (Negative)
4. I quickly figure out how to use Facebook.

Social Trust
1. Generally speaking, would you say that people with whom you interact on Facebook can be trusted?
2. People try to be fair on Facebook.
3. People try to be helpful on Facebook.

Social Capital - Bonding Subscale
1. There is someone online I can turn to for advice about making very important decisions.
2. There is no one online that I feel comfortable talking to about intimate personal problems. (Negative)
3. The people I interact with online would be good job references for me.
4. The people I interact with online would share their last dollar with me.

Social Capital - Bridging Subscale
1. Interacting with people online makes me want to try new things.
2. Interacting with people online reminds me that everyone in the world is connected.
3. I am willing to spend time to support general online community activities.
4. Interacting with people online gives me new people to talk to.
5. Online, I come in contact with new people all the time.

THE RELATIONS BETWEEN STUDENTS' ANXIETY AND INTEREST IN PLAYING AN ONLINE GAME

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ABSTRACT
In this modern and technologically dependent society, people seek to improve human performance, get higher productivity and increase user satisfaction with technologies. In Chinese society, Chinese Idiom learning plays an important role in vocabulary learning which cultural and social functions are involved. Therefore, an online game named 'Chinese Idioms String Up Puzzle' was developed by the Digital Game-Based Learning Laboratory, National Taiwan Normal University in Taiwan to motivate students to learn Chinese Idiom. A survey was conducted to examine participants' anxiety, interest and cognitive load by using this new computer-assisted game. According to the survey, students felt this new program is interesting and would like to play again in the future. For those students who believe anxiety helps their performance, and for those students whose degree of anxiety lowered after completing the test, they tend to have greater interest in playing the game. Findings of the Partial Least Squares (PLS) contribute to an expanded understanding of both psychological anxiety and somatic anxiety influence on their cognitive load, whereas both anxieties was not significantly related to their playing interest. In addition, the study results indicated that the higher degree of psychological and somatic anxiety, the greater cognitive load of the participants.
Keywords: anxiety sensitivity, competitive anxiety, interest, e-learning, Chinese idiom

INTRODUCTION

In this modern society, people, including children and adults, interact with computers in all settings almost every day. Some evidence indicated that computer-assisted educational games could be used for learning and they are more effective than traditional methods (Laffey, Espinosa, Moore, & Lodree, 2003; McGarvey, 1986), in other words, interested students will do faster and learn more in educational settings (Rieber, 1996; Romme, 2003). Additionally, past studies supported that playing games make our brains work efficiently and take in more cognitive materials than we do in traditional settings (Pange, 2003; Perry & Ballou, 1997).

Additionally, in this technologically dependent society, people seek to improve human performance, get higher productivity and increase user satisfaction with technologies. In Chinese society, Chinese Idiom learning plays an important role in vocabulary learning which cultural and social functions are involved. Teachers may have problems to provide each student with an individualized program that has each student's interests in the program (Hidi, 2001). Therefore, we, the Digital Game-Based Learning Laboratory supported by National Taiwan Normal University in Taiwan, developed the 'Chinese Idiom Puzzle' game, to trigger students' interest by visual stimulus, and to motivate students to learn Chinese vocabularies but also Chinese Idioms in either school settings or at home.

The integration of digital game and language learning is not difficult; however, Chinese language-learning programs are still memorization-orientation, and not much fun (Lin et al., 2008). Playfulness and learning can be viewed as two ends of a continuum. At the extreme of playfulness players will not learn; on the other hand, at the extreme of learning there is no fun created by the game design and the players' interaction with the game and its

design (Hong et al., 2009). Thus, the goal of this game design is to engage learners by making learning fun since Chinese is one of the most difficult languages to learn in the world. This computer-assisted educational game was tested in a national-wide competition in Taiwan. It is important to reveal the complex interplay between game and learner, and to understanding the process that occurs within learners' heads. We would like to gain an understanding to what extent participants apply their acquired knowledge and skills in this competition-like problem-solving situation. Therefore, this preliminary study aimed to investigate participants' anxiety sensitivity, cognitive load and participants' interest in playing the game. Moreover, the relationship path between anxiety and interest were examined.

RESEARCH CONTENTS AND HYPOTHESES
Competitive anxiety and game behavior
People with the symptom of anxiety sensitivity, such as racing heart, shortness of breath, or dizziness, tend to fear sensation. Based upon the definition of anxiety sensitivity that Reiss used in 1991, Stewart et al. (2001) stated that anxiety sensitivity is "a fear of anxiety-related sensations, which arises from beliefs that these sensations have harmful physical, social, or psychological consequences" (p. 443). The level of anxiety sensitivity lies on environmental influences (Watt & Stewart, 2000; Stewart et al., 2001; Reiss & McNally, 1985). Furthermore, people with high test-anxiety seemed to have an impact on tasks, achievement tests, and school grades (Cassady & Johnson, 2002; Deffenbacher, 1980; Morris, Davis, & Hutchings, 1981).

Nicaise (1995) defined competitive anxiety as an individual's physiological, cognitive and behavioral responses that stimulate negative feelings about an evaluation. When an individual becomes anxious, the physiological system becomes aroused such as the heart beating faster. At the same time, the individual may experience apprehension and a higher sense of inadequacy. When an individual experiences competitive anxiety, these physical and cognitive responses may lead to negative feelings and cognitions about competitive situations. In addition, competitive anxiety was defined as a feeling of tension that a person experiences before and during an examination (Akca, 2011). Approximately 40% of children suffer from competitive anxiety (Beidel, Turner, & Trager, 1994). According to Galassi, Frierson, and Sharer (1981) found that competitive anxiety levels are affected by positive thoughts, negative thoughts, somatic excitement, subjective discomfort and prediction of marks.

Competitive anxiety and interest in games
Interest has been divided into two types: individual interest and situational interest (Hidi, 2001; Hidi & Renninger, 2006; Krapp, 2000). Individual interest develops slowly, and lasts long; it refers to person's enduring predisposition to re-engage in certain activities. Whereas situational interest is a psychological state of interest that is triggered by specific environmental stimuli, it may or may not have long-term effect on person's knowledge or value (Ainlye, Hidi, & Berndorff, 2002; Hidi, 2001; Hidi & Renninger, 2006). Interest has been conceptualized as an individual predisposition and a psychological state.

In addition, interest has been classified as an affective variable, or an emotion (Dai & Sternberg, 2004; Iran-Nejad, 1987; Meyer & Turner, 2002). Previous studies indicated that interest has a powerful influence and positive role in learning (Hidi & Renninger, 2006; Lawless, Brown, Mills, & Mayall, 2003; Renninger, 1998, 2000; Oblinger, 2004). When children are interested in activities which offer suitable challenges that correspond to their competences, focus their attention, or enjoy their engagements, their interest in the activity will increase, and they tend to learn better than those individuals who do not have such interests (Schiefele, 1998; Kiili, 2005). Educators were suggested to help students to sustain attention for tasks, even though those tasks are challenging; and to provide opportunities for students to ask questions; and to create resources that promote problem solving (Hidi & Renninger, 2006).

Cognitive load theory
Cognitive load theory is a learning theory grounded in the learner's cognitive architecture, it is used to show the load related to the control of working memory (Paas, Renkl, & Sweller, 2004; Sweller, 2010; Van Merrienboer & Sweller, 2005; Baddeley, 1986; Miller, 1956). And it focuses on the used cognitive resources during learning and problem solving. It is more difficult to process the information in working memory when people have to learn in a shorter amount of time. Moreover, it suggested that people learn best under environments that are aligned with cognitive architecture.

Cognitive load theory distinguishes between three types of cognitive load: intrinsic, extraneous, and germane (Paas, Tuovinen, Tabbers, & Van Gerven, 2003). These three cognitive load types are not asymmetric. Intrinsic cognitive load depends on the complexity level of the information, and is determined by the interaction between the material being learned and the expertise of the learners. It measures the amount of working memory at the

given time. Extraneous cognitive load is the extra load, and results from activities or information that does not contribute to the schema construction, such as, the poorly designed instruction. Unlike intrinsic cognitive load, and like extraneous cognitive load, germane cognitive relates to the process that contributes to the schema construction, and is influenced by how information is presented to learners and the learning activities required.

RESEARCH HYPOTHESES

Out of the literature review, a couple of questions emerged that would expand the knowledge base regarding anxiety and interest in playing an online game. Therefore, hypotheses have been distilled in the following major research hypotheses:

H1: Somatic anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle'.

H2: Somatic anxiety is positively associated with students' cognitive load in playing 'Chinese Idioms String Up Puzzle'

H3: Psychological anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle'.

H4: Psychological anxiety is positively associated with student cognitive load in playing 'Chinese Idioms String Up Puzzle'.

METHOD

'Chinese Idioms String Up Puzzle' game

To achieve the benefits of interest we developed an online game named 'Chinese Idioms String Up Puzzle' that draw on the form of interest motivation and address the challenge of language learning. It was designed on the belief that this game is highly motivating and engaging.

'Chinese Idioms String Up Puzzle' game, like crossword puzzles, is a text reconstruction online program developed by the Digital Game-Based Learning Laboratory, National Taiwan Normal University in Taiwan. This tool used the power of computer and competition or collaboration toward the fun factor to motivate Chinese idiom learning. Students are timed to key in the missing words. The great amount of learner control influence students' motivation and performance in computer-based instruction (Becker & Dwyer, 1994; Schnackenberg & Sullivan, 2000). This game encouraged students to use their organizing schemes to explore language, thus, students are active participants rather than passive recipients in learning. In addition, students have more confidence and great satisfaction when they work together to find the missing words.

Figure 1 shows the illustration for practice. Students are timed to key in the missing words of the Chinese idiom in each side of the square clockwise. They are expected to type and learn Chinese idioms by searching their memory scheme and associating Chinese idioms for finding out the correct characters. In addition, this game could pair students to challenge each other (Figure 2). This game encouraged students to use their organizing schemes to explore language, thus, students are active participants rather than passive recipients in learning.

Fig. 1. Key in the missing characters to make words in each side of square becoming a four-character idiom.

Fig. 2. Paired students to challenge each other.

The designs of this game help student to sustain attention to answer questions. Furthermore, this game seek to establish relevance between Chinese Idiom learning and learners' interests.

Research Design

This study was conducted using a survey research design. The first step of the study design procedure was to develop a set of survey questions regarding anxiety and interest based on the review of documents and literature. Second, the initial version of the instrument was given to an expert panel to evaluate. Third, the final version of the survey instrument was administered to the participants. Finally, a combination of descriptive, comparative and correlative approaches was used to analyze the data.

With the time restrictions entailed in the implementation of this study, a cross-sectional sampling approach was employed in this study: this allows the study to be conducted at a single point in time, and requires that the respondents answer the survey just once (Leedy & Ormrod, 2001). Participants in this study were elementary and junior high school students involving in the final match of the 'Chinese Idioms String Up Puzzle' Competition.

Participants

The Digital Game-Based Learning Lab and Hinet EduCities hold a competition to motivate students to learn Chinese Idiom through the game-based program named 'Chinese Idioms String Up Puzzle'. To qualify themselves in the final match, each individual who was primary or junior high school student and each primary or junior high school group had to attend the kick-off regional competitions.

Therefore, those students in the final match were invited to participate in this study. Of the 122 returned questionnaires, a total of 63 participants were males and 59 participants were females. According to survey responses the minimum age of the participants was 10 years old; the maximum age was 16 years old. The mean age was 13.09 years old. Their grades ranged from grade 4 to grade 9.

Data collection

Prior to collecting data, permission to distribute the survey was obtained from the Hinet EduCities. The data collection initiated after approval by the Hinet EduCities. The Hinet EduCities was asked to pass out the survey package to each participant involved in the final match of the 'Chinese Idioms String Up Puzzle' Competition. After the competition, each participant was given a survey package which contained a cover letter including the purpose of the study, the importance of their involvement and appreciation for returning the survey. A total of 200 participants received questionnaires and 122 questionnaires were returned. Of the 122 questionnaires returned, only one was invalidated, 121 were available to analyze the data because participants who did not complete the one of the three sections of the questionnaires had to be excluded.

Instrumentation

The instrumentation was developed by the researcher based upon the literature review and previous studies regarding the objectives of the study. The survey questionnaire was a self-reporting design starting with an introduction, which consisted of the purpose of the study and the instruction to participants.

Text Anxiety Scale. The first section of the survey, Section A, was adapted from the study done by Ree, MacLeod, French and Locke (2000), and encompassed four item clusters. The first part of Section A contained 9

items asking participants to rate the degree of somatic anxiety on a 5-point Likert scale where very low =1, low=2, normal=3, high=4, and very high=5. The second part of Section A contained 11 items sought responses to identify participants' psychological text anxiety on a 5-point scale where very low=1, and very high =5.The third section of Section A contained two items asking participants whether their somatic and psychological anxiety helped their game competition performance on a 5-point scale where 'not helpful at all=1, not helpful=2, neutral=3, helps=4, and helps a lot=5'. And the fourth section of Section A contained 2 items asking participants whether their degree of somatic and psychological anxiety lower once the competition get started on a 5-point scale where not helpful at all=1, and helps a lot=5. Data collected in Section A was ordinal in scale.

Somatic anxiety questions listed in the first section of Section A, such as, Item 2 (heart beating), Item 5 (thirsty), and Item 9 (short of breath). Psychological anxiety questions listed in the second section of Section A, such as, Item 2 (worry about their performance), Item 4 (cannot concentrate), and Item 5 (afraid of losing the competition). The third section questions asking participants whether somatic anxiety help their performances (Item 1) and whether psychological anxiety helps their performances (Item 2). And the fourth section questions asking participants whether the degree of somatic anxiety lowers once the competition get started (Item 1) and whether the degree of psychological anxiety lowers once the competition get started (Item 2).

Interest toward Playing 'Chinese Idioms String Up Puzzle' Game Scale. The instrument was adapted from the studies done by Paas, and van Merriënboer (1994), and Lusk (2008). The objectives of Section B of the survey were to measure participants' interests toward playing the game named 'Chinese Idiom Puzzle'. This section included 9 items on a 5-point scale, where the responses were strongly disagree=1, disagree=2, neutral=3, agree=4 and strongly agree=5. Data collected in Section B of the survey was ordinal in scale.

Interest toward playing 'Chinese Idioms String Up Puzzle' Game questions listed in the survey, such as, Item 1 (I believe learning Chinese Idiom is interesting by playing 'Chinese Idioms String Up Puzzle' Game), Item 2 (I would like to join classmates to play 'Chinese Idioms String Up Puzzle' Game), Item 5 (I would like to recommend 'Chinese Idiom Puzzle' Game to people I know), and Item 8 (I would like to play other games similar to 'Chinese Idiom Puzzle' Game in the future) .

Cognitive load toward Playing 'Chinese Idiom Puzzle' Game Scale. The third content area of the survey was titled 'Cognitive Load Scale', and it was adapted from the studies done by Paas, and van Merriënboer (1994). It asked participants to rate 13 statements regarding cognitive load toward playing 'Chinese Idioms String Up Puzzle' Game. Data was collected ordinally in a 5-point scale where, 'strongly disagree=1, disagree=2, neutral=3, agree=4 and strongly agree=5'..

Cognitive load questions listed in the questionnaire, such as, Item 2 (I believe it is very difficult to handle the way of interaction), Item 4 (I believe it is very difficult to answer the questions regarding the game contents) and Item 7 (I feel frustrated to answer the questions in the game), Item 9 (The limited time to finish the game makes me feel disappointed), and Item 13 (I need to pay full attention to answer the questions in the game).

Reliability and validity
The issues of reliability and validity were considered to be important factors in this researcher's developed questionnaire. To ensure the questionnaire would yield trustworthy data, the initial questionnaire were sent to an expert panel to review the questions. The expert panel in this study considered university faculties, and elementary teachers who were experts in this field. They were asked to review the initial instrument and to identify (1) the words expressed, and the format used in the questionnaire; (2) the content validity of the questionnaire; and (3) the reliability of the question. After the review of the instrument, some minor changes were made according to the expert panel's feedback and suggestions. The final version of the survey was approved by the expert panel. The other issues related to reliability and validity of the survey was addressed in the data analysis sections.

Data Analysis
Analysis of Measurement Model
Partial Least Squares (PLS), a structural modeling technique, was used to test the research hypotheses in this study. PLS was appropriate for this study because it has the ability to handle missing values, small sample size, formative constructs and it presumes no distributional form for measured variables (Chin, 1998; Chin et al., 1996; Chin et al., 2003). The sample size of 122 in this study was passing the recommended minimum of 40 for model testing (Wixom & Watson, 2001).

Beside the evaluation of an expert panel, the reliability and validity of the survey were assessed in several ways

by the implementation of PLS. The measurement model of PLS included the estimation of convergent validity, discriminant validity and internal consistency. Convergent validity was confirmed by examining the Average Variance Extracted (AVE) value and the factors loadings of each item (excluding demographic section). To assess discriminant validity, the square root of AVE of each construct was computed and compared with the correlation between constructs. The results of PLS indicated that all AVE values passed the suggested value of 0.5 (Fornell & Larcker, 1981; Gefen et al., 2000; Wixom & Watson, 2001), ranged from 0.50 to 0.93 (see Table 1); the factors loadings of the all items are significant and higher than the suggested value of 0.5 (Nuunally, 1978), ranged from 0.54 to 0.97. All square roots of the AVE were larger than the correlation coefficient between constructs, indicating that each construct was closely related to its corresponding measurement items. This supports the discriminant validity of the measures.

Moreover, internal consistency was assured by examining the composite reliability of each construct, except for the demographic section. Cronbach Alpha value was measured as well for each construct except for the demographic section. Table 1 shows the results of composite reliability and Cronbach Alpha values. All composite reliability values ranged from 0.90 to 0.97, exceeding the suggested values of 0.7 (Nunnally, 1978; Hair et al., 1998). Cronbach Alpha values ranged from 0.83 to 0.93 indicating good reliability.

Table 1: *Results of composite reliability, Cronbach alpha values and AVE*

Construct	Composite Reliability	Cronbach Alpha	AVE
Somatic anxiety	0.90	0.87	0.50
Psychological anxiety	0.92	0.90	0.51
Whether anxiety helps on the test	0.92	0.83	0.85
Whether degree of anxiety lower	0.97	0.93	0.93
Interest	0.93	0.92	0.61
Cognitive load	0.93	0.92	0.52

Results of research model
In PLS, the structural model tests provided the information to assess the research hypotheses in a research model. The test of structural model included the estimation of path coefficients and R^2 values which indicate how well the model in performing. Path coefficients represent the strength of the relationships between two variables. The R^2 values indicate the amount of variance explained by the independent variables. When R^2 values get greater, the model's predictive quality is better (Chin & Newsted, 1999; Wixom & Watson, 2001).

The structural model was used to test the path coefficient which indicated the strength of the relationship between variables. Thus, the relationship between two constructs included in the model was examined. Results for hypotheses 1 through 4 were determined by using the bootstrap resampling procedure to examine the stability of the PLS estimates (Chin, 1998). Figure 1 shows the results of structural model testing.
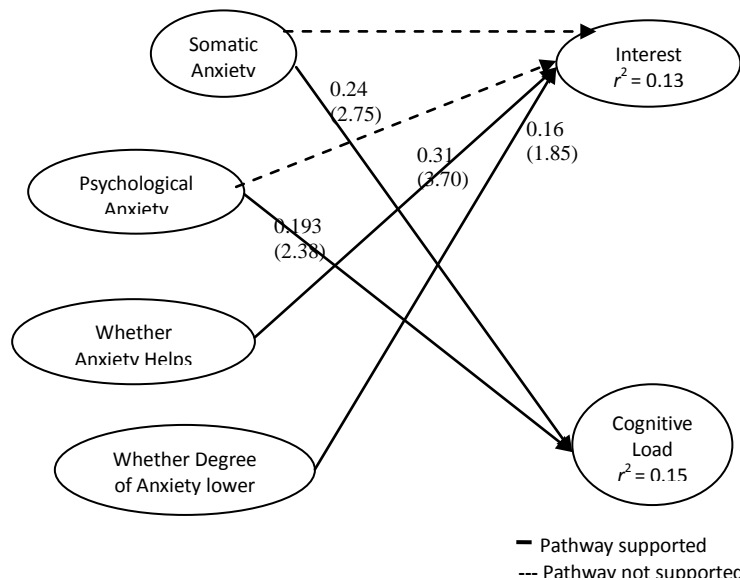

Fig. 3. Research model testing.

RESULTS

The present study was designed to use PLS to further investigate the relationships of somatic anxiety, psychological anxiety, interest in playing an online game and the cognitive load. We had hypothesized that: (1) somatic anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle', (2) somatic anxiety is positively associated with students' cognitive load in playing 'Chinese Idioms String Up Puzzle', (3) psychological anxiety is positively associated with students' interest in playing 'Chinese Idioms String Up Puzzle', and (4) psychological anxiety is positively associated with student cognitive load in playing 'Chinese Idioms String Up Puzzle'.

The structural model testing indicated that (1) hypothesis 1 was not confirmed. The path direction indicated that somatic anxiety was not significantly related to students' interest in playing the game; (2) hypothesis 2 was confirmed ($p=.24$, $t=2.75$). Somatic anxiety is positively associated with students' cognitive load; (3) hypothesis 3 was not confirmed. The path direction indicated that psychological anxiety was not significantly related to students' interest in playing the game, and (4) hypothesis 4 was confirmed ($p=.19$, $t=2.38$). Psychological anxiety was positively associated with students' cognitive load. Moreover, the results showed that students' interest in playing the game was influenced by whether somatic and psychological anxiety helps on the test ($p=.31$, $t=3.70$), and whether the degree of somatic and psychological anxiety lower when the competition begins as compare to the degree of anxiety before the competition ($p=.16$, $t=1.85$).

The structural model testing indicated that hypothesis 1 was not confirmed. The path direction indicated that somatic anxiety was not significantly related to students' interest in playing 'Chinese Idioms String Up Puzzle'. While the hypothesis 2 was confirmed, the path direction indicated that interest was significantly influenced by psychological anxiety. Briefly, the result did not mirror the results of previous studies (Deffenbacher, 1980; Cassady & Johnson, 2002; Morris, Davis, & Hutchings, 1981; Zatz & Chassin, 1983) indicating students with high degree of test anxiety or anxiety sensitivity had poorer test performance.

Descriptive analyses revealed that many participants tend to have a higher degree of somatic anxiety only on racing heart item, as compare to other somatic anxiety items. Many of participants, including people who won the first prize in elementary and junior high school group competitions, reported that they have a higher degree of psychological anxiety, such as, worry about their performances, and afraid of losing the contest. It is exciting to find that majority of all students rated this game was interesting and would like to play it again.

As predicted, anxiety levels increased over the duration of competition, dropping significantly after completing the test. This is consistent with the notion that participants experience an increasing cognitive backlog of items requiring conceptual processing. In addition, the results indicated that the higher degree of psychological and somatic anxiety, the greater cognitive load participants had. The experience of anxiety could be considered a natural result of this developing backlog. After completion of the test, a release of anxiety is observed with the completion of the memory task.

One of the interesting results of this study was no significant difference was detected between anxiety and performance. It is possible that participants had a great backlog of experience with 'Chinese Idioms String Up Puzzle' to fall back on either students worked in groups or individually. At other times the anxiety measure may have been capturing something more like a general predisposition about having tests, it only provides insight into differences in observed performance when they are administered during the performance.

CONCLUSION

The results of this study indicated that this 'Chinese Idioms String Up Puzzle' game is attractive to the learners while it implied that it is practical for the teachers, and that somatic and psychological anxiety do not seem to influence their interests in playing this game in the future. The games for educational learning grow fast, we seek to contribute to this field by showing the positive learning outcome of 'Chinese Idioms String Up Puzzle' that has attracted the attention of participants, and we hope to deploy this learning strategy in both educational settings and at home. The results of the anxiety measure this study provided initiative us to start researching different domains of learning in the future.

The major implication of the study is directed toward identifying ways to improve outcomes of computer-assisted game learning or digital learning for students in Taiwan. For example, (1) school administrators, or teachers may put more emphasis on computer-assisted games to vitalize the instruction, (2) other professionals who cares about education, such as, e-learning web site designer, could construct a variety of e-learning platforms to attract students.

Many unresolved questions in this research that need to be dealt with. For example, the power of this 'Chinese Idioms String Up Puzzle' game acts as a medium for supporting Chinese idiom learning; it creates an environment for interesting language activity while data could be collected to understand how the learner makes use of that learning environment. Obviously, a great deal of research is needed, not only on this unique game, but also on developing new instruments to explore the details of the learning experience and the nature of students' working memory, and language processing. Additionally, the length of engagement in playing the game or in tying Chinese vocabularies in the computer was needed to clarify when replicating the study.

The online game itself is unique and may be useful to future researchers interested in a deeper understanding regarding Chinese Idiom learning issues. For example, future research is needed to examine the shape of the relationships between learning, and interest, especially when comparing across different levels of knowledge. Previous studies indicated that interest increased as learning increased (Schraw et al., 1995). We feel that it is adequate to test whether interest is related to high-knowledge participants and low-knowledge participants.

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RESEARCH TRENDS AND ISSUES IN EDUCATIONAL TECHNOLOGY: A CONTENT ANALYSIS OF TOJET (2008–2011)

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ABSTRACT

This study has been conducted to evaluate the contents of articles published in the Turkish Online Journal of Educational Technology (TOJET) between 2008 and 2011. General aim of the study is to review on what trends, issues and research methods on which studies of educational technology have concentrated in the last four years. Thus, articles which have been published in the last four years have been analyzed in this study under titles of (a) general characteristics of studies; (b) research themes and issues; and (c) research design. A total of 273 articles were reviewed.

Keywords: Educational Technology, Content Analysis

INTRODUCTION

Education and technology are two basic elements that play an important role in rendering individual life effective and efficient. It may be said that conceptual definition of educational technology has evolved from the past to modern day, and this is basically caused by theories, approaches challenging educational technology, technologies used, and paradigm changes in educational technology. Historically, when looking into development of educational technology, it is observed that studies conducted in the field during the era up to 1960s were instrument-oriented. After 1960s, research has been "process-oriented" with the effects of effects of studies related to psychology and learning on teaching practices. Perceiving learning and teaching activities as a process required evaluation of these series of activities utilizing a systematic approach. Consequently with these developments and evolutions, Association for Educational Communication and Technology (AECT) has defined the field as follows: Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources (AECT Definition and Terminology Committee, 2004).

The field has been affected by different theories and it is also reflected in the studies conducted. Under the influence of behaviorist and cognitive theories of 1970s and 1980s, effect of technology used over learning has been frequently questioned (Hannafin & Young, 2008). In this context, studies mostly focused on comparing the effects of computer-based technologies against instructors and traditional textbooks.

The constructivist approach that has become predominant after 1990s argues that learning by an individual is an entirely internal interpretation process and interaction among learners during such process plays an essential role (Ertmer&Newby, 1993). Studies conducted during that era concentrated on strategies technology should employ to convey the information. Also, efforts to explore how information should be structured were influenced by concerns on the environment. Hannafin and Young (2008) stated that the effect of environment on studies conducted during that era was examined within framework of constructivist learning approaches such as collaborative learning, situated learning, and problem solving (pp. 733-734). Field of educational technology, in 2000s and onwards, mostly focused on distance education and web-based applications (Bernard et al., 2004; 2009).

Trends and Issues in Educational Technology

When literature in educational technology field is scrutinized, it is seen that many content analysis studies have been conducted which aim to establish tendencies and problems of the field. Some of the content analyses conducted are reviewed below, first, under the title of Studies on Issues and then, Research Methods according to chronological order.

Studies on Issues in Educational Technology

Klein (1997), in Educational Technology Research and Development (ETR&D) journal, reviewed the 100 articles published between 1989 and 1997 in terms of method used and issues addressed through content analysis method. When articles were reviewed in terms of issues, it was observed that studies generally aimed at investigating instructional design models for computer-based technologies.

Likewise, Masood (2004) examined 200 articles published in ETR&D journal between 1993 and 2002 and attempted to establish trends of issues addressed in educational technology within a decade. He has stated that studies were conducted on issues such as Delivery System/Media Format, Instructional Development, and Instructional Methods. During 2000s, instructional design for distance learning and computer technologies had started to be addressed more. When studies conducted during this era are evaluated in institutional terms, it has been found out that, under the effect of constructivist leaning approaches, issues such as learner-centered, collaborative, and problem-based learning were among the most popular topics.

Ross, Morrison and Lowtherve (2008), with content analysis study conducted for the period of 1994 to 2005 in the ETR&D, established the fundamental issues addressed as macro-instructional strategies such as cooperative learning, problem-based learning, and feedback that affect the design of a course.

With computer and web-based studies getting more and more popular in the field of educational technology in 2000s, number of research conducted on these themes were increased. Shih, Feng, and Tsai (2008) have examined 444 articles of five leading journals in the field of e-learning (Computers and Education, British Journal of Educational Technology, Innovations in Education and Teaching International, Educational Technology Research and Development) published during 2001-2005 by means of content analysis. Their analyses revealed that the most prominent issues were found to be as motivation, data processing, teaching approaches, learning environment, prior knowledge, meta-cognition, and cognitive characteristics in e-learning settings. Issues dealt with in respect of instructional methods were observed as cooperative learning, collaborative learning, situated learning and problem-based learning.

Alper and Gülbahar (2009) carried out a content analysis of 187 articles published in TOJET between 2003 and 2007. They reported that computer- and web-based technologies were the most comprehensively studied themes in the field of educational technology. It was observed that studies generally covered issues on constructivist learning, social learning, diffusion of innovations and cognitive learning. In another study, Alper and Gülbahar (2009) again employed the content analysis method to review 149 articles published from 2005 through 2007 in the five leading journals on educational technology in Turkey. As a result of the analysis carried out, issues addressed mostly concentrated on computer- and web-based applications, as well as open and distance learning studies.

Studies on Research Method in Educational Technology

Klein (1997) analyzed 100 articles published in ETR&D between 1989 and 1997 in terms of methods and found out that the studies were substantially descriptive in nature (49%). In addition, Klein reported that other methods employed in articles were literature review (12%), case study (18%), and empirical research (12%). Hsieh et al. (2005) analyzed studies on educational technology published in four different journals between 1995 and 2004 and extracted that method employed in those studies carried out between these years tended to be qualitative (55%).

Similarly, Ross, Morrison and Lowther (2010) analyzed 43 articles published in ETR&D between 2006 and 2008 in the section of Research and Development in terms of the methods employed in articles. Results indicated that 58% of the studies were identified as descriptive studies. In addition, he reported that 44%, 33%, and 23% of the studies were based on the qualitative, mixed, and quantitative methods, respectively.

Alper and Gülbahar (2009) examined the articles of five educational technology journals in Turkey between 2005 and 2007 regarding research methods and found that the number of qualitative (66) and quantitative (69) based studies were almost equal in data. However, studies utilizing mixed method (12) were fewer in that period. Alper and Gülbahar's (2009) another content analysis in TOJET between 2003 and 2007 showed that the

research methods in articles were dominantly literature review and descriptive based studies whereas experimental studies were not very popular. When reviewing articles over the years, within the first three years, studies were mostly structured qualitatively, however, the quantitative design was much more dominant in the last two years.

Based on information given so far, the primary purpose of the current study is to examine which issues were discussed with regards to Educational Technology in TOJET from 2008 and onwards and also which research methods were employed for these inquiries. Therefore, 273 articles published between 2008 and 2011 were reviewed using content analysis technique. Additionally, the results of this research would enable us to compare them with the findings of the previous study conducted by Alper and Gülbahar (2009), thus, we would detect whether research trends and issues in the field of educational technology have undergone any change and improvement in the last four years.

METHODOLOGY
Research Method
This study employs a content analysis of articles published in the Turkish Online Journal of Educational Technology (TOJET) from 2008 through 2011. Content analysis, also known as textual analysis, applies both qualitative and quantitative inquiries to disclose the content of communication that can take many different forms (written, verbal, electronic, etc.). The current study only adopted quantitative content analysis to provide the number of occurrences (frequency) of some concepts and themes within the research articles and to describe current patterns in this context. Content-analytic research process included the following steps: (1) developing coding system (2) extracting articles and implementation of the coding system; (3) classifying coding categories; (4) organizing emergent categories; and (5) interpreting findings.

Data Source
TOJET was selected to conduct this special inquiry since it would be a valuable source to sustain the earlier work done by Alper and Gülbahar (2009) on the same journal and to present current trends, developments, and research strategies in the field. TOJET established in 2002 is known as a scholarly journal for the field focusing on a broad range of research and development issues in the field of educational technology. It is a quarterly, peer-reviewed multidisciplinary electronic journal and abstracted/indexed in many databases including Social Science Citation Index (SSCI), Education Research Index, and ERIC. TOJET has a collection of internationally diverse editorial board members representing the leading scholars in their respective fields. The ultimate aim of TOJET is stated as increasing the depth of the subjects across disciplines and expanding knowledge of educational technology.

As aforementioned, the first content analysis study of TOJET by Alper and Gülbahar in 2009 captured a period of five publication years (2003–2007). The major intend of that study was to examine the characteristics and the general trends of research in the field of educational technology. Within this context, they primarily set certain criteria as variables such as research topics, authors, school level, research theories and design, sample selection technique, and sample size. In parallel with this effort, the current study is designed to address the related concepts as well as to explore new issues and practices of articles published in the last four years of TOJET. It is being inquired whether the findings would be altered over years. In addition, TOJET has been indexed and abstracted in Thomson Reuters SSCI since volume 7, issue 1 in 2008 and the number of articles per issue has been gradually increased since then. It is believed that the findings would be a useful benchmark to assess the past and the current research actions and agendas. From 2008 to 2011 including 16 volumes of TOJET, a total number of 273 articles were selected for this study and all were published in English. Table 1 summarizes the characteristics of the journals and the data source of this present study.

Table 1: Data Source (n=273 articles)

Journal	First Publication Year	No. of Volumes	Publication Frequency (issues/year)	Abstracted/ Indexed in	Publication Volumes & Years included in this study	Number of articles during 2008 – 2011
TOJET	2002	37	2002: 1 2003-2011: 4	24 Databases ie., SSCI, ERI, ERIC	Vol. 1–4: 2008 Vol. 1–4: 2009 Vol. 1–4: 2010 Vol. 1-4: 2011	32 articles 33 articles 79 articles 129articles

Procedure
A coding system was developed to analytically assess and evaluate the articles within the framework of the study. This coding system covers the preset measures falling into three main sections: (a) general characteristics

of studies; (b) research themes and issues; and (c) research design. In the section of general characteristics of studies, there are variables as number of articles per year, number of authors (nature of collaborations), origin of research (country), educational level, target groups, and academic subject area. The realm of research themes and issues addresses the measures as research topics and theories and also instructional mode, and type of media in articles. The last section entitled as research design includes measures on strategies of inquiry, research methods, sample sizes, and data collection methods.

Two authors, specializing in the field of distance education and educational technology and communications, coded the articles. Each researcher coded separately on a subset of articles. Some measures were then classified into emergent themes on the research topics, strategies of inquiry, research methods, and the data collection methods used in these studies. The third author also performed random quality cross-checks to ensure inter-coder reliability in the data. During this process, approximately fifty articles were randomly selected and the third coder reviewed articles in terms of coding accuracy between the panel of two initial coders.

Cohen's Kappa statistics (κ) (1960) were calculated to estimate inter-coder agreement among coders. Kappa values of .21- .40 refer to fair agreement, values of .41-.60 indicate moderate agreement, and values of .61-.80 refer to substantial agreement (Rietveld & van Hout, 1993). Kappa estimates less than .20 indicate low agreement and the estimates more than .80 refer to excellent agreement among coders. Inter-coder agreement scores in this study ranged from .72 to .87, indicating moderate to relatively high agreement for each entry.

RESULTS
I- General Characteristics of Studies
Number of Articles Published
As presented in Table 2, approximately 76 percent of 273 articles were published from 2010 through 2011. There were only 65 articles extracted during 2008–2009 period.

Table 2: Number of Articles Published per Year (n=273)

Year	Frequency	Percent
2008	32	11.7
2009	33	12.1
2010	79	28.9
2011	129	47.3
Total	**273**	**100.0**

The quantity of annually published articles changed significantly with an increasing publication rate after 2009 in TOJET (see Figure 1). This increase in the number of articles within last two years may possibly be a result of growing popularity of TOJET afterward it has been abstracted in a highly selective journal indexing system, SSCI, and therefore there might be a considerable increase in the number of submitted manuscripts to the journal.
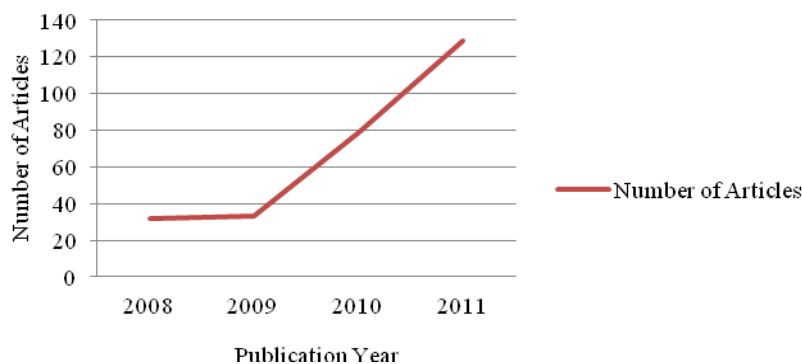

Figure 1: Distribution of Yearly Publication

Nature of Collaboration in Research
As mentioned earlier, educational technology is a multidisciplinary subject and is affected by many theories and practices. Therefore, researchers with different backgrounds and expertise are more and more involved in

collaborative research efforts. In other words, it is anticipated to observe intensive collaborations among researchers year by year. With this regard, the number of authors in articles over four years was examined to detect the nature of collaboration in research studies.

The analyses in Tables 3 and 4 illustrate the total number of single-and multiple-authored articles per year. Considering variations per publication year, both single- and multiple-authored studies gradually increased while the number of articles published increased as well. Meanwhile, the total number of single-authored papers contributed to the 99 (36.3%) studies whereas there were 174 (63.7%) multiple-authored research papers in this four year period.

Table 3: Cross Tabulation of Number of Authors and Year (n=273)

| Number of Authors | Year n (%) | | | | Total |
	2008	2009	2010	2011	
1	13 (40.6)	10 (30.3)	26 (32.9)	50 (38.8)	**99 (36.3)**
2	7 (21.9)	16 (48.5)	26 (32.9)	36 (37.9)	**85 (31.1)**
3	6 (18.8)	4 (12.1)	14 (17.7)	28 (21.7)	**52 (19.0)**
4	3 (9.4)	3 (9.1)	8 (10.1)	9 (7.0)	**23 (8.4)**
5*	3 (9.4)		5 (6.4)	6 (4.7)	**14 (5.0)**
					273 (100.0)

Indicates number of authors 5 or more

Table 4: Cross Tabulation of Single vs. Multiple-Authored Articles and Year (n=273)

| Number of Authors | Year n (%) | | | | Total |
	2008	2009	2010	2011	
1	13 (40.6)	10 (30.3)	26 (32.9)	50 (38.8)	**99 (36.3)**
2–5*	19 (59.4)	23 (69.7)	53 (67.1)	79 (61.2)	**174 (63.7)**

Indicates number of authors 5 or more

As can be seen from Table 4 and Figure 2, the frequency of multiple-authored articles demonstrates an increasing trend from 2008 through 2011 whereas solo studies did not demonstrate such a consistent positive pattern over years. In other words, collaborative efforts in educational technology research have been increasing for years. However, it should be also noted that single-authored studies have the highest frequency level over years comparing to the number of studies with two, three, four and five and more authors within this period of time (see Table 3).
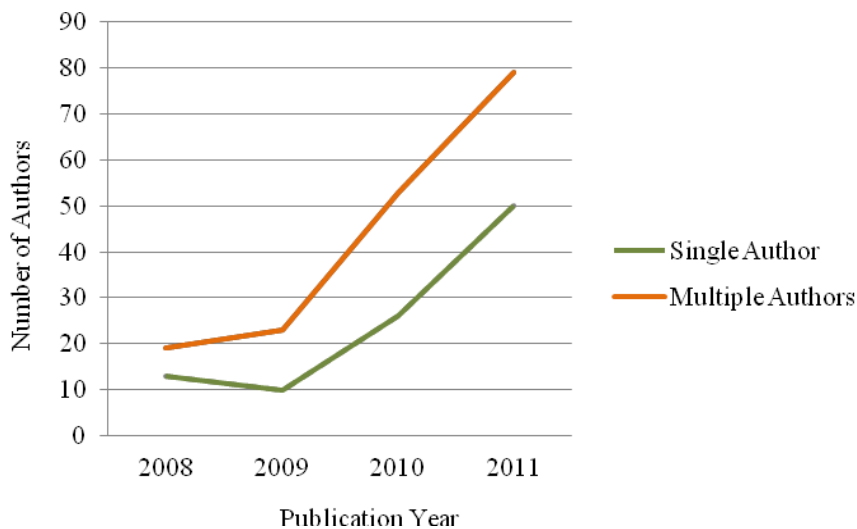

Figure 2: Comparison of single and multiple–authored articles in 2008–2011

Country-wise Distribution of Articles
An analysis of the country-wise distribution of articles revealed that a total of 29 countries were extracted from 2008 through 2011. Of these, 142 (52%) of the 273 studies were carried out in Turkey (Table 5). This could be

the reason of the fact that TOJET is the first-published and a well- known journal in Turkey. The second highest contribution was made by two Asian countries, *Malaysia and Taiwan,* with a total of 52 articles (19.1%).

Table 5: Cross Tabulation of Countries and Publication Years (n=273)

Regions Cluster	Year n (%)				Total
	2008	2009	2010	2011	
Turkey	23 (71.9)	19 (57.6)	40 (50.6)	60 (46.5)	**142 (52.0)**
Malaysia			10 (12.7)	26 (20.2)	**36 (13.2)**
Taiwan		1 (3.0)	9 (11.4)	6 (4.7)	**16 (5.9)**
Turkish Republic of Northern Cyprus		3 (9.1)	2 (2.5)	6 (4.7)	**11 (4.0)**
USA	2 (6.3)	2 (6.1)	3 (3.8)	4 (3.1)	**11 (4.0)**
Others*	7 (21.9)	8 (24.2)	15 (19.0)	27 (20.9)	**57 (20.9)**
Total	**32 (100)**	**33 (100)**	**79 (100)**	**129 (100)**	**273 (100)**

Capturing Canada, China, Czech Republic, Ghana, Greece, Hungary, Iran, Iraq, Jordan, Korea, Nigeria, Norway, Pakistan, Poland, Portugal, Saudi Arabia, Serbia, Singapore, Slovenia, Sweden, South Korea, Thailand, and UK.

The total number of publications from Turkish Republic of Northern Cyprus and USA's scholars was identical as 11 studies during this period. The number of publications from other 23 countries was found to be 57 of 273 articles. Overall, the contributions from each country have been more diversified and inflated in size over years.

Educational Level and Target Population
Multi level cross tabulation analysis of educational level and target population per year resulted that higher education as an educational level (n=165 articles) and students as a target group (n=215 articles) have been more commonly studied than other target groups from 2008 to 2011 (Table 6 and Figure 3). Following this group of participants, educators (teachers, instructors, tutors, etc.) is the second most studied target group (n=30 articles) including all educational levels. Other types of participants were not as much researched (n=12) throughout these years.

Table 6: *Articles* Classified by School Levels and Target Group per Year

Educational Level	Target Group	Year n				**Total**	**Grand Total**
		2008	2009	2010	2011		
K-12	Principal & Administrators	1		1		**2**	
	Teachers	3		10	3	**16**	
	Students	5	7	19	35	**66**	**85**
	Parents				1	**1**	
Higher Education	Instructors	6	2	4	2	**14**	
	Students	14	20	43	72	**149**	**165**
	Other Staff (Courseware developers, technical staff)	1			1	2	
Others*		3	1		3	**7**	**7**

* Target groups including adults, firms, engineers, technicians, employers, and articles
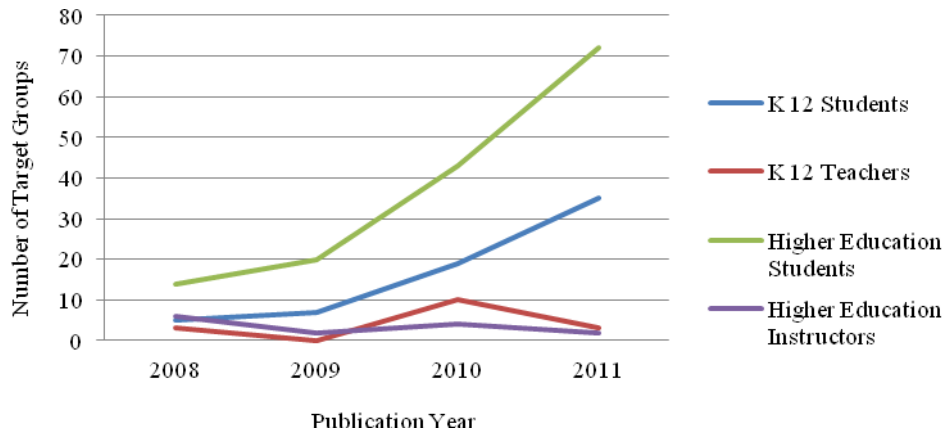*Note: Some articles include more than one target group*

Figure 3: Distribution of educational levels by target groups

These results indicate a positive tendency towards engaging college level research activities in the field of educational technology since technology integration is really a new initiatives for lower levels comparing to common applications in higher education.

Academic Subject Taught
For the analysis of the academic subjects in articles, each subject area was extracted and then grouped in five general domains as social sciences, language, mathematics, science and engineering, and finally physical education. Herein, it should be noted that some studies addressed more than one subject area. Table 7 shows that most of the studies (n=128) were related to the area of social sciences.

Table 7: Cross tabulation of Academic Subject Area

Subject Area	Year n				Total
	2008	2009	2010	2011	
Social Sciences[1]	18	16	12	82	**128**
Language	3	4	8	8	**23**
Mathematics	3	2	8	9	**22**
Science & Engineering[2]	9	8	16	30	**63**
Physical Education	1	2		7	**10**
Total	**34**	**32**	**44**	**136**	

[1] *Including education, distance education, literature, theology, music education, and early childhood education*
[2] *Including biology, chemistry, physics, computer science, biostatistics, and architecture*
Note: Some articles addressed more than one subject area

The next popular topic studied in the field of educational technology was found to be science and engineering (n=63). Studies in the language arts and mathematics were almost equally studied (n=23; n=22, respectively). Physical education was the subject of 10 studies from 2008 through 2011 in TOJET. Although research in social sciences was most popular between 2008 and 2009, science and engineering areas have been more popular subjects since then.

II- Research Themes and Issues
Research Topics
The research topics extracted from 273 studies in TOJET from 2008 to 2011 were coded and then classified into five major research themes. Each theme is described as below:

1. *Media Study* –Media comparison studies such as face-to-face versus other types of media were placed under this theme. Specifically, media comparison studies on the effects of teaching-learning process, learning characteristics and specific measurements (learners and instructors' attitudes toward media being used, achievement, technology perceptions, familiarity, self efficacy, satisfaction, motivation, perceptions of social existence, gender and age differences, learning styles , interaction levels, frequency of use of technology) were included in this theme.

2. *Design & Development* – This theme covers studies on instructional design, software development efforts or modeling technology to enhance the effectiveness and efficiency of the process of learning and teaching.
3. *Evaluation* – This theme include evaluation-based studies on teaching and learning process (peer evaluation, evaluation of technological trends, evaluations of standards/policies regarding use of technology, evaluation of distance learning environments, assessment of employees' skills regarding technology, evaluation of software).
4. *Teaching & Learning Approaches* – This theme capture studies focusing on different theories and approaches used in teaching-learning process (constructive learning, cooperative learning, problem based learning, blended learning, distributed learning, project-based learning, media richness, social networking).
5. *Others* – This theme covers studies that cannot be included in any of the above topics. For example, the effects of technology on human health, the ethical issues arising in the use of ICT.

The analysis of cross tabulation of research themes and publication years between 2008 and 2011 shows that 156 studies were focused on media related studies. Research themes of *Design and Development* (n=54), *Teaching and Learning Approaches* (n=52), and Evaluation (n=49) were almost equally studied. Only three studies did not fit to any available research themes during this period (Table 8).

Table 8: Cross Tabulation of Research Themes and Publication Year

Research Themes	Year n				Total
	2008	2009	2010	2011	
Media Study	22	16	53	65	**156**
Design & Development	5	6	8	35	**54**
Evaluation	7	5	14	23	**49**
Teaching & Learning Approaches	7	12	12	21	**52**
Others		1	1	1	**3**

Note: Some studies could focus on more than one issue

There are noticeable positive trends of research agendas on Media Study, Design and Development and also Evaluation in articles for the period of 2008–2011. However, the theme of Teaching and Learning Approaches demonstrates consistent trend between 2008 and 2010.

Research Theories
Within four years period of data, research theories in articles were identified and then classified into four domains as Learning Theories, Psychological Theories, Sociological Theories, and Communication & Media Theories. Table 9 portrays the number of frequency of each theory in the articles reviewed. The results noticeably reflected that the large proportion of learning theories (n=49) was dominant comparing to other three types of theories in the articles covered. Following this, psychological and sociological theories were implemented in studies during this term. However, it should be noted that all of these contribute to the field and cannot easily be separated from each other.

Table 9: Research Theories

Learning Theories	Number of Articles
Constructivist Theory	14
Social Learning Theory	13
Collaborative Learning Theory	7
Generative Learning Theory	6
Blended Learning Theory	2
Problem Based Learning Theory	2
Multiple Intelligence Theory	1
Distributed Learning Theory	1
Critical Thinking Theory	1
Engagement Theory	1
Cognitive Load Theory	1
Psychological Theories	
Flow Theory	2
Motivation Theory	5
Sociological Theories	

Social Network Theory	3
Digital Divide	1
Social Agency Theory	1
Communication & Media Theories	
Social Presence Theory	1
Media Richness Theory	1
Diffusion of Innovations Theory	1

Note: Some articles could be used more than one approach.

Instructional Mode

Articles were also classified based on instructional mode they utilized as traditional (face-to-face; F2F), distance and combined strategy (Table 10). Studies coded under combined strategy were also differentiated as F2F with Distance mode and F2F versus Distance mode. Considering this classification, from 2008 through 2011, traditional mode were implemented or studied in134 articles while 76 studies worked related to distance mode of instruction. 13 out of 233 studies enhanced face-to-face mode of instruction with distance learning strategies. Only 10 studies used comparison technique to examine differences between face-to-face mode of instruction and distance learning environment.

Table 10: *Articles Classified by Instructional Mode (n=233)*

Instructional Mode	Year n				Total
	2008	2009	2010	2011	
Traditional Mode (Face-to-Face – F2F)	18	18	34	64	**134**
Distance Mode	5	6	26	39	**76**
Combined Strategy					
F2F **with Distance mode**	3	1	5	4	**13**
F2F **vs. Distance mode***	2	1	2	5	**10**
Total	**28**	**26**	**67**	**112**	**233**

* Comparison type studies

Type of Media

Major types of media as a means of communicating information in articles were categorized as computer-based instruction, web-based instruction, video & visual media, web 2.0 tools, instructional TV, and mobile tools. These media were also examined considering instructional mode that was studied in articles. As can be seen, the most popular media in face-to-face mode was computer-based instruction (n=68) whereas web-based instruction was the most implemented type of media in distance learning mode in the articles (n=63) (see Table 11). The category of web 2.0 tools and mobile tools was equally incorporated in both F2F and distance environments. However, video & visual media was not as frequently studied in distance learning environments. Instructional TV was the most neglected form of communication during 2008–2011.

Table 11: Cross Tabulation of Type of Media and Year by Instructional Mode

Instructional Mode	Media	Year n				Total	Grand Total
		2008	2009	2010	2011		
Traditional	Computer-Based Instruction	6	8	20	34	**68**	
	Web-Based Instruction	5	3	7	16	**31**	
	Video & Visual Media		2	2	3	**7**	**117**
	Web 2.0 tools*	1	1	2	4	**8**	
	Instructional TV		1			**1**	
	Mobile Tools**		1		1	**2**	
Distance	Computer-Based Instruction				3	**3**	
	Web-Based Instruction	4	5	25	29	**63**	
	Video & Visual Media	1			1	**2**	
	Web 2.0				4	**4**	**76**
	Instructional TV		1		1	**2**	
	Mobile Tools			1	1	**2**	
Combined Strategy	Computer-Based Instruction	3		1	4	**8**	
	Web-Based Instruction	2	2	6	3	**13**	

Video & Visual Media		1	**1**	**23**
Mobile Tools			1	**1**	

*Blogs, wiki, second life
**Mobile tools included PDA, mobile phones, etc.
Note: One study could include more than one type of media and 17 studies using traditional mode did not mention what type of media was employed.

III- Research Design
Research Methods
Three main research methods were coded in articles as *Quantitative, Qualitative,* and *Mixed Method* approaches. Findings tabulated in Table 12 point out that almost 62% of 273 articles used a quantitative research method (n=169) whereas qualitative (17.2%) and mixed method (14.3%) approaches were almost equally preferred research approaches in articles during the period. On the other hand, no specific research method was stated in 18 (6.6%) out of 273 articles. These articles were mainly identified as literature reviews and program introduction papers.

Table 12: Cross Tabulation of Research Methods and Years (n=273)

Method	Year n				Total n (%)
	2008	2009	2010	2011	
Quantitative	23	19	48	79	**169 (61.9)**
Qualitative	7	7	14	19	**47 (17.2)**
Mixed	1	4	12	22	**39 (14.3)**
Not Specified*	1	3	5	9	**18 (6.6)**
Total	**32**	**33**	**79**	**129**	**273 (100)**

* Including review-based and program introduction articles

Even though the frequency of studies employed quantitative approach seems to have considerably been increased during 2009–2011, mixed method and qualitative methodologies have been getting more popular in research in last two years of data.

Strategies of Inquiry
Analysis of research strategies used in articles indicated that 173 articles employed quantitative descriptive-type inquiry (see Table 13). The next trendy strategy in research was found to be exploratory case study (n=43) between 2008 and 2011 followed by all types of experimental studies which were used in a total of 31 articles. Within this period only one study used a meta-analytic approach published in 2011. Results also indicated that researchers showed much more tendency towards exploratory case studies in recent years. However, descriptive strategies including survey methods seem to be a dominant technique throughout these years.

Table 13: Cross Tabulation of Strategies of Inquiry and Years

Research Strategy	Year n				Total
	2008	2009	2010	2011	
Experimental	4	1	4	12	**21**
Quasi-Experimental			4	6	**10**
Descriptive	19	21	50	83	**173**
Other Quantitative Strategies[1]				2	**2**
Exploratory Case Study	4	6	14	19	**43**
Other Qualitative Strategies[2]	2	2	1	6	**11**
Mixed Method Strategies[3]	2	3	5	9	**19**
Literature Review		2	2	5	**9**
Others*	1	2	4	4	**11**

[1] Meta-analysis, social network analysis
2 Phenomenology, grounded theory, action research, discourse analysis
3 Sequential methods, content analysis, Delphi
* Including theoretical inquiry, program introduction, system modeling articles

Data Collection Methods
According to data collection methods used in articles, seven main data collection techniques were tabulated during the years under investigation. There is a clear indication that researchers employed multiple data

collection methods to validate findings. Researchers in the field frequently used, in order, surveys/questionnaires (n=128), interviews (n=57), scales (n=51), documents (n=50), achievement tests (n=49), and observations (n=25). However, field notes were used in only six studies during this term (Table 14).

Table 14: Cross Tabulation of Data Collection Methods and Years

Data Collection Method	Year n				Total
	2008	2009	2010	2011	
Survey / Questionnaire	12	15	44	57	**128**
Scale	9	10	3	29	**51**
Interview[1]	3	8	18	28	**57**
Observation	4	1	3	17	**25**
Field Notes	1	1		4	**6**
Achievement Test	6	7	5	31	**49**
Documents[2]	5	10	17	18	**50**

[1]*Including one-to-one and focus group interviews*
[2]*Including articles, emails, written artifacts, assignments, journals/diary, portfolio, audio/video files, essays*
Note: One study could use more than one type of data collection techniques

Sample Size
Sample sizes collected by each study were determined and coded based on the range groups in Table 14. Researchers in the field frequently collected data from large samples (>200 cases; n=71) to establish generalizable data. As a matter of fact, it is an expected finding since most studies utilized quantitative methodology and survey research. On the other hand, researchers collected data from less than 60 units as samples in almost 40% of the articles.

Table 15: Cross Tabulation of Range of Sample Sizes and Years (n=235)

Range of samples	Year n				Total n(%)
	2008	2009	2010	2011	
1 – 29	4	4	11	21	**40(17.0)**
30 – 59	6	6	17	20	**49 (20.9)**
60 – 89	2	5	5	11	**23(9.8)**
90 – 119	4	1	4	7	**16(6.8)**
120 – 159	1	5	4	11	**21(8.9)**
160 – 200	1	4	2	8	**15(6.4)**
200 >	4	3	27	37	**71(30.2)**
Total	22	28	70	115	**235**

Small samples (n <30) were also detected in the 40 articles and is recognized that they were the subjects in qualitative-driven studies between 2008 and 2011 in TOJET. The next section will discuss the finding within the context and the results of the previous studies.

DISCUSSION AND CONCLUSION
Considering historical development process of the educational technology, we witness that it has a dynamic structure that evolves and develops depending on the requirements of the current era. This structure fundamentally seems to have been influenced by theories, approaches, technologies and paradigm shifts which shape the field of educational technology. Review-based studies in the field indicated that indeed, research themes and methods in studies are affected by aforementioned changes. In this context, this study aims to find out how these changes in the educational technology field were reflected upon 273 studies published in 16 volumes of TOJET in the last four years (2008-2011). Findings in the current study were discussed under the following sections; (a) general characteristics of studies; (b) research themes and issues; and (c) research design.

General Characteristics of Studies
Articles within this period of time appear to have either single- or two-authored based studies. Although this may be attributed to various reasons, the most important reason is that the Council of Higher Education in Turkey stipulates it as a prerequisite for academic promotions and appointments to have a single author-based -studies in academic studies both in social sciences and other scientific fields. Besides, preferring individual studies may also be considered as a cultural phenomenon of Turkish educational system. Some of the factors that create such an individualistic culture might be the dominance of individual-based measurement and assessment models in

the Turkish education system which lasts until the higher education and the lack of focus on collaborative working skills. This is confirmed by the content analysis of Alper and Gülbahar (2009) on articles published in TOJET between 2002 and 2007. In contrast, when content analyses on similar studies in renowned international journals of educational technology are examined, there is generally a tendency towards co-authored teamwork studies (Genç Kumtepe, Bozkaya & Erdem Aydın, 2012).

It was found out that studies published in TOJET between 2008 and 2011 were conducted in 28 different countries. It was concluded that 142 of 273 articles (52%) studies conducted in Turkey. Some of the most significant reasons of this conclusion might be the fact that the journal was originated in Turkey and is the one of leading journal in the international context of educational technology. On the other side, another factor that reduces diversity of country wise distribution of articles might be the fact that researchers in other countries were familiar with other leading international journals that they were familiar before TOJET being indexed in SSCI. However, this conclusion does not seem irrelevant when we take into account the allocated space for regional studies in many international journals.

The analyses of the educational level and target audience of the studies revealed that the studies predominantly focused on higher education (165) as the major target audience. This finding again overlaps with the results of Alper and Gülbahar's (2009) study where the variable of educational level was coded as school level. The reason why technology-based practices can be employed in the learning-teaching process much easily at the higher education level might possibly be the fact that particularly those who conduct academic studies are not much exposed to bureaucratic obstacles, or do not experience administrative problems related to the target audience.

Research Themes and Issues
Regarding research issues and themes in the period of 2008 – 2011, it was observed that studies published in TOJET in social sciences (i.e., education, distance education, theology, literature, music education) were greater in number (n=128) compared to the studies in other fields. Particularly, studies in social sciences published in 2011 were predominant compared with previous years and other fields, as well. However, it was seen that studies conducted in the field of natural sciences such as biology, chemistry, biostatistics, architecture, and computer sciences increased in number in comparison to previous years during 2011. The fact that studies in natural sciences increased in amount after 2010 might be attributed, particularly, to the innovations and development in computer technologies. The use and the integration of technology in 2000s becoming popular issues of scientific research in natural sciences might be listed among the reasons of such developments (Genç Kumtepe et al., 2010).

The analysis of articles based on research themes yielded a result that studies on *media comparison* were seen to be a popular research topic (n=156) in this period. In those studies, the effects of media on learning-teaching process and also the relationships between media and some learner related constructs (e.g. attitudes, perceptions) were evaluated. On the other hand, studies under the heading of *design and development*[1] seemed to have picked up pace in 2011. The intensive use of technology-based applications in the learning-teaching processes accelerated design and development studies as to how the technology used can best be structured in the most effective, efficient and attractive manner (Klein,1997; Masood, 2004).

The instructional mode discussed in the studies was reviewed as traditional, distance, and combined strategy. The traditional mode was found to be the most preferred instructional mode in the field of educational technology in these years. However, the interesting point, herein, is that distance learning appeared to be an instructional mode widely used in educational technology particularly in 2010 and onwards. Some of the most important reasons of this finding are the increased interest for distance learning in almost all colleges, driven by various requirements, and the organization of distance learning centers in response to such interest. On the other hand, computer- and web-based applications appear to be used intensively in all three of the instructional modes. This finding also overlaps the finding of Masood's (2004) study on the determination of trends in the educational technology which claimed that there is a research tendency towards distance learning and web-based learning in studies.

The widespread use of computer- and web-based applications in learning and teaching environment not only facilitates social learning by individuals but also enables collaborative research efforts. In other words, learning-teaching media becoming increasingly web-based brings up constructivist learning approaches to the agenda

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[1] Studies included efforts for developing a new instructional design, software or model with an aim to increase effectiveness and efficiency of the learning-teaching process

rather than behaviorist ones (Jonassen & Lund, 2000). At this point, it may be argued as well that use of technology was an effective medium and tool in the progress of the constructivist approach.

According to reviews of previous content analyses in the field (Alper & Gülbahar, 2009; Masood, 2004; Rosset al., 2008; Shih et al., 2008), it was found that collaborative learning, problem-based learning, and social learning based applications became prominent issues with the influence of the constructivist learning approaches. The current study confirms that the effects of constructivist shift that emerged in the 1990s still endure in 2011. Similarly, in line with the increase in the use of web-based applications in learning-teaching processes, it is worth mentioning that applications based on social learning and collaborative efforts have gained momentum along with constructivism. However, when examining the articles in terms of theoretical foundations, it was found that a great majority of them fail to build a theoretical framework. Such finding also mentioned in the study of Alper and Gülbahar (2009) and it was emphasized that as one of the issues that must be addressed in further studies.

Research Design

When studies published in the last four years of TOJET were reviewed in the context of research strategies, it appeared that quantitative methodology has been used predominantly (n=169). However, in the research conducted in the last two years, there is a tendency to use qualitative and mixed methods besides quantitative methods. Such conclusion suggests that researchers endeavored in their studies to identify the causes of the relationship between variables, rather than describing existing cases. These studies captures qualitative and mixed method research papers, wherein, rather than comparing media, the effects of different elements of the media on different cognitive processes are studied. These studies were also discussed on the issues including determination of opinions and expectations of learners, and social dimensions of learning. This finding is also consistent with the results of Hsieh et al. (2005)' study indicating that qualitative studies became popular in the educational technology field after the 2000s.

The results of analyses on strategies of inquiry in articles during this term, it was observed that most of the researchers preferred to conduct quantitative based descriptive studies (n=173). According to the content analysis study conducted by Alper and Gülbahar (2009) for the period between 2003 and 2007, it was seen that, as a research strategy, researchers often preferred descriptive studies and literature reviews over other methods. On the other hand, Alper and Gülbahar (2009) stated that studies involving literature reviews were the most frequently used method during such period. However, in this study which reviews the last four years, literature review appears to be the least frequently used research method in the studies (n=9). This finding indicated that researchers showed much more tendency towards empirical studies in recent years.

Regarding data collection techniques, it was found that researchers often used Surveys/Questionnaires as data collection tools in studies published between 2008 and 2011 in TOJET. Unlike this finding, in the study of Alper and Gülbahar (2009), it seems that scale was the major data collection tool of the studies rather than surveys.
Both in the current study and the study by Alper and Gülbahar (2009) indicated that authors generally worked with large samples for their studies. Working with large samples ensures generalizable of findings and consequently, it is an evidence of an attempt to establish external validity of data.

IMPLICATIONS

Regarding results of the current study, the following implications should be considered:

- Downsizing the focus on single-authored articles that are seen as a prerequisite for academic promotion and appointment by the Council of Higher Education, and encouraging co-authored and even multi-disciplinary studies.
- Keeping abreast of developments and innovations in educational technology in social sciences as well as in natural sciences such as physical sciences, mathematics, engineering, and architecture.
- Increasing examples of innovations and developments in educational technology within interdisciplinary and intercultural studies.
- Eliminating the bureaucratic and administrative obstacles for conducting studies with samples from other levels of education, namely kindergarten through secondary education, as most of the studies in the field have focused on learners in higher education.
- In addition to quantitative descriptive approaches, offering room for qualitative and mixed research methods which investigate a situation that emerges during a study, taking account the causality relationships and the circumstances under which such situation emerged.
- Conducting analytic and modeling research aimed at practice, carrying descriptive studies a step further.
- Promoting research focusing on macro analysis rather than micro analysis.
- Endorsing research efforts in diverse areas like cognitive psychology and social learning theory.

- Deviating from media comparison studies, and conducting analytic studies which will reveal the effects of media characteristics on cognition.

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