

Using the Internet to Promote Inquiry-based Learning

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Overview

This workshop empowers teachers with strategies to effectively incorporate Internet research projects into their curriculum so that the experience is meaningful and improves learning. A new framework for such projects is presented; this includes a model for student research that facilitates learning and authentic problem-solving. Techniques for managing student research so that online time is productive is demonstrated. Participants learn how to frame appropriate research questions, develop search strategies, conduct effective searches, evaluate information quality, and then build a product which represents the answer to the research question. Additional topics essential to this new framework, such as the use and construction of Internet curriculum Web pages (called a Project Page) and the use of various software products such as Inspiration, are discussed and demonstrated. The presenters demonstrate how teachers can develop assessment tools to evaluate both research process and product. Finally, the presenters discuss how the inquiry-based learning model and process address emerging education standards.

Each participant will receive an Inquiry-based Research toolkit that contains strategies, techniques and forms that promote the successful integration of Internet research into a particular curriculum.

Introduction: The essential question.

Most schools are currently rushing to connect to the Internet and the World Wide Web. With promises of rich information resources readily available, how do educators insure that an Internet project will be a valuable learning experience for students?

We believe that successful use of the World Wide Web within an instructional setting is tied directly to a pedagogical approach that promotes inquiry-based learning. Inquiry-based learning can have many definitions and can be compared to other forms of instruction such as problem-based learning. We define inquiry-based learning as a [process](#) where students formulate investigative questions, obtain factual information, and then build knowledge that ultimately reflects their answer to the original question. In this case, the factual information is obtained from Web resources. Embedded within the inquiry-based process (see the inquiry-based model on the last page of this document) are numerous process and thinking skills that make this type of learning a rich and meaningful experience for students. Students may engage in this process as individual learners, or in cooperative teams. Additionally, the process is pliable, permitting various permutations of the process to be used effectively with all types of learners.

Using the Web within an inquiry-based pedagogy begins with asking or framing an [essential question](#). For our purposes, an essential question is defined as a question that requires students to make a decision or plan a course of action. Educators need to focus on such questions; many teachers rely to heavily on “What is..” questions such as “What is cancer.” Asking a student to answer such in a research project is licensing the student to move information from point A to point B without concern for integrating discrete information pieces into new knowledge. Effectively, in this day of digital “cutting and pasting,” asking a “What is..” question is a license to plagiarize.

A much better question requiring the development of an action plan regarding the cancer topic cited above might be: “What plan can I develop for reducing the chance that I will contract cancer in my lifetime?” In this scenario, a student must research the question to develop a list of strategies; the teacher then may require the student to select the top three strategies from the list and then justify why those were chosen. In this question, active knowledge construction is required.

Teachers may also ask students questions involving decision-making. Such questions as “Should Puerto Rico become the 51st state of the United States?” or “What invention of the 20th Century has had the greatest impact?” require students to engage in critical thinking and build knowledge.

Step 2: Foundation Questions:

[Foundation questions](#) are “What is” questions. After the essential question has been framed, students then write foundation questions. As the name suggests, these questions, and their answers, provide a factual “foundation” from which the answer to the essential question can be developed. Generally, a carefully developed list of foundation questions may number between 6 to 9 questions, although the number is directly dependent on the age and skill level of the student, as well as the complexity of the question. In the cancer question above, the first foundation question is “What is cancer?” Another foundation question may be “What are the strategies that can be used to prevent cancer?” Foundation questions are extremely important; they provide structure to the inquiry investigation so that students know what they need to research. At this point it is important to emphasize that students should write foundation questions as a guide to their inquiry. Additionally, it is appropriate for teachers to assess these questions and to provide timely feedback to students relative to the quality of these questions.

Step 3: Developing a Search Strategy

In this part of the inquiry process, students [develop a search strategy](#) for locating Web information by closely examining foundation questions for keywords. Keywords are words that are placed in Web search tools (e.g. Altavista, Hotbot, Yahoo!) to locate information resources. Logically, students use the very questions they are trying to answer to develop a keyword pool to improve the likelihood of locating useful information. At this point, it is important to provide in-depth instruction relative to the [types of search strategies available](#) to students and the most effective methodology for using those tools. Teachers should also make use of the varied search resources available on the Web such as [search grids](#) that facilitate student success. Many [other resources](#) on searching provide valuable assistance to both teachers and students.

After students understand Web searching, they should use their keywords to develop a search strategy. This involves students selecting keywords, placing them together in proper syntax strings, and then identifying the search tool they are going to use.

Again, this can be collected by the teacher, assessed, and returned to the student with constructive criticisms.

At this point, it is important to note that students have not used the Web. They have their essential question framed, their foundation questions written, their keywords selected, and a proper search strategy for locating information identified. By following this protocol, students are empowered to be effective before they even use a computer connected to the World Wide Web.

Step 4: Locating Information

Students are now ready to [locate information](#). This can be an overwhelming task for students as the Web now contains over one billion pages. We suggest beginning with [Yahoo!](#) because it is a relatively small directory of fairly high quality Web sites. Students typically get a manageable number of Web sites in their search return. If this search is not successful, we then suggest using [MetaCrawler](#), a metasearch tool. MetaCrawler combines the power of many search tools together yet still returns a manageable number of Web sites in a search return. MetaCrawler also does an excellent job of returning high quality **generalized** Web sites about a particular topic. If students have still not located adequate resources, we then suggest AltaVista, one of the largest search engines available. We select AltaVista as our last choice because it has a wide range of coverage (some 250 million pages) and permits the most flexible type of search strategy. With this pathway (Yahoo! to MetaCrawler to AltaVista) students generally can collect as many resources as they need.

Step 5: Filter, Distill, and Cross-referencing

This step addresses the evaluation of the Web resources that students have collected and then the extraction of the information required to answer the foundation questions.

Information evaluation is a critical process skill that students must learn. In our model of inquiry-based learning and the Internet, information quality is assessed in a **three-part** process:

1. Students determine if the information at the Web site is related to their essential question and useful for answering their foundation questions. If their answer is yes, they continue to step 2. If not, they continue searching.
2. Students then determine if the information at the Web site originates from a readily recognizable expert, organization, or qualified person or group. **If yes, students use the Web site to answer foundation questions.** If not, students return to searching.

(It should be noted at this point that many information evaluation protocols available online require far too many steps for students to effectively evaluate content in a timely fashion. Our three-part evaluation process greatly reduces the time required to evaluate but guarantees an effective evaluation.)

3. The final step in the information evaluation process requires students to cross-reference information between Web sites for each foundation question. The cross-referencing process ensures that information reliability is assessed.

In this process, and if students are working in cooperative teams, each student in the group is assigned one Web site found by searching and proceeding through Steps 1 and 2. At this point, each student has a different site but the same foundation questions. Using their assigned Web site, each student answers the foundation questions. As a result, students are then able to compare (or cross-reference) the answers to each foundation question from a variety of Web sites to validate the information.

If students are working individually, they must answer all foundation questions using their collection of sites and then compare them in the cross-referencing process.

At this point, students have answered their foundation questions and have factual information originating from authoritative sources that has been cross-referenced for reliability.

Step 6: Evaluate the amount of information.

If several questions do not have answers, Step 3 of the information evaluation process will indicate to students that they are missing required information. They then return to the search strategy and search tools to locate new sites about that particular foundation question that they have not answered.

Step 7: Develop the Answer to the Question

Step 8: Develop a product to represent their answer

At this point, students have the factual raw material to build knowledge relative to the original essential question. In the final two steps, students must integrate the information they have found into a fresh insight. They then must represent that insight by developing some product that represents their knowledge about the essential question.

The product can have many forms. We strongly suggest that teachers consider a WebEssay, an online document that represents their answer. We believe that students can not only users of the Web, but contributors to it. WebEssays are living documents that contain multiple information types (text, sounds, graphics, movies, etc.) which can then be displayed to a worldwide audience. Students, with the aid of Web editing software, are quite capable of producing very dramatic [WebEssay documents](#) with some instruction and aid.

Other more traditional projects, such as essays, presentations, and hypermedia products, can also be used to reflect answers.

Conclusion

Using the Internet to promote inquiry-based learning is an effective pedagogy for teaching students the process skills necessary to effectively use the World Wide Web. In addition, because of essential questions, the technique above permits learners to investigate engaging and authentic topics in a student-centered manner. Such instruction directly encourages the development of an independent learner.

