THE IMPACTS OF MATHEMATICAL REPRESENTATIONS DEVELOPED THROUGH WEBQUEST AND SPREADSHEET ACTIVITIES ON THE MOTIVATION OF PRE-SERVICE ELEMENTARY SCHOOL TEACHERS

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ABSTRACT
The purpose of this study was to compare the influence of instruction using WebQuest activities with the influence of an instruction using spreadsheet activities on the motivation of pre-service elementary school teachers in mathematics teaching course. There were a total of 70 pre-service elementary school teachers involved in this study. Thirty of them were included in the group that developed WebQuests and forty of them were included in the group that did spreadsheet activities during the seven weeks of mathematics instruction. The researchers used a Likert-type questionnaire consisting of thirty-four positive and negative statements as pre-and post-tests to find out the motivational attitudes of the participants towards using technology in mathematics teaching course. After the collection of the data, the researchers used the independent samples t-test and ANCOVA to analyze the quantitative data. The study documented that although there was a statistically significant difference found between the mean scores of the groups on the pre-test favoring the one who did spreadsheet activities, the results of the ANCOVA indicated that developing WebQuests had more positive influence on the motivation of the pre-service elementary school teachers than doing spreadsheet activities in mathematics.
Key Words: WebQuest; spreadsheets; motivation; mathematics; pre-service teachers

INTRODUCTION
Research has shown that the use of technology plays prominent roles in teaching and learning in all educational areas (e.g., Schofield, 1995; Hardy, 1998; NCTM, 2000; Drier, 2001; Olkun, Altun & Smith, 2005; Freitas & Jameson, 2006; Hassanien, 2006; Lin, 2008a; Chang & Tseng, 2009). Therefore, students should be aware of the technology around them and be able to use them appropriately (Hunt, 1995). Moreover, Drier (2001) claimed that studies in teacher education have underlined the importance of learning with technology rather than learning about technology.

Technology is essential in teaching and learning mathematics. National Council of Teachers of Mathematics (NCTM) (2000) stated that the technology influences the mathematics teaching and students' learning. The use of technology in instruction has the potential to change both the teaching and the learning of mathematics. The computers with appropriate software transform the mathematics classes into laboratories much like the environment in many science classrooms, where the learners use technology to investigate, conjecture, and verify their findings. In this environment, the teacher encourages experimentation and gives opportunities for learners to summarize ideas and establish connections with previously studied topics (NCTM, 1989). Furthermore, computer technology is changing the ways we use mathematics; consequently, the content of mathematics programs and the methods by which mathematics is taught are changing. Besides, students should continue to study mathematics based on their level, and they also should be able to recognize when and how to use computers effectively when doing mathematics. Therefore, mathematics teachers should be able to appropriately use a variety of computer tools such as, geometer's sketchpad, spreadsheets, and so forth, and utilize the Internet as a resource in the mathematics classrooms (e.g., Dodge, 2001; Sharp, 2003). In particular, the use of computers with well-prepared educational software would enhance teaching and learning. Furthermore, using technology in teaching and learning has great effects on students and pre-service teachers' motivation and achievement in mathematics (e.g., Schofield, 1995; Halat, 2008a/2009; Lin, 2008b).

There are many factors such as, anxiety, gender, instruction, teacher-care, peer interaction, parental support, environment, use of technology, and so on seeming to play vital roles on the student motivation and achievement in mathematics (e.i., Schofield, 1995; Freitas & Jameson, 2006; Wei & Chen, 2006; Halat, 2008a). According to

Middleton (1995), real-life activities, group practices and hands-on activities are important factors that greatly affect student motivation towards mathematics. Likewise, Stipek (1998) and Middleton and Spanias (1999) claimed that well-structured instructional design including clear and meaningful task activities positively influences student achievement and motivation in mathematics. Moreover, Lin (2008b) stated, "Students with a high level of computer competency tended to feel less anxious, and more confident than students with a low level of computer competency toward using computers and Internet resources in teaching mathematics" (p.11). Peker & Halat (2009) expressed that designing WebQuests caused a decline in the teaching anxiety levels of the pre-service teachers more than doing spreadsheet activities in mathematics. Halat (2008a) also claimed that the ones who designed the WebQuests showed positive attitudes towards mathematics course than the ones who did the regular course work. Therefore, in this study the researchers tried to compare the impacts of instructions that include doing spreadsheet activities and developing WebQuest-based applications in mathematics on the motivation of the pre-service elementary school teachers.

Research about the Use of Spreadsheets & WebQuests in Mathematics

There can be many research studies found involving the use of spreadsheets in mathematics teaching and learning. During the last two decades, spreadsheets have been used in teacher education and K-12 classrooms to explore a variety of mathematical concepts and to help students use numerical and graphical methods to solve problems (Bright, 1989; Edwards & Bitter, 1989; Baki, Tiryaki, Celik, & Öztekin, 2000; Cinar & Ardahan, 2003, Dede & Argun, 2003; Andrews, 2003; Isiksal & Askar, 2005). These researchers believe that spreadsheets offer the potential to encourage students to explore and express mathematical ideas that they are likely to use when solving problems.

The spreadsheets can help students move from specific examples to generalized relationships. According to Sharp (2003), one of the beauties of using spreadsheets is that it is possible to set up calculations, change some cell values and look at the effect on the results immediately. Today, it is clear that educational research supports the use of spreadsheets both in teacher education and K-12 classrooms.

There are many benefits of using spreadsheets. For example, the spreadsheets allow students to talk about essential mathematical concepts without using algebraic notation. According to Edwards and Bitter (1989), the students can answer a variety of questions based on one problem and see the relationships among the variables as number change. The spreadsheets allow mathematical concepts to be illustrated through concrete and numerical examples (Neuwirth, 1996). Moreover, Sgroi (1992) claimed that it allows the students to apply a variety of mathematics skills, both thinking and computing. The spreadsheets build an ideal bridge between arithmetic and algebra and allow the student free movement between the two worlds (Friedlander, 1998).

One of the rapidly emerging uses of the Internet is web-based activities (e.g., Wei & Chen, 2006). Dodge (1995) defined a WebQuest as "an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the Internet". WebQuest has become prominent in many educational areas and has received considerable attention from teachers and educators since it was proposed and developed by Dodge (e.g., Yoder, 1999; Kelly, 2000; March, 2000; Zheng, Perez, Williamson, & Flygare, 2008). Besides, the WebQuests as an alternative instructional technique has already been widely adopted and practiced in K-16 education (Zheng *et al*., 2008; Halat, 2009).

According to Schofield (1995), the use of technology in teaching and learning has positively influence the motivation and achievement of students. Likewise, Wei and Chen (2006) argued that the Internet has a great impact on both students and teachers. It must also be remembered that although the web has a lot of valuable information, it is also full of useless information. The misuse of the Internet concerns parents, educators, administrators, teachers and others (Mason, 2000). Dodge (2001) proposed and developed a WebQuest model, new teaching & learning technique, which uses the Internet in the classroom and meets the concerns of those expressed above. Besides, several research studies showed that an instruction that uses WebQuest -based applications in the classrooms had positive effects on students' attitudes toward mathematics learning (Halat & Jakubowski, 2001; Halat, 2007). Likewise, Peker & Halat (2009) examined the impacts of mathematical representations developed through WebQuest and spreadsheet activities on the teaching anxiety level of the pre-service elementary school teachers in mathematics and found that developing WebQuest activities reduced the teaching anxiety levels of the pre-service teachers more than doing spreadsheet activities in mathematics.

According to Halat (2008b), the followings are the *strengths* of WebQuests: "Is an alternative teaching technique that enhances students' motivation in class; Serves as an alternative assessment tool of student's learning; Gives teachers an idea of the students' degree of acquisition of knowledge and implementation of the knowledge; Provides teachers an opportunity to see and assess students' ability in using technology for learning; Enhances teachers' creativity in thinking and writing, such as finding interesting and funny stories or scenarios and combining these with math or other subjects; Enhances teachers' higher-order thinking skills, such as finding topic-related Web sites and examining and selecting professional, well-prepared, and reliable Web sites; Requires students to be active learners; Allows students to use Internet as an important tool" (p.10). Furthermore, Zheng *et al*. (2008) identified *three critical constructs* of WebQuests, *constructivist problem solving, social interaction and scaffolded learning*, based on the teachers' perceptions. Moreover, their study indicated that the variables, such as years of WebQuest use, purpose of WebQuest use, years of teaching, and gender predicted, at various levels, the perceptions of teachers on WebQuests. They suggested that "the purpose of WebQuest use, that is, how and for what purpose one would like to use the WebQuest, is critical in influencing teachers' perceptions and consequently their implementation of WebQuests in teaching and learning" (p.302). They also added, "teachers' perceptions on constructivist problem solving, which in essence reflect an epistemological thinking in learning, are affected by their years of teaching and years of WebQuest use" (p.302).

The purpose of this study

The study focused on the use of technology in mathematics teaching and learning, and the effects of it on the motivation of the pre-service primary school teachers. In particular, the researchers searched for the answer of the following question:

Q: Is there a difference, if any, with respect to motivation between the pre-service elementary school teachers who designed WebQuest-based applications and the pre-service elementary school teachers who did spreadsheet activities in mathematics teaching and learning?

METHOD

Methods of Inquiry

The researchers followed the quasi-experimental statistical design procedure in the study. With this procedure the control group was compared with the experimental group, but participants were not randomly selected and assigned to the groups (Creswell, 1994; McMillan, 2000). According to Creswell (1994), the nonequivalent (Pretest and Posttest) control group design model is a popular approach to quasi-experiments. In this study, while the experimental (treatment) group included students who were required to design their WebQuests, the control group comprised students who were required to do spreadsheet activities in the classroom.

The experimental research method was chosen by the researchers because of the fact that "it provides the best approach to investigating cause-and-effect relationships" (McMillan, 2000, p. 207). In the study pre-test and post-test were given to the participants before and after the instruction as an independent variable. The researchers investigated the influences of doing both spreadsheet and WebQuest activities on the pre-service primary school teachers' attitudes towards the mathematics teaching course. The comparison of students' motivational levels was made in the study. Therefore, this experimental approach enabled the researchers to evaluate the effectiveness of developing both spreadsheet and WebQuest-based applications in mathematics classroom.

Participants

In this study the researchers followed the "convenience" sampling procedure defined by McMillan (2000), where a group of participants is selected because of availability. There were a total of 70 pre-service elementary school teachers, 30 in experimental group and 40 in control group, involved in this study. Participants in the study were pre-service elementary school teachers enrolled in mathematics teaching course at a university located in central Turkey. The study was conducted during the spring semester of 2008, and it took place seven weeks. Each group had four hours of instruction in a week.

Data Sources

The researchers used a questionnaire, Course Interest Survey (CIS), in the collection of the data. It was used as pre-test and post-test in the study. The questionnaire Course Interest Survey (CIS) taken from Keller's (1999) work includes thirty-four statements categorized into four parts, Attention, Relevance, Confidence and Satisfaction. Using a Likert-type rating scale including statements, some positive and some negative, relating to the attitude being measured, this questionnaire was administered to the participants for 20 minutes. The course interest survey is designed to evaluate a situational measure of students' motivation in a specific classroom setting. The goal with this instrument is to investigate how students are motivated, or expected to be, by a particular setting. In the study, participants in both groups met for four hours of instruction in a week for a semester.

The following statements are taken from the Course Interest Survey (CIS) in order to give the readers some idea about the questionnaire; “The instructor knows how to make us feel enthusiastic about the subject matter of this course”, “I feel confident that I will do well in this course”, “This class has very little in it that captures my attention”, “I have to work too hard to succeed in this course”, “I feel that this course gives me a lot of satisfaction”, “In this class, I try to set and achieve high standards of excellence”, “The students in this class seem curious about the subject matter”, “I enjoy working for this course”, “The instructor does unusual or surprising things that are interesting”, “My curiosity is often stimulated by the questions asked or the problems given on the subject matter in this class”, “I feel that I get enough recognition of my work in this course by means of grades, comments, or other feedback”, “I get enough feedback to know how well I am doing”.

Instructional Procedures

The researchers conducted this study in a mathematics teaching course requiring; problem solving and writing based on major mathematical concepts at their levels, such as operations, fractions, numbers, measurements and so on, developing teaching methods and materials that are appropriate to elementary school students from 1st grade to 5th grade, and learning how to teach certain topics in mathematics. These were the main tenets of the course offered to the students at the Department of Elementary Education. In addition to these requirements, whereas the participants who were in the experimental group were required to design WebQuest-based applications as an individual project, the others who were in control group were required to develop spreadsheet activities.

Procedures of WebQuests Designing and Developing Spreadsheet Activities

At the beginning of the study, the pre-service elementary school teachers in the experimental group were introduced a web-page editor, Microsoft FrontPage, taught the components of a good WebQuest, and showed how to design one. After becoming familiar with the structure and preparation of a WebQuest, the participants worked themselves and chose one of the topics in mathematics, such as numbers, operations, fractions, three-dimensional figures, volume, quadrilaterals, triangles, area, perimeter, and so on under the guidance of the researchers. Each student wrote his/her scenarios or adapted cartoon movies, such as Casper, Shrek, Ice-Age, Alice Birthday Party, Treasure Island, and so on to a math topic that s/he chose. Furthermore, the participants in the experimental group designed their teaching materials that were appropriate for elementary school level students. Then, all participants searched on the Internet to find reliable websites to fulfill their needs. After the collection of all necessary resources and materials, each participant designed his/her WebQuest portal on which students were supposed to follow the given instructions and complete the assigned tasks to learn the topic. After the process of designing WebQuests, the pre-service elementary school teachers in the experimental group presented their WebQuests in 5-10 minutes in the class.

Likewise, at the beginning of the study the participants in the control group were given information and shown how to use Microsoft Excel and do some spreadsheet activities in the computer lab. In particular, they were required to create spreadsheets about mathematics that were appropriate and useful for the elementary school students. For example, they developed spreadsheets that find the perimeters and areas of triangles and quadrilaterals, and check whether it constructs a triangle or a quadrilateral with the given lengths or angles. They also developed spreadsheets that helped them solve routine and non-routine mathematical problems such as, magic squares (3x3), head and feet problems of animals, and so forth. After seven weeks of instruction, each student made 5-10 minutes presentation to the class.

Test Scoring Guide for the Course Interest Survey (CIS)

The researchers followed the Keller’s (1999) test scoring guide in the analysis of the CIS. The response scale ranges from 1 to 5. According to this scale, the minimum score is 34 on the 34-item survey, and the maximum is 170 with the midpoint of 102. The minimums, maximums, and midpoints vary for each subscale because the numbers of item distributions are not the same as shown below. Keller (1999) also gives an alternative scoring method that is to find the average score for each subscale and the total scale instead of using sums. For each respondent, divide the total score on a given scale by the number of items in that scale. This converts the totals into a score ranging from 1 to 5 and makes it easier to compare performance on each of the subscales. He noted, “Scores are determined by summing the responses for each subscale and the total scale. Please note that the items marked reverse are stated in a negative manner. The responses have to be reversed before they can be added into the response total.

Data Analysis

In the analysis of the data, first the researchers conducted the independent-samples t-test statistical procedure with $\alpha = 0.05$ on the pre-service elementary school teachers’ pretest scores from CIS to determine any differences in terms of motivational level between experimental and control groups. This t-test procedure showed means score differences in terms of levels and motivation between the two groups favoring the control group. Then, scores from the CIS were compared using one-way analysis of covariance (ANCOVA) with $\alpha = 0.05$, which is a variation of ANOVA, to adjust for pretest differences that existed between control and experimental groups. "For instance, suppose in an experiment that one group has a mean value on the pretest of 15 and the other group has a pretest mean of 18. ANCOVA is used to adjust the posttest scores statistically to compensate for the 3-point difference between the two groups. This adjustment results in more accurate posttest comparisons. The pretest used for the adjustment is called the covariate" (McMillan, 2000, p. 244). In other words, because of the initial differences with reference to the participants' motivational levels between the groups, ANCOVA was used to analyze the quantitative data in the study. The pretest scores from the Course Interest Survey served as the covariates in the analysis of participants' motivation by WebQuests and spreadsheet activities. ANCOVA enabled the researchers to compare the motivation level of each group

RESULT

Q: Is there a difference, if any, with respect to motivation between the pre-service elementary school teachers who designed WebQuest-based applications and the pre-service elementary school teachers who did spreadsheet activities in mathematics teaching and learning?

Table 1 displays the descriptive statistics for the pre-service elementary school teachers' motivation based on the CIS scores, and indicates that there is a change in the participants' motivational levels between pre- and posttest scores for both groups. Whereas there was an increase between the pre-and post-test scores in the motivational level of the participants in the experimental group, there was a decline in the motivation of the participants in the control group. The mean score of the control group on the pre-test (M=130.08) was numerically higher than that of experimental group (M=104.27). However, the mean score of the participants in the control group on the post-test* (M=116.02[a]) was numerically lower than that of the participants in the experimental group (M=126.24[a]) (look at the table 1).

Table 1: *Descriptive Statistics For The Pre-Service Elementary School Teachers' Motivation*

	N	Pre-test		Post-test		Post-test*	
		M	SD	M	SD	M	SE
Group (Webquest)	30	104.27	16.50	117.60	16.22	126.24[a]	3.27
Group (Spreadsheet)	40	130.80	14.68	122.50	18.06	116.02[a]	2.72
Total	70						

Note: a: Covariates appearing in the model are evaluated at the following values: Pre-test = 119.43, *Estimated Marginal Means.

Table 2, however, presents the analysis of covariance (ANCOVA) for both groups so as to the participants' motivation, and is based on the Course Interest Survey. It demonstrates a significant main impact for the pre-service elementary school teachers who were required to design WebQuest-based applications, [$F(1, 70) = 4.57$; $p=0.036 < \alpha=0.05$]. In other words, the participants in the experimental group developed WebQuest-based applications outscored the ones who did spreadsheet activities in mathematics teaching and learning.

Table 2: *Summary Of ANCOVA For Pre-Service Elementary School Teachers' Motivation*

Sources	Sum of Squares	df	Mean square	F-statistic	p-value
Pre-test	5291.45	1	5291.45	23.54	0.000
Group	1028.32	1	1028.32	4.57	0.036*
Total	20764.80	70			

Note: $\alpha=0.05$, *p=0.036, *p< 0.05.

DISCUSSION & CONCLUSION

This study showed that designing WebQuest-based applications in teaching and learning mathematics had great effects on the motivation of the pre-service elementary school teachers. This result is not in contrast with the several research findings (e.i., Halat, 2007/2009; Halat and Jakubowski, 2001). For instance, Halat (2008a) found that the students who developed WebQuests displayed more positive attitudes towards mathematics than the others who did not. Similarly, according to Halat and Jakubowski (2001), designing a WebQuest gave the pre-service middle & secondary mathematics teachers an opportunity to practice their mathematics knowledge in a different way, showed them how to adapt technology in their teaching and taught them how effectively the Internet and other programs could be used in the classrooms. They (2001) added, "All groups provided positive responses to wanting to use WebQuests as a break from textbook and traditional ways of teaching" (p. 3).

Furthermore, Schofield (1995) who claimed that using technology in teaching and learning has great effects on students' motivation, attitudes and achievements. On the one hand, the finding of this study supports the argument of Schofield because of the fact that the participants in the experimental group involved in this study used computer and several software programs, and designed WebQuests that increased their motivational level toward mathematics. But, on the other hand, the result of this study does not agree with claim of Schofield because the pre-service elementary school teachers who were in the control group also used computer and did spreadsheet activities that even caused a decline in the students' motivation towards mathematics. Doing spreadsheet activities is more about learning and practicing mathematical topics or rules in comparison to designing WebQuests. In WebQuests, students are able do more mathematical activities and explorations in a game or in a story than just practicing mathematical rules. In other words, developing WebQuest-based activities is more attractive, funny and relaxing, and it is not more traditional in comparison to doing spreadsheet activities. Therefore, it may have caused a considerable increase in the pre-service teachers' motivation towards mathematics. This also supports the finding of Peker & Halat (2009) who claimed that the ones who developed WebQuests had lower teaching anxiety levels in mathematics than the ones who did spreadsheet activities in the classrooms.

However, the finding of this current study is not lined up with the reports of research (e.g., Eccles & Midlegy, 1989; Gottfried, Fleming, & Gotfried, 2001) claiming that there is a decline in students' motivation towards mathematics courses. Therefore, WebQuest-based activities either as a group project or a new instructional approach can be used in teaching and learning at college level (Halat, 2007/2009). This supports the claims of Stipek (1998) and Middleton and Spanias (1999) who stated that carefully structured instructional design including clear and meaningful task activities and level of difficulty had a great impact on students' achievement and motivation in mathematics because WebQuests includes well-designed and meaningful task activities in its structure.

In addition, Middleton (1995) stated that according to the teachers beliefs, doing real-life examples or activities in a mathematics classroom were major motivating factors. He added that it seems that using real-life applications, group practices, hands-on activities, and other strategies played important roles in students' motivation. Furthermore, he reasoned out, "in general the better teachers were at anticipating the motivational structures of their students, the better they were at providing an environment that facilitated the development of intrinsic motivation" (p.349). This shows that environment is essential to students' motivation (Stipek, 1998). One of the main tenets of WebQuests is that designers, learners or teachers are supposed to write a scenario or adapt a story related to a math topic that they chose to teach. In other words, the designers of WebQuests include real-life activities in their teaching model, which enhances the participants' motivation in the study (Halat, 2008a).

Briefly, this study concluded that there was statistically significant difference detected with reference to the motivational level between the experimental and control groups. This was in favor of experimental group. In other words, the ones who designed WebQuest-based applications in a mathematics teaching and learning course indicated better motivational performance than the others who did spreadsheet activities in their course work.

Implications and Recommendations for Practitioners

This current research has several possible implications and suggestions for practitioners. The result of this study implies that developing WebQuest-based activities in a college level method courses may affect more positively the attitudes of the pre-service elementary school teachers towards teaching and learning mathematics than doing spreadsheet activities. Therefore, if the instructors use the technology in their teaching environment, the authors recommend the use of WebQuest-based activities for them in their teaching based on the result of this study. Because developing WebQuest-based activities provides instructors an opportunity to see and assess their students' ability in the use of technology, enhances the instructors' creativity in thinking and writing such as, finding interesting and funny stories and combing these with mathematics or other subject areas, and gives the instructors an idea of the students' level of acquisition of the knowledge and implementation of the knowledge (Halat, 2008b).

Moreover, if the pre-service teachers try to design WebQuest-based activities as a group or individual project in their method courses, they might have an opportunity to practice their pedagogical and content knowledge in a different environment. In addition, developing WebQuest-based activities requires the students to be active learners, and allows the students to enhance higher-order thinking skills, such as finding topic-related Web sites and examining and selecting well-prepared and reliable Web sites (Halat, 2008b).

The finding of this study highlights the importance of National Council of Teachers of Mathematics' recommendations for teachers and students. NCTM (2000) stated that new educational theories and strategies be implemented in mathematics classrooms. According to Hardy (1998), successful technology adaptation requires careful planning and plenty of time. If the ones find time and carefully plan to work on this technique, they might be successful in the practice of developing WebQuest- based activities in their teaching.

However, both WebQuest and spreadsheet activities would be helpful for students to learn different things in mathematics. WebQuests are exploratory while spreadsheets help learners to determine relationships between variables in mathematical equations or practice mathematical concepts and rules. Although in this perspective doing spreadsheet activities is more conventional than developing WebQuest-based activities, mathematics teachers can use both WebQuests and spreadsheets in teaching for different reasons based on the mathematical concepts.

Limitations and Future Research

Limitations in developing and using WebQuests in teaching and learning include the possibility of lack of access to the Internet, the time spent by the teacher and student to design a WebQuest, and finding reliable links for resources for the WebQuest. Moreover, the findings of this current study should not be generalized to all pre-service teachers because this is not a pure-experimental study. This is a quasi-experimental study. With this research design the control group was compared with the experimental group, but participants were not randomly selected and assigned to the groups. Therefore, this research design limits the findings of the study.

There is enough support to encourage the further research studies of the use of WebQuests in Teacher Preparation Programs and the implementation of WebQuests in the middle and high school classrooms. According to Halat (2008a), designing WebQuest-based activities enhances the motivation of the pre-service elementary school teachers towards mathematics. This supports the finding of this current study. Therefore, although this study included the pre-service elementary school teachers as participants, future research can be done with others who are in different Teacher Education Programs such as, geography, linguistics, history, mathematics, biology, physics, chemistry, and so far. This sort of studies might be also done with high school students. In addition, the researchers examined the effects of the WebQuests and Spreadsheets on the pre-service elementary school teachers' motivation in mathematics. Therefore, the future research can be done on the other areas such as, social sciences, health, and science.

Furthermore, the researchers might investigate the influence of the in-class implementation of the WebQuests on the middle and high school students' motivation and achievement. WebQuests, when done successfully, can be meaningful teaching strategies that utilize student use of technology in the classroom. This is in agreement with the claim of Freitas and Jameson (2006) argued that the ways in which technological developments can and do contribute to increased successful learning outcomes.

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