Designing Problem-based Learning Using the Internet: WebQuest as an Instructional Tool

Thana Thaver, Mary Anne Heng & Levan Lim

Abstract

The internet offers many resources that can be used for educational purposes. Many teachers, however, are uncertain about how to incorporate the use of these resources into their classroom curriculum and instruction. This article describes WebQuest, a tool for inquiry-based or problem-based learning and instruction that integrates the resources of the World Wide Web with student learning. The benefits of using WebQuests as well as implications for use in schools are also discussed.

Introduction

The internet is undoubtedly one of the most powerful educational tools of our time. The fact that we are connected through the World Wide Web to vast repositories of information and knowledge from all over the world provides unprecedented opportunities for constructing new and effective ways of learning and instruction. Schools in Singapore are extensively supported by an internet infrastructure that offers limitless opportunities to enrich and extend learning beyond the confines of the traditional classroom. A primary cause for concern, however, is that teachers may not be equipped with the skills or the know-how to conduct lessons that effectively incorporate internet resources and technology into their curriculum and instruction in a pedagogically defensible manner.

This paper describes WebQuest, a tool teachers can use with internet access to provide stimulating and authentic inquiry-based, problem-solving activities for students that relate directly to the school curriculum. Steps on how to create a WebQuest are outlined with links to respective websites, followed by brief examples of WebQuests. Benefits as well as concerns and challenges with using the WebQuest as an instructional tool are discussed in the last section.

Constructivist Learning and the Internet

Current educational best practices argue that knowledge is most effectively learned when individuals actively participate in constructing and developing their own personal understanding. The individual's learning experience can be enhanced when constructive learning processes occur in social interaction with others (Rogoff, 1990). The opportunity for social interaction in a learning environment that is rich in resources and engages individuals in tasks and problems representative and reflective of authentic life situations equips students with the skills and knowledge to "own" their learning and better handle real-life issues. Such an inquiry or problem-based approach to education can also help students to develop the skills to become lifelong independent learners (Boud, 1985). Indeed, problem-based learning is one of the best exemplars of a constructivist learning environment where learners actively interact with one another to test and stretch current understandings and schemas in the contexts and situations in which they are used (Savery & Duffy, 1995).

It is now commonplace to see the computer as an interactive tool to develop knowledge and learning in the school-based experience of students. The computer provides an instructional environment where multimedia, graphics and internet resources create a virtual reality that learners can actively interact with to construct their own knowledge and customize their own space and pace of learning. Such an instructional environment is able to imitate real-life situations that traditional classroom teaching methods find hard to duplicate. Linked with a problem-based approach to learning, the computer offers educational opportunities that integrate the presentation of realistic tasks and problems with the active construction of meaning and understanding for learners.

The internet offers a learning environment that is rich in resources and readily available beyond the traditional physical spaces for learning, such as libraries and classrooms. It is exciting to know that communities of teachers and students the world over are already using the internet to construct curricular and instructional activities that tap on World Wide Web resources. For example, at the National Institute of Education, pre-service teachers enrolled in the Diploma in Education Programme take a foundational Education Studies module where they learn to apply and incorporate relevant content and pedagogical knowledge and information via the internet into curriculum and instruction at the primary school level. In this module, beginning teachers learn to integrate the use of the internet into inquiry or problem-based learning projects for their students using a particular approach known as the WebQuest.

The WebQuest Tool

Accessing the internet with its vast resources is, in itself, not too difficult a task. The challenge for teachers is to learn the skills to guide their students to locate,

select, make use, apply and evaluate their own use of the internet. A set of specific skills known as the "Big Six" provides a very useful method for conceptualizing and teaching the skills necessary for using the internet based on an inquiry or problem-based approach (see Eisenberg & Berkowitz, 1990, for a more detailed account).

The six skills refer to: (i) identifying the nature of the problem by defining what needs to be known (Task Definition); (ii) establishing the parameters of information gathering and identifying the appropriate resources (Information Seeking); (iii) locating and accessing the specific resources identified (Locating and Accessing); (iv) processing the information to decide and extract what is useful (Use of Information); (v) organizing and communicating the information (the solution) to address the problem posed (Organizing and Communicating); and (vi) evaluating the quality of the solution (Evaluation).

Jansen and Culpepper (1996) express the Big Six in terms of the following questions:

- What needs to be done?
- What can I use to find what I need?
- Where can I find what I need?
- What information can I use?
- How can I put my information together?
- How will I know if I did my job well?

WebQuest is a tool or format, premised upon the specific skills of the Big Six, that is designed to provide scaffolded instruction to the use of the internet for planning and implementing inquiry-based learning. Developed by Bernie Dodge (1995, 1998) at the San Diego State University, WebQuest is a popular learning tool used by educators across the globe in guiding students in cooperative groups to construct their own learning by defining issues or problems and working their way through to solutions that they can post on-line (in the form of a WebQuest) for sharing and review. In a WebQuest, most of the information used by learners is drawn from the Web. WebQuests are designed to help learners construct their own understanding of a topic, focus on using information rather than regurgitating it and supporting learners' higher-order thinking at the levels of analysis, synthesis and evaluation.

In addition, WebQuests promote cooperative learning and team work. Through collaborative research, learners examine large, complex or controversial topics that would be difficult for one person to manage in its entirety. In WebQuests, learners take on roles within their groups to master one aspect of a complex topic and share their knowledge with their group members so that an overall understanding of the topic or problem can be achieved. Working as a team, this knowledge is then transformed into a creative product. The quality of the product more often than not hinges on the collaborative efforts of the group. WebQuests also demand that group members evaluate their own product, their work processes and their performance

as a team. This helps learners analyse and improve upon their performance and contribution as a member of the group in the future.

A quick search of the Internet for the word "WebQuest" will show up myriad examples of vastly differing quality. Many WebQuests seem to have been created hurriedly, usually worksheets with URLs masking as WebQuests. Others appear to have been developed over a longer period of time, painstakingly refined with each year of implementation (Dodge, 2001).

According to Christie (2000), a WebQuest should ideally contain the following sections (which are based on the Big Six set of skills described earlier):

1. Introduction: sets the stage and arouses interest of learners.
2. Task: description of what the learners will accomplish during the exercise.
3. Process: the steps the learners should go through to complete the task.
4. Resources: a list of web pages that the teacher has located which will help learners accomplish the task. Web pages should be pre-selected to avoid aimless surfing.
5. Evaluation: a rubric that learners can use to assess their own product. It can also include a section on reflection, for example, learners' views on how effectively they collaborated with their group members to complete the project.
6. Conclusion: brings closure to the WebQuest and provides the opportunity to summarize, to encourage reflection, and generalize what was learned.
7. Teacher's Page: this is to help teachers understand the objectives and scope of the WebQuest developed and the preparation needed.

Steps To Developing Competence with Using and Creating a WebQuest

The following steps guide the process of developing competence with using WebQuest as a tool for educational purposes. These steps were used with our pre-service teachers in completing their WebQuest assignment.

Step 1: Gain more Understanding of WebQuest

Trainees were encouraged to gain further understanding of what a WebQuest is and the theoretical underpinnings of the WebQuest by accessing and reading the following articles:

*   "What is a WebQuest?" by Alice Christie (2000) at
    http://www.west.asu.edu/achristie/675wq.html
*   Why WebQuest? An introduction by Tom March (2001a) at
    http://www.ozline.com/webquests/intro.html
*   "The Student WebQuest" by Maureen Brown Yoder (1999) at
    http://www.iste.org/L&L/archive/vol26/no7/features/yoder/index.html

Step 2: Get Familiar with the WebQuest Model

Next, trainees were asked to become familiar with the WebQuest model by going through Bernie Dodge's (1999) interactive website, "Building Blocks of a WebQuest" at "The WebQuest Page". This site teaches them what is required of each section of the WebQuest model and uses examples from different WebQuests to illustrate how they can write each section.

(Go to "The WebQuest Page" at http://edweb.sdsu.edu/webquest/webquest.html (Dodge, 1999), click on "Training Materials" and on the page, "Readings and Training Materials", go to the link "Building Blocks of a WebQuest").

Step 3: Explore Examples of WebQuests to Evaluate the Quality of WebQuests

Trainees were asked to explore the following websites for more information and examples of WebQuests:

"The WebQuest Page" (Dodge, 1999)
at http://edweb.sdsu.edu/webquest/webquest.html
"WebQuests for Learning" (March, 2001b)
at http://www.ozline.com/learning/index.html

They were asked to examine "A Visitor's Guide to the Solar System" by Stephanie Pierce found in the "Examples" page at Bernie Dodge's (1999) "The WebQuest Page" for a very good example of a WebQuest for Grade 5 (Primary 5) students.

They then learnt to evaluate the quality of WebQuests by going on a WebQuest themselves using the activity "A WebQuest about WebQuests" found at "The WebQuest Page" (Dodge, 1999).

Step 4: Creating a WebQuest

In groups (four to six members), trainee teachers were then asked to create a WebQuest as part of project work in a content area for a target group of students (e.g. Primary 4 or 5). The project designed was to take about 3–4 weeks and was to explore one of the themes from the curriculum of the primary level(s) selected. The WebQuest created was to have the sections as described earlier in the WebQuest model. Trainees were then pointed to sites in Bernie Dodge's (1999) "The WebQuest Page" to guide them through the following development steps:

- Introduction.
- Task (use the *"The WebQuest Taskonomy: A Taxonomy of Tasks"* at the WebQuest Page website to help you think about the different types of tasks you can create).
- Process (use the *"WebQuest Process Checklist"* at the "The WebQuest Page" website to guide you in ensuring that you have provided the necessary scaffolding

for your students. Your students should know at every step of the WebQuest what they are to do and how they are to do it).

- Resources (you may have this as a separate section or embedded in the "Process" section of your WebQuest).
- Evaluation (Create a rubric to assess your students' product. This rubric will also be used by your students to assess their own product and their work processes. Use "*Rubrics for Web Lessons*" at "The WebQuest Page" to help you create rubrics to assess both processes and product).
- Conclusion.
- Teachers' page: This section should include an *introduction* of the WebQuest to teachers; a description of the *target group of students*, the *aims and objectives* of the WebQuest; what *curriculum standards* you are intending to meet/achieve for the level targeted; the *background knowledge and resources* required and what *preparation* needs to be made before students embark on the WebQuest; the *rationale for your choice of the internet sites* chosen; and a *conclusion* to encourage teachers to use WebQuests in their teaching).

When members were ready to create their WebQuest, they could have either created their own template or used the ready-made "WebQuest Template" found on "The WebQuest Page" by clicking on "Training Materials" and then going to "*Internet Expeditions: Creating WebQuest Learning Environments*". They could create their WebQuest as a word document, on powerpoint or as a HTML file.

Examples of WebQuests Created

WebQuests created by the pre-service teachers ranged from those which asked students to examine contemporary world or local problems (such as endangered animals, pollution or water issues in Singapore), examining history (such as the Japanese occupation in Singapore or "historic" volcanic eruptions), creating a product (models of safari parks for endangered animals, multi-media presentations or a "wayang kulit" play) or quests that sparked the pupils' imagination and made learning of otherwise dry topics exciting (such as learning about insects using a crime scenario where students pretend to be FBI – Federal Bureau of Insects – agents to uncover the criminal "insect", or going on a discovery voyage inside the human body).

An example of a WebQuest developed by one group of trainees (which examined a current issue/problem in Singapore, entitled "NEWater, A NEW BEGINNING") targeted students at the Primary 6 level, and sought to help them understand, in greater depth and with critical awareness, the water issue in Singapore. The WebQuest begins with the introduction of an actual event: the launching of "NEWater" at the 37th National Day celebration in 2002 at the National Stadium where thousands of Singaporeans, as well as the leaders of Singapore, toasted the birth of NEWater.

The trainee teachers in this group examined the events and issues that led to the creation of NEWater, the past, present and future water needs in Singapore and the concerns of interested parties. Four roles were created so that members in the WebQuest group could take on the perspective of the average Singapore citizen, a hydrologist, the Government and an investigative reporter in the discussion of concerns and issues related to NEWater. Findings and conclusions were to be presented in a multi-media presentation to their classmates who would evaluate the quality of their project using the rubric developed by the group themselves.

Benefits of the WebQuest Assignment

The WebQuest assignment for our pre-service teachers involved learning on two levels. On one level, the trainees were applying what they were learning in the Education Studies module about:

- how to help learners construct knowledge, scaffold learning and create meaningful cooperative learning situations where the students' ultimate product depended as much on individual learning as well as on the group working collaboratively;
- supporting higher-level thinking (thinking that goes beyond reading and recalling to transformation of knowledge), creative problem-solving, reflective thinking, decision-making and a focus on using and evaluating knowledge rather than acquiring it;
- alternative or authentic assessment, project work and the use of rubrics to evaluate both process and product, and the achievement of complex performance at the higher levels of thinking (i.e. analysis, synthesis and evaluation).

On another level, our pre-service teachers were experiencing first hand through the WebQuest what the module was purporting to teach them to apply in their classrooms.

- They now had to take charge of their own learning and construct their own understanding of a WebQuest through a guided discovery learning method.
- They experienced what cooperative/collaborative learning meant, the social and interpersonal skills required, and learned accountability as an individual and as a group member.
- They learned to exercise their critical and creative thinking skills in designing the WebQuest, evaluating their own and their peers' WebQuests and assessing the effectiveness of the WebQuest as a pedagogical tool for meeting learners' needs.
- They also gained an understanding of the use of rubrics to evaluate processes and products as they used the rubrics that were created to evaluate their own and their peers' Webquests.

Learning to develop WebQuests based on the Singapore curriculum not only helped the trainee teachers to develop the skills mentioned above but also created resources of WebQuests with valuable links to relevant websites which the pre-service teachers could use in their future classrooms.

Implications for Use in Schools

A well-conceived WebQuest is a powerful tool that transforms learning and helps establish new levels of understanding for students. It involves the dynamic construction and meaning-making of real-world problems, framed within the context of interdisciplinary and collaborative learning communities. In its most limited sense, a thoughtlessly put together pseudo-WebQuest functions as a reference tool that masquerades as a problem-centred, inquiry approach to learning.

In a paper entitled, "In Defense of Academic Rigor," Sawyer (1988) derided and condemned the thoughtless use of enrichment units and educational kits in the education of able children. Given that educational reform in Singapore in the last few years places significant importance on project work and problem-based approaches to learning, it is perhaps imperative and timely to give some thought to the cautionary insights put forth by Sawyer, and to draw implications for well-conceptualized WebQuest tasks that are able to enrich and extend classroom learning.

First, there is a need to keep sight of a body of rigorous academic content while focusing on nurturing processes such as high-level thinking skills set forth in Bloom's taxonomy of learning. Sawyer (1988) cautions that, "it is robbery ... merely to teach ... [children] how to learn without teaching something worth learning" (p. 8). In other words, "... knowledge of process is *always* founded on basic knowledge and because problem-solving is *in fact* meaningless if *in fact* there is no problem to begin with." Hence, the process of thinking and problem-solving becomes meaningful only if there is something worth thinking *about*.

Second, creativity, critical thought and other process skills should not be taught *in vacuo*, but should be grounded in the real-world, authentic problems of the math, science and literary domains, for example. A sound, academic content thrust is therefore central to planning a rigorous and defensible WebQuest task.

Third, WebQuest is not synonymous for busywork. "Academic rigor means posing big questions ... [and] seeking answers to problems that truly matter" (Sawyer, 1988, p. 17). What this means is that it is important for teachers to give careful thought and guidance to help students pursue WebQuest tasks that have sufficient intellectual weight. While problem issues that may have a sociological focus (e.g. endangered animals, pollution) or a historical focus (e.g. Japanese occupation in Singapore) are worthwhile intellectual projects to pursue, Sawyer would describe a study of the history of the Teddy Bear, for example, as a project mired in trivial fluff.

Conclusion

It would be wise for us to remember the words of Tapscott (1996, cited in Hanson, 2001) that "Growing up is about learning. The Net Generation is beginning to process information and learn differently from the boomers ... The destination is different and so is the route the kids must take". In encouraging our pre-service teachers to consider the creation and use of web-based inquiry-oriented learning of content, that is solidly grounded in theory, in their classrooms, we are taking the first crucial step to preparing them to meet the learning needs of this digital "Net Generation".

Thana Thaver is a Teaching Fellow in the Specialised Education Academic Group, National Institute of Education. Before being seconded to NIE, she worked with pupils and teachers of the gifted in the Gifted Education Programme. E-mail: tlthaver@nie.edu.sg.

Mary Anne Heng is an Assistant Professor in the Specialised Education Academic Group at the National Institute of Education. She received her EdD in gifted education from Teachers College, Columbia University, USA.

Levan Lim is an Associate Professor in the Specialised Education Academic Group at the National Institute of Education. He received his Ph.D. in Special Education from Lehigh University in Pennsylvania, USA, and worked in the United States and Australia before coming to teach at NIE.

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