

AN EVALUATION OF A CONSTRUCTIVIST ONLINE COLLABORATIVE LEARNING ACTIVITY: A CASE STUDY ON GEOMETRY

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ABSTRACT

This paper reports a case study which involved 32 secondary school students participating in an online collaborative learning (OCL) activity known as Diary of Discovering Geometry. This activity aimed to explore the real contents in the learners' surrounding for discovering the spatial concepts and the applications of geometry. The purpose of the study was to explore and investigate the online interaction that occurred in Diary and the perceived effects of Diary. A combination of descriptive and qualitative approaches was utilized to analyze the data. Findings indicate that the students tended to follow rather than being pro-active in Diary online interaction. The gain of knowledge in geometry was minimal. However, a majority of the participants perceived Diary positively as to increase their interest in computer, geometry and to share knowledge among the participants. Their interest in Diary decreased according to time. This can be remedied by introducing some interesting activities in order to maintain their interest throughout the activity. Discussion on the possible reasons of affecting online interaction was discussed. Limitation and recommendation based on the findings were also presented.

Keywords: Constructivist learning environment, Engagement Theory, Online collaborative learning, Secondary school, Case study.

INTRODUCTION

The penetration of Information and Communication Technology (ICT) has resulted educational changes in some ways that we conduct teaching and learning in schools, from conventional drill and practice and direct instruction to a more constructivist, learner-centred teaching and learning. Constructivist learning environment refer to a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities (Wilson, 1996b, p. 5). Its implications in education are obvious, and have been discussed and promoted in educational research. Some of the instances of constructivist learning environment are problem-based learning (Barrows, 1996), learning through relate-create-donate (Kearsley & Shneiderman, 1998), activity-based learning (Jonassen & Rohrer-Murphy, 1999; Engestrom, 1987), collaborative learning (Slavin, 1995; Johnson & Johnson, 1996); learning through construction (Kafai & Resnick, 1996), etc.

Kearsley and Shneiderman (1998) proposed their ideas of constructivist teaching and learning through "Engagement Theory". They suggested that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. They proposed three basic engagement principles. They are, 1) Relate - emphasises team effort that involves communication, planning, management and social skills. Students are requested to clarify and verbalize their problems (in groups), thereby facilitating solutions and multiple perspectives; 2) Create - Act of creating makes learning a creative, purposeful activity (conducting a

project is more interesting than answering sterile textbook problems). Project-based learning is the essence of problem-based learning (PBL) approaches; and 3) Donate or Have an authentic focus - Stress on the value of making a useful contribution or service (to any kind of customers) while learning. This will increase motivation and the meaning of learning.

PURPOSE OF THE STUDY

This paper used the design research approach to design an online collaborative learning (OCL) activity for geometry using the three principles of Engagement Theory (Kearsley & Shneiderman, 1999). The activity was named after “Diary of Discovering Geometry” or Diary. The aim of the study was to explore factors affecting Malaysian secondary school students’ readiness for OCL, especially for teaching and learning geometry.

Two objectives were formulated in this study:

- (a) To explore and investigate the nature of students’ interaction and participation in Diary or OCL.
- (b) To investigate whether Diary was able to promote positive effects in cognitive and affective learning aspects as perceived by the students.

CONSTRUCTIVIST LEARNING THROUGH ONLINE COLLABORATIVE LEARNING (OCL)

Sociocultural constructivism is one aspect of constructivist view which emphasizes the socially and culturally situated context of cognition. Learning is viewed as a process of acculturation and thus the study of social, cultural processes and artefacts are central. For example, learning occurs as people participate in shared endeavours with others, with all playing active but often asymmetrical roles in sociocultural activities (Duffy & Cunningham, 1996). Research in conventional, classroom-based collaborative and cooperative learning has gained much attention for the past decades in the works undertaken by Johnson and Johnson (1996), Slavin (1995) and Kagan (1994). Findings show that collaborative and cooperative learning has significantly improved the overall academic achievements and interpersonal skills of the students.

In recent years, many researchers adopted computer, Internet or online technology as one of the key features to engage collaborative learning (Garrison & Anderson, 2003; Koshmann, 1996; McInerney & Roberts, 2004; McConnell, 2000), in which McInerney & Roberts (2004) quoted it as Online Collaborative Learning (OCL), which is also has the similar concept of Computer Supported Collaborative Learning (CSCL).

Working in small collaborative groups has social and academic benefits for children (Dillenbourg, 1999; Johnson & Johnson, 1999). Also, there is experimental evidence that under certain conditions, CSCL activities produce a significant increase in children’s learning when compared with individual training (Dillenbourg, 1999). Computer has always been a helpful tool to facilitate collaborative learning apart from being a tool for construction, communication, records and publication. The recent research approach for CSCL is more on process oriented account and not just on finding how the independent variables interact with the outcomes of collaborative learning (Dillenbourg et al., 1996; Koschman, 1996). Dillenbourg et al. (1996) believe during collaboration with different interfaces, different computer-based tasks and activities may yield very different interactions and learning outcomes.

EVALUATION ON ONLINE INTERACTION AND DISCOURSE

Online discussion or computer conferencing is a common online learning activity. Alavi and Dufner (2005) found that individual students who acquired more motivation and enjoyment from online discussions reported higher perceptions of learning. They recommended that students be graded for their quality of participation and responses to others, as well as for their efforts of making new postings. Individual characteristic is considered as one of the input factor affecting online learning outcomes apart from other factors such as instructor characteristics, course or activity types, technology used, and the learning process (Benbunan-Fich et al., 2005). For individual characteristics, students need to have motivation to learn online, skills or knowledge, cognitive ability to perform in the subject matter and their learning styles are all relevant to affect their quality of interaction in online learning environments (Benbunana-Fich et al., 2005). Any subject can be learned partially or fully online as long as the learner has motivation to learn online (Harasim et al., 1996).

Apart from this, Cecez-Kecmanovic and Webb (2000) suggested that a deeper understanding regarding the “inside” of collaborative learning process is necessary for establishing a deeper insight in collaborative learning. For example, message flow analysis was used to perform simple frequency count on the number of messages posted within a timeframe (Ruberg et al., 1996; Waugh et al., 1988); message act analysis was used to identify the functions that each message is to accomplish or to analyze the speech acts (Levin et al., 1990; Ruberg et al., 1996).

Message act analysis was initially based on a system for classifying instructional speech acts developed by Mehan (1979). He explained that there is a fundamental interaction sequence called initiation, reply and evaluation (IRE) relevant to the conventional classrooms where teacher usually initiates, student replies and teacher evaluates in instructional session. Ruberg et al. (1996) used this analysis to analyze the functions in online discourse to trace the act of “Reply, Initiate and Evaluate” which enables researchers to create a message map, describing multiple threads of interwoven discussion.

Another phenomenon highlighted in adopting new technology such as online interaction, Fidler (1997) has mentioned about the characteristics of early adopters and early excitement of adopting new technology, which is a common phenomenon in technology adoption theory and this phenomenon, was also supported by Fishman (2000), who commented that in any computer-mediated communication project, it is predicted that there would be an initial peak of computer-mediated communication tools use early in each project cycle, followed by a gradual decrease in use until each project is concluded.

ONLINE COLLABORATIVE LEARNING IN MALAYSIA

Since 1997, Malaysia has embarked on the Smart School Project that emphasizes on self-directed learning and thinking-based education through the use of ICT (Malaysia Ministry of Education, 1997). According to Jaafar and Samshir, (2004) more development policies or programs should be targeted on secondary school students because they are the key people to shape the productivity and confident usage of the ICT in the country. Zoraini (1998, 2001) believes that online collaborative learning (OCL) is able to contribute positively to the creation of smart learning environments and to develop teachers’ professionalism in teaching by opening more interaction opportunities with other colleagues (or experts) locally or internationally. On the contrary, the number of studies focusing on OCL or online projects for secondary schools in Malaysia is limited (Muhammad Kamarul & Mohamed Amin, 2004).

Lee and Zulkifli (1999) found some problems when they conducted a network writing class with some international students in a school. Some key problems faced were: Lack of access to the Internet, constraints from school administration as the activity was regarded as not pertinent to the curriculum, difficulty in gauging and maintaining partners’ commitment, and the unfamiliar used of graphical-based chatting software. These problems could be the reasons for hindering the adoption and development of OCL in schools.

DIARY: A CASE STUDY ON OCL FOR GEOMETRY

The principle of “relate-create-donate” (Kearsley & Shneiderman, 1998) was adopted in Diary of Discovering Geometry (or Diary). Diary was intended to achieve the following learning objectives: (1) To explore the possibility of using the real or surrounding contents as rich resources for learning geometry, (2) To record and document students’ learning experiences in electronic presentation, (3) To promote reflective thinking among learners based on their real-life observations, reading and thoughts about geometry. The scope of geometry content covered the basic concepts of geometry such as points, lines, planes and spaces in real life, and their attributes. Other concepts and applications including shapes, polygons, symmetry, tessellations, perimeter, area, angle and volume were also suggested as topics for exploration.

The participants were required to be in their small groups to clarify and verbalize their findings through observation and share their ideas through the exchange of electronic messages (to fulfil the “relate” principle). The participants were then grouped according to their specialization in different roles such as editors, PowerPoint author, graphic designers and translator, in order to produce digital presentations with images and written reports of their findings (to fulfil the “create” principle). These works were sent to all participants and an International project (ie IEARN, www.iearn.org) on “Connecting math with our lives” (to fulfil the “donate” principle). The main communication tools used were emails and online messages sent through Diary e-group system. See Figure 1a for the main interface for Diary and Figure 1b for its online exchange.



Figure 1a. Diari’s Website showing weekly activities

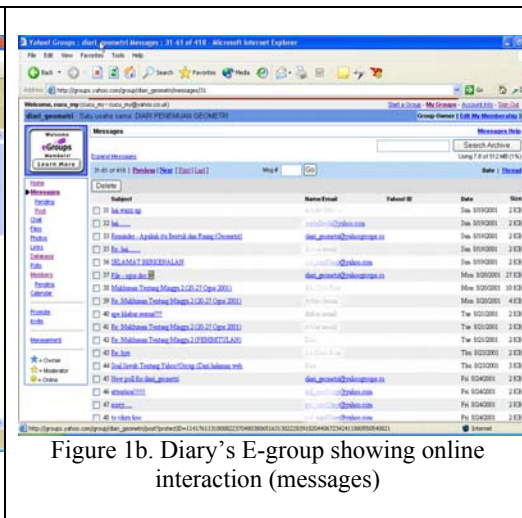


Figure 1b. Diari’s E-group showing online interaction (messages)

METHODS

Participants

The participants involved were 32 students (23 males, 9 females), who had successfully subscribed to the Diari electronic group system or mailing list and continued participating the Diari until the end of the activity. Most of them (24 out of 34, 75%) were lower forms students, namely Form 1 (aged 13) and Form 2 (aged 14) students. A few upper secondary students (8 out of 32, 25%), namely Form 4 (aged 16) students were also invited to join Diari so that they could share their knowledge and guide their juniors in learning and exploring geometrical concepts and applications through the use of ICT. These participants were drawn from four schools based on the prescribed selection criteria, specifically, they must (1) be able to access the Internet either at home or at schools, (2) possesses a functional email address, (3) secure parental consent and (4) volunteer to participate in this activity. To protect their privacy and to avoid any possible biases, each of the participant was identified using a pseudonym such as ‘S01’, ‘S02’, ... in the analysis.

Instrumentation

The following instruments were used for collecting data:

- 1) A project entry form was to collect the students’ particulars before they start joining Diari.
- 2) Survey questionnaires for the beginning and post-Diari stage which contain questions related to the students’ background information and various aspects on online collaboration.
- 3) Interview questions to collect students’ feedback after participating Diari.
- 4) Emails and electronic messages posted to the electronic group. All emails and electronic messages related to Diari were recorded and analyzed.
- 5) Research journals were used to record the activities and the process of implementing Diari from the beginning until the ending stage.

The data collected were analyzed to descriptive data such as frequency, percentage, and were represented in chats. Qualitative data were also used to complement the quantitative findings.

Procedure

Diari was conducted for six and half months in three stages, namely (1) The Beginning Stage, (2) The Ice-breaking Stage and finally (3) The Collaborative Stage. The progress and development of Diari project were observed and recorded in research journals. Electronic mails sent to the group and teacher coordinator were recorded. When the project was introduced in schools, project entry forms were given to each student and collected on the next day. After three weeks of exploration in the Beginning Stage, the students were asked to complete the questionnaires mainly covering on the problems faced in Diari and their suggestions to improve it.

After the Collaborative Stage, the students were interviewed via telephone at their preferred timeslot. They were asked to complete the Post-Diary questionnaires at their respective schools where demographics information and their feedback on their perceived knowledge acquisition and interest gained in geometry were collected. They also provided feedback on their learning outcomes.

Data analysis and findings

The statistical analysis revealed that 32 students had positive perception of the Diary. Majority of them agreed that Diary was useful (93.75%), easy to use (84.3%), important for learning (75%), interesting (78%) and well-managed (84%). By contrast, four students who perceived Diary as not important for their learning also perceived it to be not interesting.

The following are the types of analysis to analyze the participants’ interaction and participation for Diary over a period of six and half months: Message flow analysis, individual participation, content analysis and message act analysis.

Message Flow Analysis

Figure 2 shows that the coordinator who initiated Diary and invited the students to join Diary was dominant in Diary postings. The coordinator briefed and updated the overall processes and progress of Diary and therefore posted most of the messages in Diary. The students sent a relatively small number of postings (75 postings) to Diary’s mailing list compared to the coordinator’s (145 postings). Overall, the students’ participation in Diary was passive.

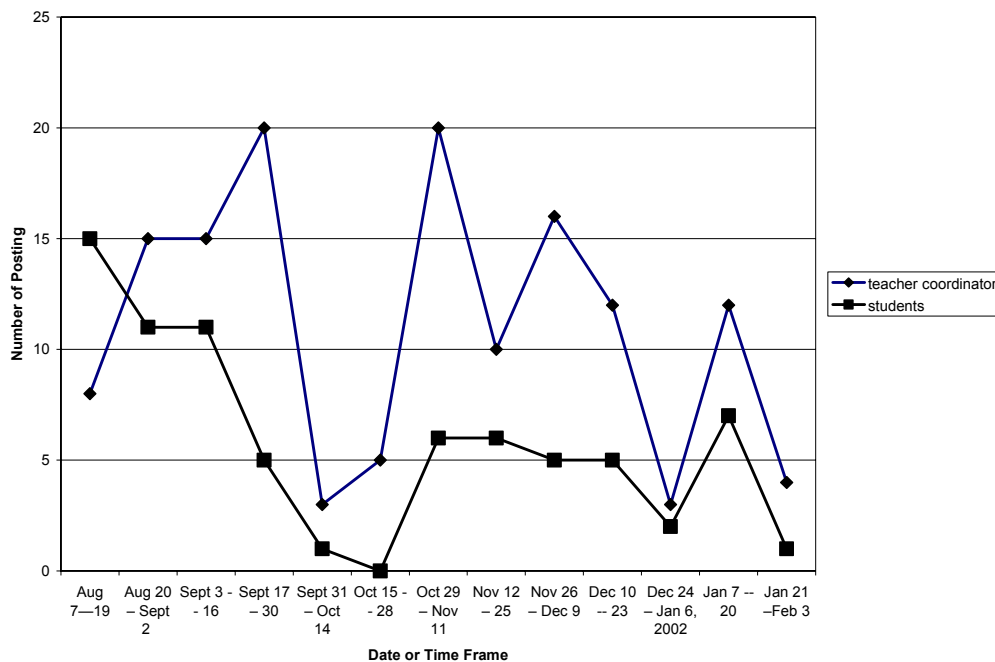


Figure 2. Message flow analysis for Diary

Based on Figure 2, most of the time, the flow of the messages posted by the coordinator and the students had a similar orientation. When the number of messages sent by the coordinator increased, the messages sent by the students would also increase, and vice versa.

At the Beginning Stage (middle of August), there were more messages sent by the students. The students had more interest (excitement) to know the topic on “Ice-breaking” by posting their particulars to the mailing list. They also asked some questions on Diary in order to get to know more details about this activity (see Figure 3). However, their participation declined towards October. During the Collaboration stage, the flow of students’ messages became more consistent from November onwards. During this period, only those who were committed in Diary continued to show their responses in the final stage, they consistently posted some messages in Diary’s

mailing list during this stage. To generalise, Diary’s message flow was quite consistent with the norm of online project cycles as reported in the literature.

In general, the message flow showed that the motivation level of participating in Diary decreased with time (see Figure 2, August 7–19 to October 15-28) but increased when the field trip was initiated in October. This reflected that attractive activities were able to increase the level of students’ motivation in OCL environment.

Individual Participation

The active and moderately active students were identified. The two active students were S23 and S24; the moderately active students were S08, S31, S29, S27, and S16. However, S16 withdrew from Diary at Collaborative Stage due to health problem. These students were interviewed after Diary and their postings were analyzed. Some personal traits were identified, particularly on their attitudes of learning and their interpersonal skills. For their learning attitudes, they have the following attributes:

1) These students had a higher sense of responsibility for Diary compared to the passive ones. They wanted to know more about Diary and their tasks in Diary so that they were able to plan and manage their time. For example, S29 took some time to decide whether to join Diary as he perceived this activity needed commitment from him. On the other hand, S23 usually had difficulties to access the Internet as he did not have the access at home, he voluntarily provided his phone numbers and his schedule during school holidays (as he worked part-time during school holiday) in case he was needed for Diary project. He also asked S24 to update him the progress of Diary. These students showed their responsibility by suggesting their roles in Collaborative Stage. S24 volunteered to be the editor or proof reader for PowerPoint slides, and his younger brother, S27 volunteered to help him. S08 volunteered to be the translator from local to English language, S29 volunteered to do the graphics for Diary and S23 agreed to become the editor for Diary.

2) They were more proactive to initiate and provide suggestions for Diary project. S23 suggested that some of the members needed to jumpstart the Diary project without waiting for others. He had a pragmatic personality and he preferred to do the project rather than merely talk. S24 initiated a chat channel in IRC for Diary Geometry as he felt that online chat was useful. S29 and S08 volunteered to join Diary by sending emails to the coordinator to express their interest in Diary. Their active participations were an indication of their leadership skills. One of them was a school prefect and the other was a school librarian. In contrast, the passive students were merely followers and most of them, did not hold any position in their schools.

3) They were problem solvers. Even though they faced obstacles in Diary, such as computer problems, time constraint, Internet access and lack of responses from other participants, they tried to solve these problems on their own. For example, S23 expressed that he did not want to give much excuses but wanted to complete the task for Diary and he wanted to see the output of this collaboration.

In terms of interpersonal skills, this group of students was more expressive through responding and providing feedback to others. In fact, S23, S24 and S29 complained that Diary was inactive due to passive responses from others. Hence, they initiated the idea for conducting chatting among the partners and interpreted as “Hye all”, “hope everyone fine there...”, “OK how’s everyone there”, “I am waiting”, and “I hope you are clear on my message” .

Content Analysis

Table 1 lists the types of contents and their examples posted by students in Diary mailing list meanwhile Figure 3 shows the occurrence of these contents in Diary.

Table 1. Types of contents sent to Diary Mailing List

Types of contents	Example of this content (Direct quotation from the messages)
C1 – Q & A about Diary	<i>I am S01 from School [C]. I faced problem to activate the left button in e-group program (Translated from local language).</i>
C2 – Project coordination	<i>Teacher, I hope you will send invitation email to:xxxx@yahoo.com because we are not able to join this group.</i>
C3- Geometry and mathematics	<i>hi...i think i would like to try to solve this just for fun problem...okay lets make it.. vase A has 5 litres in it and vase B has 3 litres in it.. why don't vase A pour 1 litre into Vase B...</i>
C4 – Socialization	<i>Hi & a'kum all! I wish u all gotta nice day. I am from [school D] would like 2 intro my self 2 ya ...</i>

C5 - Field trip arrangements and coordination	...For your information, during PMR exam, we must take the year end examination, so how do we able to join the trip. Hopefully teacher is able to ..
C6 – International project – “Connecting math with our lives”	...Attached is a photograph of a cultural display of my country men - a man dressed in female costume standing on a Stilt We are interested in investigating and telling you the mathematics involved.
C7 – others	Blank messages sent by S16.

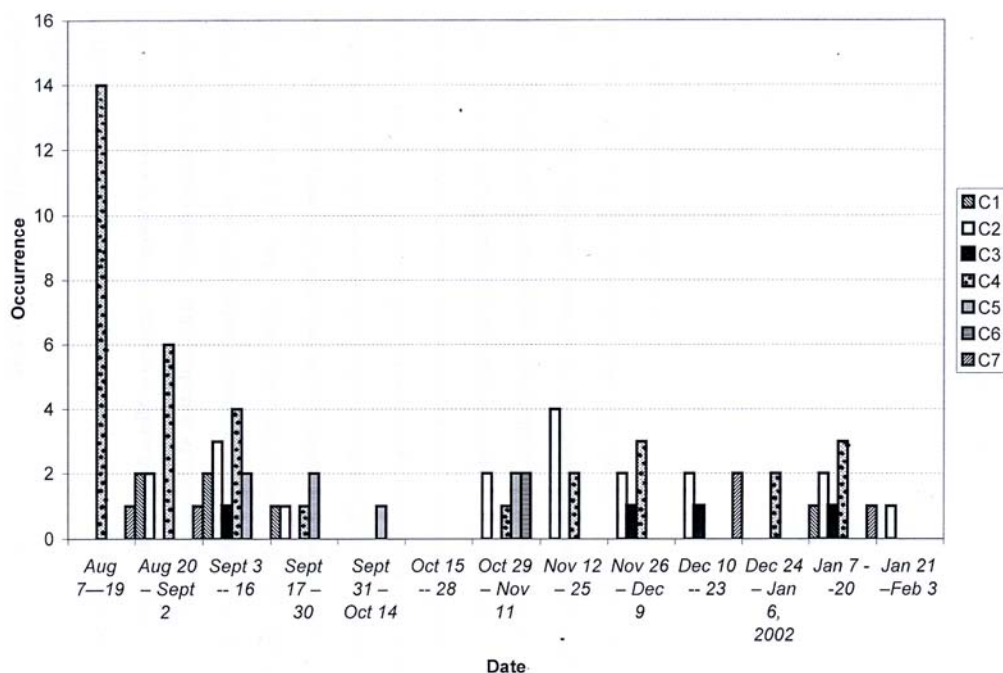


Figure 3. Content analysis of the messages sent by students

During the initial stage, C4 (socialization contents) dominated the online discourse for Diary as shown in Figure 3. The content related to geometry (or Mathematics) was not frequently posted although the coordinator had posted many messages to encourage discussions, especially during the school holidays in December. On the other hand, based on the students’ posting (see Figure 3), there was no difference in terms of the number of posting in December with other months. Hence, school holiday was not a factor to increase the students’ participation in Diary.

Message Act Analysis

The 75 messages sent to Diary mailing list (see Figure 1) were analyzed based on speech act, Initiate-Reply-Evaluate (IRE) sequence (Levin et al., 1990). In this context, “initiate” means students’ initiated or suggested some opinions or questions to find out something related to Diary project (e.g. S24 initiated chat channel in mIRC for Diary). “Reply” requires the information to be responded directly to the requester. This information usually has less depth and substance to communicate further. “Evaluate” on the other hand means to analyze some matters or questions by giving their own analysis or interpretation.

Table 2 shows the percentage (%) of the occurrence of IRE sequence in the messages sent by the students to Diary mailing list. Some of the messages contain more than one type of message act. The total acts were 83:

Act Sequence	Occurrence in Diary*	Percentage
I (Initiation)	31	37%
R (Reply)	48	58%
E (Evaluation)	4	5%

*Total occurrence of IRE = 83 in 75 messages.

The findings showed that “Reply” was the major act followed by the “Initiate” act. Most of the time, the students replied to the coordinator, especially at the early stage. The “evaluate” act has the least occurrence as the students needed to practice higher order thinking skills and longer time was spent for this act.

Perceived Effects of Diary- Cognitive Learning Aspect

During post-Diary interviews, those who expressed that they learnt geometry were asked to elaborate further about their learning gained. Surprisingly, most of them were not able to provide their answers in a greater detail even though geometry definition was posted on the Diary website and sent out to the mailing list a few during the course of Diary. They described geometry as “drawing”, “is the study of lines or angles and shapes”. However, one positive note about Diary is, many of them expressed that they were able to relate geometry to real life applications. S09 for example interpreted geometrical shapes through buildings and some artefacts in real life. S32 expressed that geometry was about the shape and the appearance of things that can be observed from the surroundings and S25 realized that geometry concept was not only limited to buildings, it can be extended to the natural beings.

Another aspect of cognitive learning was to investigate whether student-centred learning and active learning had taken place in Diary. In this case, data gathered from research journals, students’ correspondence with the coordinator, and interview transcripts were analyzed. The findings provided substantial evidence that teacher-centred learning was more prominent than student-centred learning. This was inferred from the following observations:

- 1) The teacher coordinator sent most of the messages in Diary mailing list (See Figure 1). The coordinator posted numerous messages and tried to initiate more ideas or exchange of ideas related to geometry and mathematics, but received low responses from the students.
- 2) Although the students were encouraged to contribute ideas for the Diary’s electronic presentation, they tended to accept opinions, to become followers rather than initiators. In fact, very few of them responded to the research questions or problems related to geometry (refer to C3 in Figure 3). Respondent S23 and S30, who were active earlier, however tended to wait for instruction by expressing “...please tell us what to do; we will do it without delay” and “...I am not good in giving suggestions...I will follow what has been done by others...” Respondent S25 felt shy and preferred her friends as companion to join Diary. Overall, the students felt more comfortable to follow rather than to initiate.

Perceived Effects of Diary – Affective Learning Aspect

Data from the interviews and post-Diary survey informed the following feedback from the students: 1) they learnt and gained experiences in using computers and the Internet through Diary. 2) Diary was able to promote sharing of knowledge among the participants. The frequency count of the agreement on these two items showed a strong agreement on both items (34% strongly agreed and 59% agreed, total: 93%). On another statement, “Diary has increased my interest towards geometry”, 16% of them strongly agreed and 62% agreed (total: 78%). Overall, a majority of the participants had shown positive perception towards Diary in affective learning domain.

DISCUSSIONS

The major purpose of this exploration is to observe whether constructivist learning environment was able to be created through Diary, using the principles of Create-Relate-Donate (Kearley & Shneidermann, 1998), via online collaborative learning environment.

The overall results show that even though there were indications of positive perception of Diary from the students (such as perceived it as useful, interesting, promote knowledge sharing and increased their perceived interest in geometry and computer). However, the students’ overall geometry knowledge gained in this study was minimal which they were not able: 1) to demonstrate through online discussion, online project submission and interviews that they learnt geometry, 2) to define the meaning of geometry, 3) to observe and report critically what kind of geometry concepts (shapes, areas, symmetry, etc) were used in their surrounding. These could be due to their overall participation and interaction in Diary was low or passive.

Only several students were active and moderately active. Relatively, a majority of the exchanged messages were categorized as administrative purposes and on socialization matter; all of these did not prove the learning of geometry.

Apart from these, two phenomena were also observed to explain the process of Diary:

1) Early excitement of using OCL technology was observed from the message flow analysis. However, the excitement decreased over time (Fidler, 1997; Fishman, 2000). In addition, efforts to boost and maintain the students' motivation in online collaborative learning are not easy. The initial peak of OCL or online project will be over. To maintain continuous participation, attractive and suitable activities should be introduced to the participants. In Diary, this was demonstrated by introducing field trip which was able to draw interest from the participants.

2) Individual motivation and their personal quality do affect the process or outcomes of online projects. This was also supported by the literature of the importance of individual's motivation in online learning (Harasim et al., 1996; Benbunan-Fich et al., 2005). In Diary, only those who were responsible committed and have shown positive interpersonal skills were positively reacted in Diary.

The implication of these findings informed the critical aspect to design OCL activities which were able to gain interest from the target learners and also to educate more students to have motivation in constructivist and exploratory kind of learning activity and of course to have better interpersonal skills to communicate with peers. In addition, the provision of a conducive learning environment to support online learning activity is also vital to ensure active participation in online project. This can be explained in the following section.

Contextual Factors

In order to bring an innovation to scale, it is important as the first step to understand how the innovations are adopted in local contexts (Fishman, 2000). Hence, it is recommended that if online tools are going to be used by students, there must be a good fit with the teacher's intentions, perceptions, and actions with respect to classroom culture.

There were some contextual factors affecting the process and the results of this activity. In Malaysian secondary school education, traditionally, in classroom learning environment, students are usually teacher- and examination-centric, focusing on summative assessment (Yaakop, E., 2002). Activities involving students' exploration on network writing was considered as not pertinent to curriculum (Lee & Zulkifli, 1999).

Diary was designed to be learner-centred, constructivist learning environment through the principles of relate-create-donate. However, the learning process that took place was evidently teacher-centric where most participants were passive rather than active. Students were merely being reactive, responding or reacting only to teachers' postings rather than being pro-active to initiate project ideas as encouraged by the coordinator.

Educational Reform

Through the Smart School Project, Malaysian secondary schools are going through educational reform to promote active and self-directed learning among the school students through the use of ICT (Malaysia MoE, 1997). In this transition period, it is not surprising to find out that Diary was not able to completely change the learning environment to a more student-centric paradigm. Apparently, more time is needed for students to adapt to online learning environment. However, more importantly, the overall educational setting and all parties who are involved in school education such as the Ministry, schools, teachers, school culture and parents should prepare and commit in any form of educational reform through technology.

The change from teacher- to learner-centric environment is a complex undertaking involving many aspects of educational system such as the contents, the curriculum, the teachers' belief and their instructional skills. Ibrahim (1994) suggested that teachers should play an important role before changing their instructional methods because there is a strong relationship between teachers' beliefs in mathematics and mathematics education with their instructional methods. Lee (1999) reminded that the changes brought by the technology should not be regarded as irritating or a threat in education. On the contrary, it needs to be viewed as ways to improve education. OCL can become an agent of change provided that all parties involved in the educational system are able to play their roles to inculcate constructivist education.

Limitation

Diary was introduced in schools as a case study to evaluate the acceptance of the students towards this mode of learning and how they react in this learning environment. While Diary has the ability to offer many positive learning experiences such as the opportunity to learn from others and to handle computers and the Internet, it is still bounded with a few limitations. These include (a) low participation of the students as Diary was not adopted as a compulsory activity for classes, it was introduced as an enrichment activity for their after school activity, and they volunteered to join it (as withdrawal was allowed); (b) possible biases of the teacher coordinator who

was also one of the authors of this study, and (c) small sample size prohibiting generalization to student population at large.

Recommendation

Based on the findings, the following are some recommendation: 1) Further research on OCL by using different activity and approach to investigate the effects of OCL in different settings; 2) The need to inculcate the right attitudes towards OCL should not only be confined to students but also to teachers, principals, ministry and parents, so that the educational culture can be geared towards a constructivist based teaching and learning environment through the use of online collaborative technologies; 3) Diary or OCL should be integrated in classroom learning and should be supported by principals and teachers in schools.

CONCLUSION

This study use Engagement Theory for designing a pedagogical sound learning activity through OCL. Several evaluation methods were carried out to evaluate this activity. Diary was able to draw positive perception from the students. However, in order to gain the most out of OCL as another form of instructional strategy for classroom-based activity or for any open-based educational program, the students need to be more pro-active, expressive and committed in the program. The success (or failure) of OCL is depending on the students' attitudes and their participations. The activities introduced in OCL must be attractive, useful and important to them, or able to complement their existing learning activities in school.

For the participants who were involved in this study, they should be trained for expressing ideas confidently without feeling shy to make mistake and also to have better interpersonal skills to deal with people and to work with others. This should be supported by the educational system and culture to seriously promote constructivist learning environment be in it in classroom or outside classroom such as through OCL.

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