DOCUMENT RESUME

ED 477 112 IR 021 840

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TITLE	WebQuests for Reflection and Conceptual Change: Variations on a Popular Model for Guided Inquiry.
PUB DATE	2002-06-00
NOTE	7p.; In: ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Proceedings (14th, Denver, Colorado, June 24-29, 2002); see IR 021 687.
AVAILABLE FROM	Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Critical Thinking; Educational Resources; Inquiry; Instructional Development; Learning Theories; *Models; Problem Solving; Schemata (Cognition); World Wide Web
IDENTIFIERS	Schema Theory

ABSTRACT

WebQuests have become a popular form of guided inquiry using Web resources. The goal of WebQuests is to help students think and reason at higher levels,and use information to solve problems. This paper presents modifications to the WebQuest model drawing on primarily on schema theory. It is believed that these changes will further enhance student reflection and deepen conceptual change through the use of WebQuest activities in the classroom. The revised model is illustrated in a makeover of a sample WebQuest. Includes two figures. (Contains 12 references.) (Author)

WebQuests for Reflection and Conceptual Change: Variations on a Popular Model for Guided Inquiry

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Abstract WebQuests have become a popular form of guided inquiry using Web resources. The goal of WebQuests is to help students think and reason at higher levels, and use information to solve problems. In this paper we present modifications to the WebQuest model drawing on primarily on schema theory. We believe these changes will further enhance student reflection and deeper conceptual change through the use of WebQuest activities in the classroom. The revised model is illustrated in a makeover of a sample WebQuest.

WebQuests have become a popular form of guided inquiry using Web resources. The goal of WebQuests is to help students think and reason at higher levels, and use information to solve problems. Thousands of teacher-authored WebQuests are currently available on the Web for use in different subject areas and at all educational levels. Teachers may thus choose to incorporate WebQuests developed by others, or they may develop their own WebQuest as a way to get their students reasoning at higher levels.

Dr. Bernie Dodge of San Diego State University first created the WebQuest model in 1995 (Dodge, 1995). Though he and Tom March articulated a fairly specific model and created many example WebQuests, there is now an even wider range of activities that fall under the WebQuest umbrella. Of course, the WebQuest model is a subset of the larger class of guided inquiry activities in use today. Other guided inquiry activities contain instructional strategies that are not a part of the WebQuest model, e.g., stronger reliance on a case as a resource; higher levels of guidance toward reflection. In this paper we propose modifications to the WebQuest model drawing on primarily on schema theory. We believe these changes will further enhance student learning through the use of WebQuest activities in the classroom. We also discuss ways to help teachers integrate WebQuests successfully into the overall curriculum.

The WebQuest Model: Evolving Over Time

There is no strict format for WebQuest design, and this flexible structure is one of its most appealing attributes (Dodge, 1995). Most WebQuests have the following elements:

1. An *introduction* that sets the stage and provides some background information. The introduction can be likened to an instructional set that stimulates prior knowledge and prepares students for new learning.
2. A *task* or problem to be addressed. This problem-solving task is at the heart of the WebQuest. The task is like the problem in a problem-based learning unit--It is the challenge or conflict to be addressed in the WebQuest activities. Dodge has provided additional assistance to educators attempting to create the WebQuest task through his online training materials. His "Taskonomy" helps educators envision a wide array of possible WebQuest tasks (Dodge, 1999).

3. A clear description of the *process* learners should go through in accomplishing the task. It is here that collaborative teams are formed and roles for each member of the team identified. Specific guided activities are often included in the process.
4. A set of *information sources* needed to complete the task. Since the WebQuest itself is delivered as a webpage, these resources are most typically Web-based, though widely available print or video resources can be identified for student use as well. Some WebQuests provide a common list of resources used by all members of the team; others identify information sources based on team member role.
5. An open-ended *evaluation* system for products created by students as a result of their problem solving. It is recommended that rubrics be used for the purposes of evaluation (Pickett & Dodge, 2001).
6. A *conclusion* that brings closure to the quest, reminds the learners about what they've learned, and perhaps encourages them to extend the experience into other domains.

A number of sites serve as portals or clearinghouses for WebQuests, allowing teachers to search for resources in their areas, including:
Blue Web'n (http://www.kn.pacbell.com/wired/bluewebn/),
The Matrix of Examples (http://edweb.sdsu.edu/webquest/matrix.html), and
The WebQuest Collections (http://edweb.sdsu.edu/webquest/webquest_collections.htm).

Many of the more innovative WebQuests will include unique design elements. Some developers have offered formal variations on the WebQuest model. March (2000), for example, has made modifications to the original WebQuest structure. Spartenburg (2001) presents a model for CyberInquiry projects that, at once, are more open and more linear in progression than WebQuests. Rather than seek out information from prespecified locations, CyberInquiry students conduct more open searches as part of a clear line of inquiry.

Schema Theory and Guided Inquiry

WebQuests can be seen as part of a broader movement within education that was heavily influenced by the paradigm shift away from behaviorism and toward cognitive psychology in the 1970s and 80s (Mayer, 1992). Schema theorists of that era advocated an approach to education that valued deep conceptual change over simple behaviors (Norman, 1976). Following this schema-based approach, students use their existing knowledge to make predictions and address problems (Posner, Strike, Hewson, & Gertzog, 1982; Strike & Posner, 1985). By engaging in a number of inquiry and problem-solving activities, students undergo a conceptual shift that leads to new schemas and ways of seeing the world--as well as specific procedural skills for dealing with that world. At beginning, middle, and end of problem-solving activities, students reflect on their changing schemas and their growing understanding. Math and science have been particularly fertile areas for schema-based curricula because new schemas can provide the hooks for making the computational details meaningful and stable in memory (Perkins & Simmons, 1988).

STAR.Legacy is a promising instructional model developed by Vanderbilt's Cognition and Technology Group that is based on conceptual-change principles (Schwartz, Lin, Brophy, & Bransford, 1999). The basic framework is an inquiry cycle with repeated opportunities for reflection and prediction. STAR is an acronym for Software Technology for Action and Reflection. The authoring tool, currently in prototype form, is intended to support the development of multimedia units for encountering and solving authentic inquiry challenges through small-team collaboration and research activities.

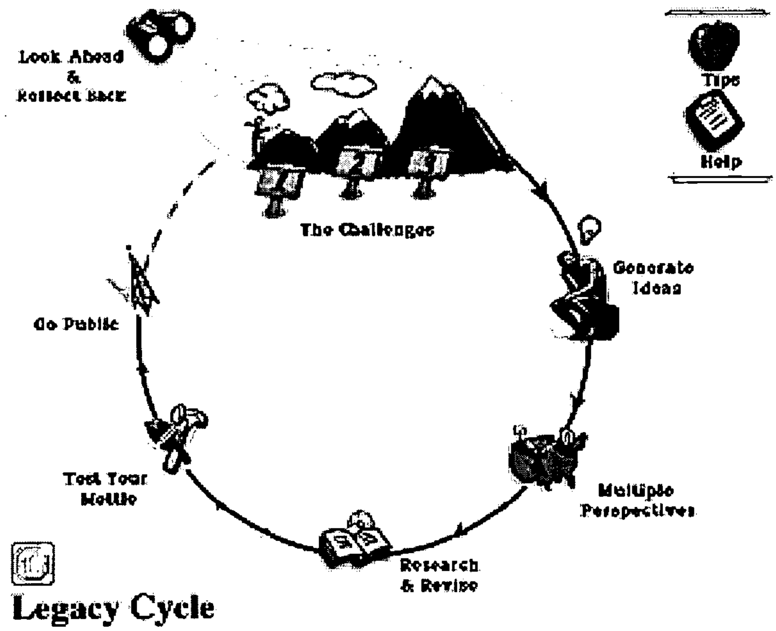

Figure 1: problem-solving cycle embodied within the STAR.Legacy instructional model. From http://peabody.vanderbilt.edu/ctrs/ltc/brophys/legacy1.html.

In a website overview, Sean Brophy provides a succinct description of the STAR.Legacy approach (see http://peabody.vanderbilt.edu/ctrs/ltc/brophys/legacy1.html):

> The learning cycle begins with the presentation of a challenge in either audio or text format. Then students are asked to reflect on the challenge and to "Generate Ideas." Once they've articulated their thoughts, then they listen to "Multiple Perspectives" from various experts. These experts provide hints about things to think about when solving the problem. However, these hints do not provide a specific solution to the problem. This allows users to compare their naive first impressions with the experts to help them notice their lack of differentiated knowledge.

This initial sequence is similar to a WebQuest, but takes things a little slower. Students are asked to use their existing knowledge to think about the problem and generate some initial ideas. They are then exposed to other points of view about the problem. All of this precedes formal inquiry using outside sources.

> Now they are prepared to engage in a process of "Research and Revise." This stage of the learning cycle organizes resources into meaningful learning activities designed to help them focus on issues related to the initial challenge.

This is like a WebQuest's process activities, with students using various Web resources to learn more about the subject.

> Once they feel they've learned enough they can go to "Test your mettle." Here they engage in a set of activities that helps them explore the depth of their knowledge. The goal is to create assessment situations that help them evaluate what they do not know so they can return to the "Research and Revise" section to learn more.

This cycle of "testing mettle" and returning to resources is more elaborate than the WebQuest model and requires a more fully developed instructional unit.

Students progress to the "Go Public" stage after proving to themselves that they understand the content well enough to express a solution to the challenge.

Students "go public" with their solution, but they also "look ahead and think back." The reflection involved in the process--from beginning stages using limited knowledge, to final stages at the conclusion of inquiry--creates greater opportunities for students to undergo conceptual change rather than simple incremental addition of new facts. As Brophy explains:

> This cyclical process of active research and reflection on the process provides an excellent opportunity for students to generate their own understanding of the content knowledge.

A Variation on the WebQuest model

STAR.Legacy units require more comprehensive resources and design than most teachers are able to include in a WebQuest. Even so, WebQuests can do more to encourage reflection and active use of knowledge. Our project incorporates elements of the STAR.Legacy model to create a more schema-based approach to WebQuest design (see Fig. 2 below).

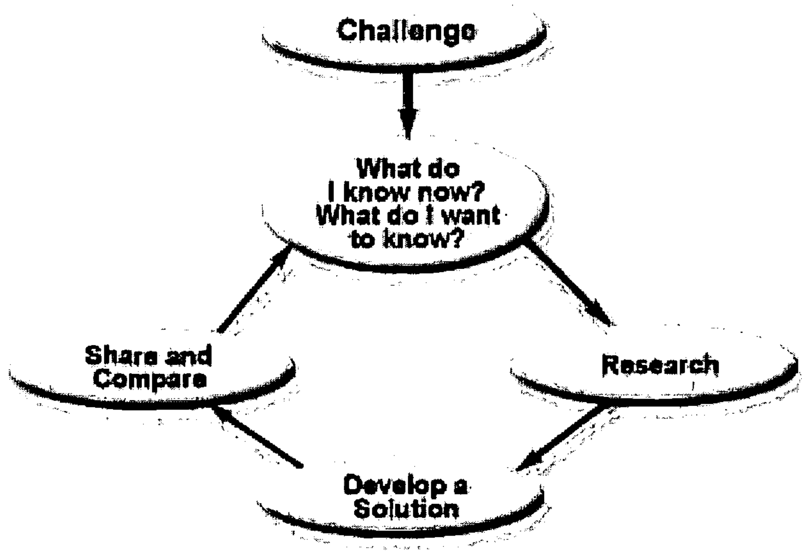

Figure 1: A four-stage reflection process can be triggered by an outside assignment or by continuing work of an individual of team.

This cycle of reflection can be prompted by an external challenge, as in WebQuests, or by the natural and continuing interests of team members. We see this reflection cycle as a variation on the Star.Legacy and K-W-L models of inquiry learning (Ogle, 1986).

Specifically, the WebQuest model is revised at two main points:

1. What Do You Think? following the task. Students need opportunities to test and use their initial understandings before engaging in specific search activity. We suggest that once students have been introduced to the Task in step 2 of the WebQuest, they be given a chance to propose possible solutions to the problem based on their current knowledge and understandings. What Do You Think? requires team members to pool their initial knowledge concerning the topic of research, and to present that knowledge as a basis for inquiry.

   There are specific advantages to adding this step. First, by allowing students to articulate possible solutions to the task or problem, both students and teacher can identify students' existing knowledge.

Second, this first pass at a solution provides a benchmark against which students can compare their conceptual growth over the course of the WebQuest. Third, the collaborative discussion that occurs as students share their ideas allows them to understand the thinking of the other members of their team (van Zee & Minstrell, 1997). And finally, it may become apparent to the teacher, based on the solutions generated at this stage that one or more steps of the WebQuest activity need to be revised. For example, it may be discovered that the information sources identified in step 4 of the WebQuest are inadequate. Or, a teacher may uncover that the task itself needs to expanded or narrowed to make the job of problem solving more meaningful to students.

2. Share and Compare. Students also need time to debrief and reflect with others as they complete WebQuest activities. The Conclusion step of most WebQuests often seems to be an afterthought rather than an essential component. We believe that this step should allow students to take an active role in assessing their conceptual growth throughout the course of the WebQuest experience. This could be easily done by comparing and contrasting the final team solution to the problem or task with their initial attempts at problem solving articulated in the new "What do you think?" step that we have added earlier. Share and Compare provides a structure for the public sharing of research findings, then feeding those findings into further inquiry questions.

   Public sharing of findings allows all students in the class to experience the solutions offered by each of the teams. This opens up opportunities for large-group analysis of the solutions and further opportunities for conceptual development. Active sharing will also allow the teacher to help link the understandings and knowledge that students gain from the WebQuest experience to the rest of the curriculum for the course. This linkage back to the curriculum is an oft-neglected aspect of WebQuest use.

A Modified WebQuest

To illustrate how a typical WebQuest can be modified for increased reflection, we have conducted a makeover of a WebQuest preparing 5th grade students for a field trip to Southern Colorado (see http://ouray.cudenver.edu/~dl0young/adam/html_files/ for the revised site). In this WebQuest, students study a site they will visit and prepare inquiry questions relating to that site.

Three pages are added to the site to increase support for reflection and conceptual change: Teacher Page, What Do You Think? and Share and Compare. The Teacher Page presents the learning objectives for the site and suggestions for appropriate use. The Teacher Page also presents the four-stage model (see Fig. 2 above). As part of the What Do You Know? activity, students brainstorm together to pool their initial knowledge about their site. In the Share and Compare page, students submit their research questions and are prompted to review and compare questions from other teams. Once the teams have contributed questions, the whole class, working under the teacher's direction, can decide how to use the questions as they physically visit the geographic sites. Alternatively, the visits can be conducted virtually, with similar kinds of sharing and reflection activities.

Contextual Use of WebQuests

It is important to remember that WebQuests are not isolated instructional activities. Instead, they are intended for use within the larger context of course objectives and curriculum. Encouraging greater reflection by active students will increase the likelihood that they will successfully link the activity back to the principles and ideas of the curriculum. Achieving this connection between specific activities and general principles is a challenge for education. We see WebQuests as powerful tools to help meet that challenge.

In some instances, a WebQuest may be used as the instructional set for a larger unit of work. In other instances, it may be a culminating activity. Because the ability of students to think and reason at higher levels varies widely, a teacher may elect to implement a particular WebQuest in different ways from class to class. In fact, a teacher's first administration of WebQuest will most likely vary significantly from their later use of the strategy. In general, we need to examine closely how teachers choose to incorporate WebQuests into their everyday activities.

The Need for Continuing Research

The rapid rise of the WebQuest as an educational practice has outstripped the research community's ability to provide a solid theoretical foundation for its use. This is no different than other technologies that rise rapidly into use. The many approaches to WebQuest design further complicate efforts to study the impact of these interventions. We see this dynamic and diverse state of affairs as a healthy condition that now provides a fertile opportunity for research of various forms.

We have proposed modifications to the original WebQuest model. The key issue for research, however, may not be finding the perfect model but, rather, finding ways to help teachers make best use of these models in their teaching practices. We intend to continue studying how teachers make use of models and frameworks, and how they adapt these frameworks to their own purposes and conditions. Over time, we hope to better understand conditions and strategies that will help students develop higher-order reasoning skills.

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