Discovery Learning for the 21st Century: Article Manuscript

Joyce A. Castronova

Abstract: An action research study was conducted at a suburban elementary school in which the use of a WebQuest, an online instructional tool based on discovery learning, was compared to the use of a traditional, didactic-method of teaching the same lesson. Areas that were compared include areas of achievement, student engagement, and student interactions with teachers and other students while working in cooperative groups. The lesson was on the reasons for the South's secession during the Civil War. Four classes made up of 87 5th grade students and 4 teachers participated in the study. In the study, it was found that there was little or no difference in achievement between the two groups. Students were more engaged in learning in the classes taught using a WebQuest. The interactions of the students with their teachers and peers were found to be at a higher order of thinking in the class using a WebQuest, and the students in the WebQuest classes also had more interactions pertaining to the topic than the students in the traditionally taught classes.

Introduction

A general call for educational reform has been increasing in its urgency over the last decade (McCain, 2000). Because of increasing global economic competition, businesses are looking for higher achieving employees who need little training once hired (Lunenberg, 1998). Businesses and society expect graduates to acquire, interpret, and evaluate data to learn, reason, and solve problems (Rice & Wilson, 1999), but how can schools prepare their students to accomplish these tasks?

Discovery learning seems to be a good match to teach these tasks. Discovery learning is an approach to learning that can be facilitated by particular teaching methods and guided learning strategies. Bicknell-Holmes and Hoffman (2000) describe the three main attributes of discovery learning as 1) exploring and problem solving to create, integrate, and generalize knowledge, 2) student driven, interest-based activities in which the student determines the sequence and frequency, and 3) activities to encourage integration of new knowledge into the learner's existing knowledge base. The question remains, however, how does discovery learning compare overall to traditional learning.

There has not been a great deal of research done comparing the discovery learning method and traditional teaching. From research that does exist, there appear to be four main areas of focus. These areas are 1) motivation (Hardy, 1967), 2) retention (Alleman & Brophy, 1992; Nelson & Fayer, 1972; Peters, 1970), 3) achievement (Hardy, 1967; Mabie & Baker, 1996), and 4) transference (Chambers, 1971). In these studies, discovery teaching was found to be 1) more motivating than traditional teaching (Hardy, 1967), 2) similar, if not slightly better, at increasing retention (Alleman & Brophy, 1992; Nelson & Fayer, 1972; Peters, 1970), 3) better in terms of student achievement when teaching skills as opposed to facts (Hardy, 1967; Mabie & Baker, 1996). Discovery teaching was a weaker method than a more traditional method when students were learning fact based math problems (Chambers, 1971). Even with these research findings, however, teachers still tend to be hesitant about using the discovery method in their classrooms because of many misconceptions (Bicknell-Holmes & Hoffman, 2000).

According to Bonwell (1998), three major reasons teachers do not teach using discovery learning are that they believe 1) discovery learning will not cover the course content, 2) discovery learning will require too much preparation and learning time, or 3) class sizes are too big or too small to permit the strategy's use. These beliefs stem from the current school structure, in terms of class sizes, curricula and grade levels, and accountability requirements, including standardized tests. These factors hinder the use of the discovery learning method in the classroom; however, technology may assist in bringing discovery learning into the classroom.

Technology can be used to compensate for some of the main disadvantages of discovery learning and simplify its use in the classroom. Technology allows classrooms to shift more easily from fact-based learning to

skill-based learning as it becomes less important to know a great deal of facts when they can easily be accessed using the Internet (Papert, 2001). One tool that bridges this shift from fact-based to skill-based learning is the WebQuest.

WebQuests are Internet-based tools created by Bernie Dodge (1995) that incorporate the principles of discovery learning into a usable classroom product. WebQuests pull the best from discovery learning while still addressing the circumstances found in schools today, such as accountability using standardized testing, fact-based curricula, limited computers, etc. Any content area that gives teachers the flexibility to guide students toward the content on which the evaluations will occur while still using the principles of discovery learning can be addressed in the WebQuest format. How, though, do WebQuests compare to traditional teaching in the areas of achievement, student engagement, and the level of student interaction? There is a gap in the research in finding how WebQuests compare to traditional teaching.

A study was conducted to address this gap in the research. The action research study was conducted in a suburban elementary school. The school has a relatively large at-risk population with 46% of the students in the free and reduced lunch program. The school is equipped with two class-size computer labs and two networked machines in every classroom. All of the computers provide access to the Internet.

The researcher in this study was an Instructional Technology Specialist at the school where the study occurred. The researcher was familiar with the students and had worked with all of them in a computer lab and classroom setting. The researcher was aware of past achievement levels of the students during their previous years in the school. The researcher could have had potential bias due to past knowledge, but the researcher tried to remain neutral and simply record what was seen and heard without applying bias.

The purpose of this action research study was to compare a WebQuest based on the theory of discovery learning to a traditional method based on standard, teacher-led instruction. The WebQuest method was defined as an inquiry-oriented activity following the format designed by Dr. Bernie Dodge (1995) that incorporates Internet resources on the South's secession in the Civil War. The traditional method was defined as didactic teaching using a web page containing a list of Internet resources (a hot list) on the same topic. The research questions for the study addressed student achievement, student engagement, and the differences in student interactions between the WebQuest and traditional groups.

Method

Participants

In this study, four classes, consisting of a total of 87 fifth grade students and 4 teachers, studied the causes of the South's secession during the Civil War using either a WebQuest method or a traditional method. The students ranged in ability from requiring special education services to receiving gifted education services. Each participating student had to have a signed parent permission form to be included in the study.

Intervention

Two classes of students were taught using a WebQuest based on the format designed by Dr. Dodge (1995) that included an introduction, a task, a process, Internet resources, an evaluation rubric, and a conclusion. The other two classes were taught using traditional teaching which involved reading passages from a textbook, answering textbook questions, lecture, and a hot list of the same websites used in the WebQuest. All four classes studied the reasons why the South seceded during the Civil War.

The students in all four classes were divided into cooperative groups of four or five students. In three of the four classes, the students were divided into their groups based on their reading ability. The students were divided into four reading ability groups and then one person from each group was assigned to each cooperative group. This ensured that there would be at least one strong reader in each group. There had to be at least one very strong reader in each group so that the online documents could be read and understood by all the groups. In the fourth class, the students were divided into same-sex groups due to social conflicts that were pre-existing in the classroom. In this class, two girls and two boys who had high reading achievement were assigned to four groups. Three other girls were then assigned to the girl groups, and three other boys were assigned to the boy groups.

The four classes participated in three, 45-minute lessons taught during a one-week period. The two WebQuest classes spent all three lessons in a computer lab working in groups. The two traditional classes participated in one lesson that was taught by their teacher lecturing and writing on a chalkboard, one lesson in a computer lab when they worked in groups to look at the hot list of Internet resources, and one lesson when they worked in groups to complete the written assignment.

The objectives for the lessons for both groups were:

- Students will effectively argue the case, why the South wanted to secede.
- Students will state the reasons for the South's secession.
- Students will research the reasons for the South's secession.

The final product that had to be produced by all four classes was a letter written to a New York senator on the reasons the South wanted to secede during the Civil War period. The letters were graded using a rubric that was presented to all of the students before they began writing their letters.

Data Collection Strategies & Procedures

Before the lessons began, all of the students were given a five question pre-test on the reasons for the South's secession during the Civil War. These questions were selected based on the lesson objectives and talking to fifth grade teachers. During the lessons, the researcher conducted privileged, active observations during which the researcher observed, made notes, and asked questions of the four students who were assigned to the same cooperative groups in each of the classes. These observations served to record the number of times the students were off-task and the duration of the off-task behavior, the number of questions the students asked of the teacher pertaining to the content and lesson structure, the number of questions the students asked of the teacher not pertaining to the lesson, and the number of task-oriented group interactions and non-task-oriented group interactions.

After the lessons were completed, the students were given a post-test with the same five questions as the pre-test. The difference in the pre- and post-test scores was calculated and the mean and standard deviation was determined. Also, five students were selected from each class to be formally interviewed by the researcher, a high achiever in the class, a low achiever in the class, a high achiever for this activity, an average achiever for this activity, and a low achiever for this activity. The classroom teachers determined the achievement level of the students in the class. The achievement levels for the activity were determined using the following criteria:

1. High – Does research outside of class; Asks teacher for additional resources; Acts as leader in the small group setting, excited about learning more

2. Average – Participates in research in class; Asks questions of teacher, but only ones needed to complete assignment; Participation in group limited to getting the project done

3. Low – Does not do any research, relies on others doing the research; Does not ask questions of teacher; Does not participate in group

These interviews were coded to find trends in student achievement, student engagement, and student interaction with their teacher and peers.

To determine student engagement, students and teachers completed three forms of Likert-type scales that asked questions about enjoyment of the lesson, whether or not they believed learning occurred, and participation in cooperative groups. The responses on these scales were then converted into numerical values so that they could be analyzed. The mean and standard deviation of each question for the different Likert-type scales were then calculated.

A rubric, that rated the research, grammar, concepts, and interpretation, was given to all the students in the four classes before they began writing their letters. The rubric was then used to assess the letters the groups wrote. These point values from the rubrics were then averaged and compared between the traditional classes and the WebQuest classes.

An electronic research journal was kept during the research and informal interviews with the four teachers served to record overall beliefs and trends that were occurring as the students participated in the lessons. The electronic research journal and teacher interviews cross-referenced to the observations were used to record the level of questions the students were asking during the lessons.

For the purposes of triangulation, Table 1 shows how the data collection techniques were used to address the research questions.

Research Question	Data Collection Techniques Used
Is there a difference between the WebQuest method and the traditional method in student engagement?	▪ Pre- and Post-tests of achievement ▪ Rubric of letters ▪ Structured, formal interviews ▪ Research journal
Is there a difference between the WebQuest method and the traditional method in student engagement?	▪ Likert-type scales on student engagement by students and teachers ▪ Structured, formal interviews ▪ Privileged, active observation ▪ Research journal
What are the differences in the way students interact with WebQuest instruction and traditional instruction?	▪ Structured, formal interviews ▪ Privileged, active observation ▪ Research journal

Table 1: Data collection techniques used for research questions

Results

Pre-/Post-Test

The mean pre-test score was similar for both groups. The WebQuest classes had a greater variance in pre-test scores. The traditionally taught classes had a higher mean post-test score than the WebQuest classes. The traditionally taught classes had a greater variance in post-test results. The students taught using the traditional method of instruction had a higher mean difference between their pre- and post-test results. The standard deviation between the two groups was similar (See Table 2).

Instruction Method	Mean Pre-test Score	Standard Deviation of Pre-test Scores	Mean Post-test Score	Standard Deviation of Post-test Scores	Mean Difference in Scores	Standard Deviation of Difference in Scores
WebQuest	1.82	1.00	2.36	1.22	.18	1.68
Traditional	1.95	.89	2.88	1.37	.56	1.83

Table 2: Pre-/Post-Test mean difference with standard deviation

Likert-type scales of Student Engagement by Students

The WebQuest group had a higher mean in the areas dealing with their satisfaction with the lesson and working in their groups and their belief that they learned something from the lesson. The WebQuest and the traditional means were very close in the area of the Internet sites meeting the students' needs. The traditional mean in the area of looking at unrelated material on the Internet was slightly higher than the WebQuest group's mean. (See Table 3.)

Group	I enjoyed doing the South's Secession activity.	I was interested in this topic.	While I was participating in the activity, I found that I wanted to do more	I worked on learning the information involved in this activity more than I normally work on learning information.	I would like more lessons taught in the format of this activity.	The Internet sites that I saw had all the information I needed.	I looked mostly at material about the topic.	I spent some of the time looking at material not related to the topic.	I enjoyed working in my group.	I believe I learned something from this lesson.
WebQuest Mean	2.55	2.36	2.03	2.24	2.18	2.45	2.39	1.58	2.61	2.70
Traditional Mean	2.21	2.18	1.67	2.15	1.88	2.48	2.44	1.66	2.50	2.66
WebQuest Standard Deviation	.56	.78	.77	.75	.77	.71	.70	.71	.56	.53
Traditional Standard Deviation	.70	.68	.89	.71	.78	.67	.67	.83	.76	.65

Table 3: Mean response and Standard Deviation for each question

Likert-type scales of Student Engagement by Teachers for the whole class

The teachers from both groups, WebQuest and traditional, rated their students very closely in every area except the websites' having adequate information and the students looking at Internet materials not pertaining to the topic. The traditional method teachers rated the websites' having adequate information lower than the WebQuest method teachers. The traditional teachers gave a higher rating for their students' looking at Internet materials not pertaining to the topic (See Table 4).

Group	I enjoyed doing the South's secession activity with my class.	My class seemed interested in this topic.	While my class was participating in the activity, I found that they wanted to do more research outside class.	My students worked on learning the information involved in this activity more than they normally work on learning information.	I would like to teach more lessons in the format of this activity.	The Internet sites that my students saw had all t he information they needed.	My students looked mostly at material about the topic.	My students spent some of the time looking at material not related to the topic.	My students enjoyed working with their groups.	I believe my students learned something from this lesson.
WebQuest	4.5	4.0	3.5	4.0	4.0	4.0	4.0	2.0	3.5	4.0
Traditional	4.0	4.0	3.5	3.0	3.0	2.5	3.0	4.0	3.5	4.0

Table 4: Results from Student Engagement Surveys on the Whole Class Completed by the Teacher

Two teachers added comments to the surveys. One WebQuest method teacher wrote, "Material on site too difficult for many students. Some students wanted to do lots more research." A traditional method teacher wrote that he would have liked to see the results of the pre-test to better gauge his teaching.

Likert-type scales of Student Engagement by Teachers for Selected Individual Students

The average rating of the traditional teachers for the selected students on whether the students worked on learning the information in this activity more than normal was less than the rating indicated by the WebQuest teachers. The traditional method teachers also indicated that their selected students looked less at the materials on the topic and more at materials not pertaining to the topic than the WebQuest method teachers indicated (See Table 5).

Group	I enjoyed doing the South's secession activity with my student.	My student seemed interested in this topic.	While my student was participating in the activity, I found that he or she wanted to do more research outside class.	My student worked on learning the information involved in this activity more than he or she normally works on learning information.	I would like to teach more lessons in the format of this student.	The Internet sites that my student saw had all the information he or she needed.	My student looked mostly at material about the topic.	My student spent some of the time looking at material not related to the topic.	My student enjoyed working with his or her group.	I believe my student learned something from this lesson.
WebQuest	4.2	4.3	3.7	4.1	4.0	4.1	4.2	2.8	3.8	4.1
Traditional	3.6	3.3	2.7	2.9	3.0	3.0	2.9	3.5	3.3	3.6

Table 5: Results from Student Engagement Surveys on Individuals Completed by the Teacher

Observations

The students participating in the traditional lessons were off-task more frequently and for a longer duration than the WebQuest lesson students. Students participating in the WebQuest lesson asked fewer questions not pertaining to the lesson and had fewer interactions within their group about topics not pertaining to the lesson (See Table 6).

Group	Total Times off task	Total Duration off task (4 members @ 45 minutes for a total time of 180 minutes per session)	# of questions asked by the students of the teacher about the topic	# of questions asked by the students of the teachers about the structure of the lesson	# of questions asked by the students of the teacher not pertaining to the lesson	# of interactions within the cooperative groups pertaining to the topic or lesson	# of interactions within the cooperative groups not pertaining to the lesson
WebQuest	8	41 min.	8	24	6	259	24
Traditional	67	413 min.	15	16	22	165	105

Table 6: Observation Results

Rubric

The groups of students learning with a traditional method of teaching had an average rubric point value of 10.68 out of a possible 16 points. The groups of students learning with the WebQuest had an average rubric point value of 11.15 out of a possible 16 points. The average of the students taught with WebQuest was 0.47 points higher than the average of the traditionally taught students. A *t*-test gave a two-tailed *P* value equal to 0.73 which is a not statistically significant difference.

Interviews

Seven out of the ten students participating in the WebQuest lessons who were interviewed indicated that the Civil War activity was different from their normal activities because they had to find the answers themselves. Nine out of the ten of the WebQuest students said they liked this activity better than their normal activities because they had access to more details and different resources, and they enjoyed using the computer to do research. One of the WebQuest students indicated that she did not like the lesson because "I don't like anything about social studies"; however, she did indicate that the format of this activity was better than the normal Social Studies lessons. All of the WebQuest students who were interviewed indicated that they enjoyed working in groups because "We got to work with our friends" and "you have other people there to help you". The responses from the WebQuest students about the things they did not like about the lesson included groups not working well together, the topic being social studies, difficulty writing the letter, a lack of choice in group assignments, and the quantity of reading. Four of the students indicated that there was nothing that they did not like about the activity. The majority of the students indicated that what they liked about the activity was the use of the computers, writing the letter, and being in a group with their friends. All of the students interviewed indicated that they felt they had learned something about the content from this activity.

The traditional method students indicated that the Civil War activity was different than their normal activities mainly because they got to use the computer and that the topic was more interesting than other topics they have studied. All of the ten traditional method students interviewed indicated that they enjoyed working in groups, but three indicated that they did not like the groups they were in because of fighting in the group over who would do particular jobs. Three of the students indicated that they thought the lecture was boring. Five indicated that they did not like having to read so many documents to find information. One student indicated that he felt that there was not enough time spent on the topic and that he would have preferred to have had more time to read all the documents that were on the computer. One student said, "I learned that book learning is the best way because the book is easier to read than the stuff on the computer. The computer had really big words and I had to look for the answers." All of the traditional method students interviewed believed that they had learned the content they were supposed to learn from this activity.

Informal Interviews with Teachers

The WebQuest teachers indicated that they were surprised when their students wrote their letters because they did not know if the students would be able to find the information without guidance. The WebQuests teachers were also surprised that their students were reading their printed materials from the Internet and writing information at home and in class when it was not assigned as homework or class work outside the three 45-minute lesson periods. The teachers indicated that they believed their students would have done better with the activity if they had had more practice with the discovery learning process. The students had done some research, but had never applied it to an assignment in the past. The teachers said the students struggled with having to find their own answers because they had not had to find many answers on their own.

The traditional method teachers indicated that they noticed that their students were more engaged when they were reading the Internet documents in the lab and writing their letters with their groups than when they were listening to the lecture in the classroom. The traditional method teachers indicated that they did not see any of the students reading the information the students had printed from the Internet and had not heard any of the students, except one, say they had read the information at home. Most of the students kept the printed information and scanned through it while trying to write their letters. One student taught in the traditional method was very interested in the topic and read everything he had printed from the Internet. This student asked his teacher if they could study the Civil War longer and indicated in his interview with the researcher that he wished the topic could have been studied longer.

Research Journal

The researcher recorded overall impressions of the lessons in the research journal. The WebQuest students seemed much mo re engaged in learning about the reasons for the South seceding during the Civil War because they had a purpose for what they were learning. They had an idea of what they were working to learn and knew that they must learn it in order to complete the activity. The interactions among the students learning with the WebQuest method were generally at a higher order of thinking. The students would ask each other questions such as, "Where do you think we can find this (information)?", "Why do you think that would be a problem?", "Why did they think that?", and "Why would someone keep slaves?". The students would also make statements such as, "I don't think they had a choice.", "There had to have been a better solution.", and "If slaves could have read, this would all have been different."

The traditionally taught students started listening to the lecture and almost all the students had their notebooks out to take notes; however, after approximately ten minutes, the majority of students were not paying attention to the information the teachers were discussing. They were playing in their desks, drawing in their notebooks, and asking to go to the restroom. When the students were working in their groups to do research and write their letters, several of the groups had one person writing the letter or taking notes while the other three discussed non-related topics, just sat, or played on the computer. During the lectures, only one student from either of the classes asked questions. This student is the same one who indicated that he wished he could have studied the topic longer.

Both groups seemed to be learning the information, but the WebQuest group was taking longer to find the answers than the traditional group who were being told the correct answers by the teacher. Although, the WebQuest group appeared to be more engaged in learning because they had to find the answers. The Traditional group could be engaged in other activities not pertaining to the topic and still hear the critical answers that they knew they needed or just copy what the teacher wrote on the board which gave them all the answers.

Discussion

The purpose of this study was to compare a lesson taught in a WebQuest format, based on discovery learning, to the same lesson taught in a traditional format, based on traditional, didactic and textbook learning. The study examined student achievement, student engagement, and the differences in student interaction between the two methods.

Comparing Student Achievement

Both the WebQuest and traditional method groups showed a gain in knowledge as indicated by the pre-/post-test results. The traditional method group, however, showed a slightly larger gain in the number of questions answered correctly. This difference, although small, is likely due to the nature of the questions on the pre-/post-test. The questions on the test were fact-based. Discovery learning is less effective when compared to traditional learning on fact-based information (Chambers, 1971). The WebQuest students scored slightly higher on the rubric than the traditionally taught students. The difference is very minor and can likely be attributed simply to group differences. With a two-tailed *P* value equal to 0.73 showing no statistical significance between the two groups, the groups essentially performed the same on their letter writing as measured by the rubric. All of the students interviewed from both groups indicated that they had learned something from this activity. Looking at these three measures, student achievement is the same whether the WebQuest method or a traditional method is used.

Student Engagement

On the student Likert-type scales, the students in the WebQuest group indicated more strongly than the traditionally taught students that they wanted to do more research outside class. They also indicated this fact in interviews with the researcher. Interviews with the classroom teacher, the Likert-type scales completed by the teachers, and the research journal kept by the researcher also indicated that the students were engaged in learning and wanted to do more research related to this assignment. Observations by the researcher also showed that the students in the WebQuest group were more likely to be on task for a longer period of time, ask more questions about the topic, have more interactions with other students about the topic, and have less interactions with other students and the teacher about things not pertaining to the topic. The students in the WebQuest group were more engaged in learning about the topic because they were responsible for finding their information with their group and completing the assignment; whereas, the students in the traditional group were given the answers by the teacher and simply had to turn in a letter summing up what the teacher had told them.

Differences in Interactions

Student interviews, teacher interviews, observations, and the research journal indicate that the students learning using the WebQuest asked more and higher order of thinking questions than those participating in the traditional lessons. The WebQuest lessons required the students to figure out the information they needed; therefore, they were required to synthesis more than the traditional students who simply had to listen to someone tell them the reasons for the South's secession.

Incidental Findings

The students in both the traditional and the WebQuest groups preferred to work in groups as opposed to working individually or listening to a lecture. Student interviews, teacher interviews, observations, the research journal, and the Likert-type scales indicated that the students enjoyed and preferred working in cooperative groups rather than working individually. The students indicated that the groups provided extra support and made doing the work easier because they did not have to do the work alone.

Future Action Plan, Implications, and Closing

The findings of this action research were communicated to the teachers at the elementary school and school system curriculum directors and coordinators in an afternoon faculty meeting through the use of a PowerPoint presentation and handouts. This study shows that WebQuests should be combined with traditional methods of teaching to allow for content to be learned quickly, through the use of direct, traditional teaching, while encouraging students to be more engaged in their learning and interact at a higher order of thinking, through the use of a WebQuest.

Studying these same research questions over a longer period of time would be very beneficial. Because most students are not accustom to finding their own answers, doing the study over a longer period of time would give a better indication of the differences between the two methods. As shown by this study, WebQuests offer a tool to encourage discovery learning within the existing school structure. Students are not accustom to finding their own answers, but good results come from their practicing the skills required to learn in this way. This study serves to show the positive qualities of WebQuests for preparing students to meet the demands of the business world they will be entering while still maintaining the requirements found in a public school system.

References

Alleman, J. & Brophy, J. (1992). College students' reports of learning activities experienced in elementary school social studies. *EDRS Clearinghouse*. ED365583.

Bicknell-Holmes, T. & Hoffman, P. S. (2000). Elicit, engage, experience, explore: Discovery learning in library instruction. *Reference Services Review*. 28(4), 313-322.

Bonwell, C. C. (1998). *Active Learning: Energizing the Classroom.* Green Mountain Falls, CO: Active Learning Workshops.

Chambers, D. W. (1971). Putting down the discovery learning hypothesis. *Educational Technology*. 11(3), 54-59.

Dodge, B. (1995). Some thoughts about WebQuests [Online]. Available: http://edweb.sdsu.edu/courses/edtec596/about_webquests.html

Hardy, D. W. (1967). Inland Valley Elementary School archaeology project: An experimental comparison of two teaching approaches, final report. *ERIC Clearinghouse-SE006731*. ED059862.

Lunenberg, F. C. (1998). Constructivism and technology: Instructional designs for successful education reform. *Journal of Instructional Psychology. 25* (2), 75-81.

Mabie, R. & Baker, M. (1996). A comparison of experiential instructional strategies upon the science process skills of urban elementary students. *Journal of Agricultural Education*. 37(2), 1-7.

McCain, T. (2000, April). New schools for the new millennium. Concurrent session presented at the Georgia Educational Technology Conference, Macon, Georgia.

Nelson, B. & Frayer, D. (1972, April). *Discovery learning versus expository learning: New insight into an old controversy*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Papert, S. (2001). Jean Piaget. *Time* [Online]. Available: http://www.time.com/time/time100/scientist/profile/piaget.html.

Peters, D. L. (1970). Discovery learning in kindergarten mathematics. *Journal for Research in Mathematics Education*. 1(2), 76-87.

Rice, M. L. & Wilson, E. K. (1999). Says 1998 in text on pg. 19/20 How technology aids constructivism in the social studies classroom. *Social Studies*. 90(1), 28-33.