WebQuest Learning as Perceived by Higher-Education Learners

By Robert Zheng, Bradd Stucky, Matt McAlack, Mike Menchana and Sue Stoddart

The WebQuest as an inquiry-oriented approach in web learning has gained considerable attention from educators and has been integrated widely into curricula in K-12 and higher education (Dutt-Doner, Wilmer, Stevens, & Hartmann, 2000; Joseph, 2000; Pohan & Mathison, 1998). It is considered to be an effective way to organize chaotic internet resources and help learners gain new knowledge through a guided learning environment (Patterson & Pipkin, 2001). Originated by Bernie Dodge and Tom March in 1995, the WebQuest is an instructional tool for inquiry-oriented learning in which learners interact with resources on the Internet, develop small group skills in collaborative learning and engage in higher level thinking. The WebQuest can be designed within a single discipline or be interdisciplinary. Two levels of WebQuests exist: short term and long term. Short term WebQuests focus on learners' knowledge acquisition and integration that can be completed in one to three class hours, whereas long term WebQuests emphasize learners' ability to extend and refine knowledge. Long term WebQuests may take between one week and a month in a classroom setting. A well designed WebQuest typically contains six parts: (a) introduction; (b) task; (c) information sources; (d) description of process; (e) guidance; and (f) conclusion (Dodge, 1995). These segments guide learners through WebQuest activities by providing descriptive background information, defining tasks, supplying information resources needed to complete tasks and offering a description of the process learners should go through in accomplishing tasks.

Although WebQuests have been adopted in K-12 schools and universities, their functionality and underlying principles are often not well-understood. Vidoni and Maddux (2002) pointed out that WebQuests are sometimes used as "a panacea for all manner of educational ills" (p.113). Dodge (2001) expressed his concern that some WebQuests "do not represent the model well at all and are merely worksheets with URLs" (p.7). The existing body of research on WebQuests is mainly focused on their design and development (Gohagan, 1999; Joseph, 2000; Pohan et al., 1998; Seamon, 2001). Little is known about how learners perceive the WebQuest as an instructional and learning tool. Research suggests that perceptions can influence exit behavior and should become part of the design process (Blose & Fisher, 2003; Sahin, 2003). Sahin (2003) observed that student teachers' perceptions of instructional technology, for example, may influence the way they "incorporate technology for teaching and learning across the curriculum" (p. 67). Wheeler (2002) asserted that student perceptions, such as their perceptions of learning and social support, can affect the way that distance learning is designed and implemented. This paper offers a discussion of the underlying constructs of WebQuests followed by the report of a study examining existing issues regarding WebQuest learning. Implications for teaching and learning with WebQuests will be made, along with suggestions for future research.

"Little is known about how learners perceive the WebQuest as an instructional and learning tool."

The constructs of WebQuests

The WebQuest is characterized by what Dodge (2001) describes as deep learning that involves constructing new knowledge through a critical thinking process. Studies show that WebQuest learning is supported by four underlying constructs: *critical thinking*, *knowledge application*, *social skills*, and *scaffolded learning* (e.g., Brucklacher & Gimbert, 1999; Dodge, 1995, 2001; Pohan et al., 1998; Vidoni et al., 2002).

Critical thinking

Critical thinking is an important construct in WebQuest learning. Richard Paul (1995) defines critical thinking as "disciplined, self-directed thinking which exemplifies the perfections of thinking appropriate to a particular mode or domain of thinking" (p. 526). Weinstein (2000) proposes a framework of critical thinking that includes (a) skillful thinking, (b) responsible thinking, (c) non-routine thinking, (d) applying criteria, (e) self-correction and (f) sensitivity. Vidoni et al. (2002) compared the characteristics of WebQuests with Weinstein's critical thinking theory and concluded that "WebQuests meet all six of Weinstein's key elements in critical thinking and therefore are powerful tools for inspiring critical thinking skills in students" (p. 101). Dodge pointed out in 1995 that, "The instructional goal of a WebQuest is that a learner would have analyzed a body of knowledge deeply, transformed it in some way, and demonstrated an understanding of the material by creating something that others can respond to, online or off" (p. 10).

Knowledge application

An important component in WebQuest learning is to develop students' ability to apply what they have learned to new learning (Pohan et al., 1998). Dede (2004) described the 21st century skills and knowledge required of learners as "...applying, refining and generalizing [knowledge] ... moving from passive assimilation of information to active construction of knowledge ..." (p. 16). According to Dodge (2001), WebQuests require students to go beyond "retelling and mastering factual information ... to apply knowledge, engage in problem solving, creativity, design, and judgment" (p. 9). Studies show that emphasis on knowledge application fosters knowledge association and promotes meaningful, deep learning (Brucklacher et al., 1999).

Social skills

Based on Johnson and Johnson's (1994) cooperative learning theory, WebQuests are designed to promote positive interdependence, individual and group accountability, and interpersonal and small group skills in learning (Dodge, 2001). Brucklacher et al. (1999) found that developing students' social skills including collaboration, positive interdependence and individual accountability enhances the efficacy of learning "in the quest for knowledge" (p. 39). However, how to create an effective cooperative learning environment remains a central issue in WebQuest design. Lim et al. (2001) point out that "strategies for ensuring effective group interaction should be carefully prepared" (p. 26). Commenting on what constitutes an effective and well orchestrated WebQuest, Dodge (2001) thus wrote, it is "a matter of organizing your learners ... to support effective cooperation" (p. 8).

Scaffolded learning

Studies show that scaffolding positively affects student achievement (Baylor, 2002; Bereiter & Scardamalia, 1984; Cho & Jonassen, 2002; Lim et al, 2001). As an important construct in WebQuest learning, scaffolding helps students achieve better learning results through a structured process. Dodge (2001) mentioned that the role of scaffolding is to "transform what they read into some new form" (p. 58). It facilitates, to some extent, what Mezirow (2000) called transformative learning.

As an Internet-based instructional tool the WebQuest is undergirded by the constructs of *critical thinking*, *knowledge application*, *social skills* and *scaffolded learning*. Despite the fact that the WebQuest has been widely adopted in K-16 classrooms, issues pertaining to WebQuest learning still exist, which affect the way the WebQuest is implemented in schools.

Gender as a potential issue in student perceptions of WebQuest learning

The issue of gender in technology has been a continuous cause of concern to educators. Forcier and Descy (2005) deplored that "computer use suffers from an inherited gender bias that holds that math and science are not 'feminine things'" (p. 42). This gender bias has deterred many female students from getting involved in computer related learning. However, recent studies showed that females could become as involved as males in computer literacy and application activities (Forcier et al., 2005). Bain, Hess, Jones, and Berelowitz (1999) studied the technological competency of female students in the high access integrated program and found that females exceeded their male counterparts. They also found that educational experience could become a determining factor in gender differences in technology as "profoundly altered educational experience enabled women to improve their technological skills beyond the levels of their male counterparts" (p. 7).

Experiences with WebQuests as a potential issue in student perceptions of WebQuest learning

Of particular concern to teachers and researchers is the inconsistency of WebQuest implementation (Zheng, 2005). Currently, WebQuests are used as (a) electronic worksheets, (b) problem-solving tools and (c) URL resources. When WebQuests are used as merely URL resources or electronic worksheets, learning is limited to information search and rote memorization. Conversely, when WebQuests are used as problem solving tools, the ability to analyze, synthesize, and evaluate information as well as social skills and creativity are emphasized. Zheng (2005) asserted that such inconsistency would affect students' perception and their performance in WebQuest learning. It might be anticipated that WebQuests created by instructors would adhere to the underlying constructs more closely than those created for students as class assignments, or for their own use in teaching. Such a difference might show up as a difference in perception between students who have only used WebQuests created by instructors and those who have only created their own, or between either of these and students who have had both experiences.

Research Questions

The following research questions were proposed as the basis for this study:

Research Question 1: What are the factors critical to WebQuest learning as perceived by learners?

Research Question 2: Are there any differences between theoretical constructs and factors identified in this study?

Research Question 3: Are there any differences between males and females in their perceptions of WebQuest learning?

Research Question 4: Is there a relationship between experience and perceptions in terms of WebQuest learning?

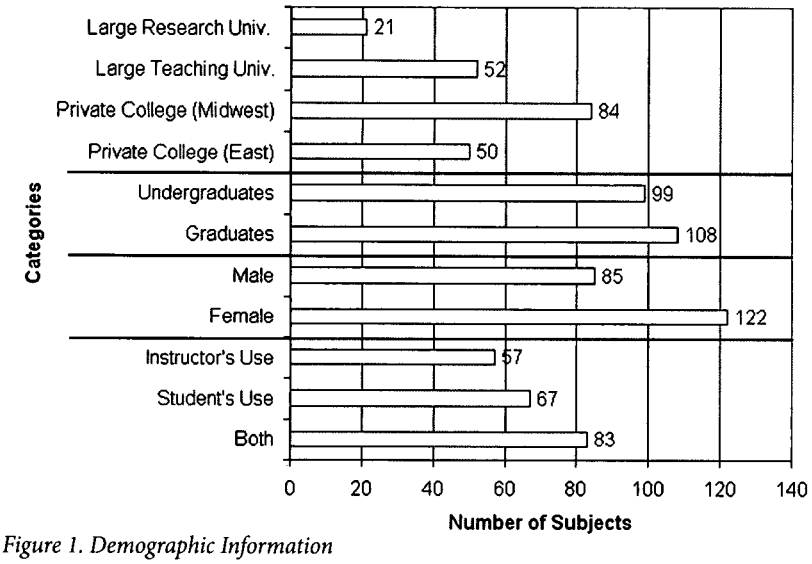

Figure 1. Demographic Information

WebQuest Research Project Questionnaire

I. Directions: This part of the questionnaire is to collect information about the participant. Please make an appropriate choice of the following, and fill out the information as required.

1. Select one of the following institutions in which you are currently studying:
   - ◻ Temple University
   - ◻ Philadelphia Biblical University
   - ◻ Marian College of Fond du Lac
   - ◻ California State University - Sacramento
2. Select one that matches your current academic status:
   - ◻ Undergraduate
   - ◻ Graduate
3. Select one of the following situations that matches your experience:
   - ◻ Our instructor uses WebQuests as an instructional tool in teaching and learning.
   - ◻ I have created a WebQuest either as part of course requirement or for my own instructional use.
   - ◻ Both
4. Select one of the following:
   - ◻ Male
   - ◻ Female
5. Your age is ☐

II. Directions: This part of the questionnaire is to collect information about your perception of WebQuest learning. Please choose an answer that you feel most appropriate to each question.

1. In WebQuest learning, learners are able to examine the problem from multiple lenses.
   - ◻ Strongly Disagree ◻ Disagree ◻ Neutral ◻ Agree ◻ Strongly Agree
2. In WebQuest learning, learners develop the ability to challenge each other's point of view.
   - ◻ Strongly Disagree ◻ Disagree ◻ Neutral ◻ Agree ◻ Strongly Agree
3. WebQuest learning facilitates learners to arrive at a conclusion by assembling various evidences through reasoning.
   - ◻ Strongly Disagree ◻ Disagree ◻ Neutral ◻ Agree ◻ Strongly Agree
4. Learners are able to propose a solution with more than one approach.
   - ◻ Strongly Disagree ◻ Disagree ◻ Neutral ◻ Agree ◻ Strongly Agree
5. Learners are able to solve the problem with more than one solution.
   - ◻ Strongly Disagree ◻ Disagree ◻ Neutral ◻ Agree ◻ Strongly Agree
6. WebQuests enable learners to effectively use the information to solve problems.

Figure 2. Sample of the questionnaire

Methodology

Participants

Two hundred and seven subjects participated in this study, 57 in the fall of 2003 and 150 in the spring of 2004. Subjects were students at one large research university (10%, n = 21), one large teaching university (25%, n = 52) and two private colleges (65%, n = 134). All participants were undergraduate (n = 108) and graduate students (n = 99) enrolled in the Department/College of Education at their respective institutions. There were 122 females and 85 males. Fifty-seven participants (28%) reported experiencing WebQuests used by their instructor in instruction, 67 participants (32%) reported using WebQuests for their own instructional purposes, and 83 participants (40%) reported both. Participants' ages ranged from 18 to 61 years (M = 29) (Figure 1).

Instrumentation and procedure

The instrument consisted of two parts: demographic information and questionnaire. Participants were asked to supply information about gender, age, institutions, academic status (graduate or undergraduate) and experience relating to WebQuest use. The experience of WebQuest use consisted of three levels: (a) "Our instructor uses WebQuests as an instructional tool in teaching and learning," (b) "I have created a WebQuest either as part of course requirement or for my own instructional use" and (c) "Both."

The questionnaire consisted of twenty questions, each with a five point Likert scale ranging from strongly disagree to strongly agree (strongly disagree = 1, strongly agree = 5). The instrument was developed based on the four theoretical constructs previously identified: *critical thinking*, *knowledge application*, *social skills* and *scaffolded learning*. The questionnaire was reviewed carefully by each of the five investigators, all of whom had developed and taught WebQuests to undergraduate and graduate students. Feedback from each investigator was evaluated to increase the instrument validity. For example, one of the comments was that since critical thinking involved various approaches and solutions in problem solving, the instrument should tap into student perceptions on those issues. Based on reviewers' comments, question 4 and 5 were revised to reflect the operational concepts in critical thinking: "Learners are able to propose a solution with more than one approach" and "Learners are able to solve the problem with more than one solution." The questionnaire was created as an online form that was hosted on a university server. Subjects were asked to sign a consent form and given the URL to complete the survey which took about 40 minutes (Figure 2).

Analysis and results

To determine the factors perceived by learners as critical to WebQuest learning, a Principal Axis Factoring analysis with varimax orthogonal rotation was performed on the data. Kaiser's eigenvalue greater than one rule

was used to retain the components. Selection of items was based on the criterion set by Hair, Anderson, Tatham and Black (1998) for significant factors (relevant factors have loading greater than .40).

Three interpretable factors with 19 items were extracted, accounting for 55.2 % of the variance. Item 11 did not fit within the factor constructs and was deleted from the list. The factor analysis rendered the following constructs: (a) constructivist problem solving, (b) social interaction and (c) scaffolded learning. An alpha reliability analysis was performed to determine the internal consistency for the items within each of the three constructs. Reliability scores for constructivist problem solving, social interaction and scaffolded learning were .88, .85, and .83, respectively (Table 1).

Item Number	Factor 1	Factor 2	Factor 3
1			.69
2			.70
3	.40		
4			.54
5			.41
6	.53		
7	.53		
8			.42
9	.61		
10	.44		
11			
12		.49	
13		.62	
14		.61	
15		.76	
16	.55		
17		.74	
18	.51		
19	.58		
20	.59		
Eigenvalue	8.42	1.50	1.11
% of Variance	42.10	7.51	5.57
Cronbach alpha	.89	.85	.83

Table 1. Rotated factor loading and eigenvalues for three factors

A 2 x 3 experimental design was used with gender (males and females) and experience group (instructor's use, student's use and both) as independent variables and factor scores as dependent variables. A MANOVA analysis showed a main effect for gender. There was a significant difference between males and females in relation to their perception of WebQuests (Wilk's Lambda = 4.216, $p < .01$). A follow-up ANOVA for gender showed that males and females differed significantly in Factor 1 "Constructivist problem solving" ($F(1, 205) = 10.734$, $p < .01$). No gender differences were found in Factor 2 "Social interaction" ($F(1, 205) = 1.759$, $p = .19$) and Factor 3 "Scaffolding learning" ($F(1, 205) = 2.734$, $p = .10$). With a small effect size of .055 the gender difference in Factor 1 may not have any substantial impact in practice. There was no main effect for experience group. No significant difference was found among the groups who experienced the WebQuests through the instructor, by themselves or both (Wilk's Lambda = 2.114, $p = .051$).

Discussions and conclusion

Discussions of the findings are focused on four research questions with an emphasis on their implications in teaching and learning.

Research question 1 tried to identify factors critical to WebQuest learning as perceived by learners. Three constructs were found: *constructivist problem solving*, *social interaction* and *scaffolded learning*. As is readily apparent, these constructs differ from the four cited in literature related to WebQuests. Although they share components with the four "old constructs," the nature of these "new constructs" (as explained below) needs to be taken into account by those who design WebQuests for learning (Table 2).

Constructs derived from literature	New constructs derived from factor analysis
• **Critical thinking**	• **Constructivist problem solving**
Examining problems from multiple lenses	Examining problems from multiple lenses
Promoting challenging other's view	Assembling various evidences though reasoning
Assembling various evidences though reasoning	Proposing a solution with more than one approach
Proposing a solution with more than one approach	Solving the problem with more than one solution
Solving the problem with more than one solution	Using information effectively to solve problems
• **Knowledge application**	Transferring knowledge from one problem solving situation to another
Using information effectively to solve problems	Pulling knowledge from different fields to solve problems
Transferring knowledge from one problem solving situation to another	Retrieving prior knowledge to new learning
Focusing on problems	Organizing for new learning
Pulling knowledge from different fields to solve problems	• **Social interaction**
Retrieving prior knowledge to new learning	Promoting accountability among learners
• **Social skills**	Gaining a better understanding of each other's point of view
Promoting positive interdependence	Promoting interaction between learners
Promoting accountability among learners	Developing better interpersonal and small group skills
Gaining a better understanding of each other's point of view	Promoting challenging other's view
Promoting interaction between learners	• **Scaffolded learning**
Developing better interpersonal and small group skills	Facilitating subject content comprehension
• **Scaffolded learning**	Clarifying learning
Facilitating subject content comprehension	Connecting between learning activities and goals
Clarifying learning	Better understanding how to achieve learning goals
Organizing for new learning	Focusing on problems
Connecting between learning activities and goals	
Better understanding how to achieve learning goals	

Table 2. Differences between old constructs derived from literature and new constructs derived from factor analysis

The construct of *constructivist problem solving* is explained by the concepts of prior knowledge, knowledge transfer, knowledge association, and so on. This finding is consistent with the literature that a constructivist learner (a) examines issues from multiple viewpoints, (b) self-initiates problems by posing thoughtful, open-ended questions and (c) solves them using multiple approaches (Brooks and Brooks, 1993; Duffy & Jonassen, 1992). The construct of social interaction involves the concepts of interpersonal and small group skills, looking from other person's view and challenging other's view. This construct is consistent with the relevant literature such as Johnson and Johnson's (1994) cooperative learning theory. The construct of *scaffolded learning,* which includes the concepts of content comprehension, learning and goal attainment, is consistent with what has been found in the literature. According to Dodge (2001), scaffolding is a cognitive structure that "helps learners act more skilled than they really are" (p. 58). It facilitates better understanding, bridges prior knowledge to new learning, helps focus on problems and relates learning activities to goals (Baylor, 2002).

The above finding suggests that students perceived *constructivist problem solving, social interaction* and *scaffolded learning* as important factors for WebQuest learning. An important inference from this finding is that when teachers create WebQuests, they need to shift from creating prescriptive learning situations to developing environments that engage learners and require them to solve problems and construct knowledge that is most meaningful to them. More importantly, the finding can help teachers to understand better the constructivist aspects in problem solving and incorporate into WebQuest design such elements as applying and constructing new knowledge, encouraging critical thinking, promoting collaboration and building scaffolds for higher level thinking and learning.

Research question 2 asked if there were differences between theoretical constructs and factors identified. There were several conceptual changes between theoretical constructs and new constructs. Firstly, the theoretical constructs of *knowledge application* and *critical thinking* were merged into a new construct called *constructivist problem solving*, which shows that the problem solving as perceived by students is a broad process that includes critical thinking, knowledge application, association and construction. Secondly, there was a difference between the construct of *social interaction* and its counterpart *social skills.* For example, the item "promoting challenging other's view" was factored into the new construct of social interaction from a different construct known as critical thinking. This indicates that learners' perception of social interaction entails a broader array of concepts than was previously identified in the literature. Finally, the construct of *scaffolded learning* reflected several conceptual changes with "organizing for new learning" being factored out and "focusing on problems" factored in from a different construct known as knowledge application. This suggests that learners' perception of scaffolded learning seems to gravitate more toward knowledge application and problem solving than merely providing structured cognitive support in learning.

By comparing the differences between old and new constructs, teachers can gain a better understanding of the constructs of WebQuests. For example, by differentiating the old constructs of knowledge application and critical thinking from the new construct of constructivist problem solving, teachers can understand better what underlies the construct of constructive problem solving, hence design learning situations that facilitate constructive and creative learning. By comparing the construct of social interaction with that of social skills, teachers would become better informed about what *effective* collaboration is, hence develop an effective cooperative learning environment that facilitates interdependence and accountability, as well as individual and small group skills. Finally, the study of the underlying concepts of the old and new constructs of scaffolded learning can help teachers understand that scaffolded learning is not just providing structured cognitive and academic support as it was traditionally defined. Instead, it includes knowledge application and problem solving skills for more meaningful learning.

"When teachers create WebQuests, they need to shift from creating prescriptive learning situations to developing environments that engage learners and require them to solve problems and construct knowledge that is most meaningful to them."

"The effort to identify underlying constructs of WebQuests should not be interpreted as an effort to establish uniform standards for WebQuest design and development."

In short, the study on old and new constructs of WebQuests helps clarify the underlying concepts and the functionality of WebQuests in learning.

Research question 3 asked if there was a difference in gender in terms of perceptions. The study revealed an overall difference between males and females in perceptions. Analyses showed that there was a gender difference for factor 1, but no gender difference was found for factors 2 and 3. It is interesting to note that the gender difference in factor 1, despite its small effect size, seemed to relate to males' and females' perceptions in problem solving approaches, which were specifically shown in their different perceptions in item 4 "Learners are able to propose a solution with more than one approach" ($F(1, 205) = 6.252$, $p < .05$) and item 5 "Learners are able to solve the problem with more than one solution" ($F(1, 205) = 8.985$, $p < .05$). A possible explanation for "no significant difference" in factor 2 is that males and females have an equal opportunity to participate regardless of gender. Factor 3 is related to scaffolded learning. It is possible that as a cognitive and academic support, scaffolding is embedded in WebQuests that enables both males and females to benefit from the scaffolding without any gender preferences. The findings for factors 2 and 3 were consistent with the literature that both males and females can perform equally well in cooperative learning (Forcier et al., 2005) and in scaffolded learning (Baylor, 2002).

Research question 4 asked if there was a relationship between experience and perceptions. Surprisingly, no significant difference was found among experience groups (i.e., instructor's use, student's use and both) in terms of learner perceptions.

The effort to identify underlying constructs of WebQuests should not be interpreted as an effort to establish uniform standards for WebQuest design and development. Since WebQuests display a wide range of quality and design elements, it is only appropriate to interpret the results of this study as something that facilitates better understanding of the elements essential to WebQuest learning.

There are two limitations pertaining to the design of this study. First, the study is limited by the homogeneity of population. The majority of the participants were college students, which could limit the generalizability of the findings. Second, although there was an effort to understand the relationship between learner characteristics (e.g., gender and experience) and their perceptions, this effort did not address the issue from a broader perspective; that is, individual differences such as learning styles, attitude and so on. Future research should include a more diverse population from K-16 and study the issue by including individual differences in terms of learner perceptions. It is suggested that future study be extended to examine teacher perceptions of WebQuests, so that a more comprehensive and systemic approach can be taken to effectively integrate WebQuests in teaching and learning.

Robert Zheng is an assistant professor of instructional technology in College of Education of Temple University, Pennsylvania.

Bradd Stucky is an associate professor of instructional technology and educational leadership at Marian College of Fond du Lac, Wisconsin.

Matt McAlack is an associate professor in Philadelphia Biblical University, Pennsylvania.

Mike Menchana is an assistant professor in the Department of Teacher Education of California State University--Sacramento, California.

Sue Stoddart is an instructor at Marian College of Fond du Lac, Wisconsin.

References

Bain, A., Hess, P., Jones, G., & Berelowitz, C. (1999). Gender differences and computer competency: The effects of a high access computer program on the computer competence of young women. *International Journal of Educational Technology, 1*(1). Retrieved January 18, 2005, from http://smi.curtin.edu.au/ijet/v1n1/bain/index.html

Bereiter, C., & Scardamalia, M. (1984).Teachability of reflective processes in written composition. *Cognitive Science, 180*(8), 173-190.

Baylor, A. (2002). Expanding preservice teachers' metacognitive awareness of instructional planning through pedagogical agents. *Educational Technology Research and Development, 50*(2), 5-22.

Blose, R., & Fisher, D. (2003). *Effects of teachers school-level environment perceptions on changing elementary mathematics classroom environments.* Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Brooks, J., & Brooks, M. (1993). *In search of understanding: The case for constructivist classroom.* Alexandria, VA: ASCD.

Brucklacher, B., & Gimbert, B. (1999). Role-playing software and WebQuests: What's possible with cooperative learning and computers. *Computers in the Schools, 15*(2), 37-48.

Cho, K., & Jonassen, D. (2002). The effects of argumentation scaffolds on argumentation and problem solving. *Educational Technology Research and Development, 50*(3), 5-22.

Dede, C. (2004). Enabling distributed learning communities via emerging technologies--Part one. *T.H.E. Journal, 32*(2), 12-22.

Dodge, B. (1995). WebQuests: A technique for internet-based learning. *Distance Educator, 1*(2), 10-13.

Dodge, B. (2001). FOCUS: Five rules for writing a great WebQuest. *Learning and Leading with Technology, 28*(8), 6-9, 58.

Duffy, T., & Jonassen, D. (Eds.). (1992). *Constructivism and the technology of instruction: A conversation.* Hillsdale, NJ: Lawrence Erlbaum Associations.

Dutt-Doner, K., Wilmer, M., Stevens, C., & Hartmann, L. (2000). Actively engaging learners in interdisciplinary curriculum through the integration of technology. *Computers in Schools, 16*(3-4), 151-66.

Forcier, R., & Descy, D. (2005). *The computer as an educational tool: Productivity and problem solving. (4th ed.).* Upper Saddle River, NJ: Pearson-Merrill/Prentice Hall.

Foshay, R., & Bergeron, C. (2000). Web-based education: A reality check. *TechTrends, 44*(5), 16-19.

Gohagan, D. (1999). Computer-facilitated instructional strategies for education: Designing WebQuests. *Journal of Technology in Human Services, 16*(2-3), 145-159.

Hair, J., Anderson, R., Tatham, R., and Black, W. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Johnson, D., & Johnson, R. (1994). *Leading the cooperative school* (2nd ed.). Edina, MN: Interaction Book Company.

Joseph, L. (2000). FoodQuest for health. *Multimedia Schools, 7*(1), 34-37.

Lim, B., Plucker, J., & Nowak, J. (2001). We are what we weave?: Guidelines for learning by web design. *Educational Technology, 41*(6), 23-27.

Mezirow, J. (2000). Learning to think like an adult: Core concepts of transformation theory. In J. Mezirow (Ed.), *Learning as transformation: Critical perspectives on a theory in progress.* (pp. 3-33). San Francisco, CA: Jossey-Bass.

National Center for Education Statistics. (2000). *Teacher's tools for 21st century: A report on teachers' use of technology.* U.S. Department of Education: Office of Educational Research and Improvement.

Patterson, N., & Pipkin, G. (2001). Guiding readers to new understandings through electronic text. *Voices from the Middle, 8*(4), 64-66.

Paul, R. (1995). *Critical thinking: How to prepare students for a rapidly changing world.* Santa Rosa, CA: Foundation for Critical Thinking.

Pohan, C., & Mathison, C. (1998). WebQuests: The potential of internet-based instruction for global education. *Social Studies Review, 37*(2), 91-93.

Seamon, M. (2001). Changing instructional practices through technology training, Part 2 of 2. *Book Report, 19*(5), 40-42.

Sahin, T. (2003). Student teachers' perceptions of instructional technology: Developing materials based on a constructivist approach. *British Journal of Educational Technology, 34*(1), 67-74.

Vidoni, K., & Maddux, C. (2002). WebQuests: Can they be used to improve critical thinking skills in students? *Computers in the Schools, 19*(1-2), 101-17.

Weinstein, M. (2000). A framework for critical thinking. *High School Magazine, 7*(8), 40-43.

Wheeler, S. (2002). Student perceptions of learning support in distance learning. *The Quarterly Review of Distance Education, 3*(4), 419-429.

Zheng, R. (2005). From WebQuests to virtual learning: A study on students' perception of factors affecting design and development of online learning. In S. Ferris, & S. H. Godar (Eds.), *Teaching and learning with virtual teams* (pp. 115-143).. Hershey, PA: Idea Group.