

Final Report:

Effectiveness of Web-Based Technology in Preservice and Inservice Teacher Education Programs

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Introduction

All CIC institutions are involved in various ways with the preparation of future teachers or with professional development for practicing teachers, and in each of these institutions we see efforts to refine or redesign programs as part of the overall systemic reform of education agenda (Loucks-Horsley, 1997). More specifically, there are efforts to prepare teachers to address the needs of their students in a highly diverse, globalized, knowledge-rich, and technology-enhanced world. While teachers still need to help students learn the "hard skills" of basic literacy and computation, there are increasing demands for the "soft skills," such as the abilities to communicate with those from different perspectives and parts of the world, to articulate problems out of complex and messy situations, and to collaborate with others (Murnane & Levy, 1996).

Awareness of the need for this broader base of skills has been one impetus for the reform of coursework and accompanying practical experiences in teacher education programs. A central theme in these reform efforts is that *learning is the process of constructing meaning*. This view of learning moves beyond memorization, recording, and storing information to the analysis of phenomena, in short, to more *inquiry-based instruction* (Beyer, 1971).

By *inquiry-based instruction* we mean teaching methods that emphasize students' knowledge construction rather than simple transmission, that call for active learning, and provide strategies for independent thinking. Inquiry-based instruction is especially important in the information-age environment in which knowledge is represented in highly interconnected, multimedia forms such as on the World Wide Web, and citizens need to manage information, investigate complex data, and evaluate what they discover. The Web holds exciting possibilities for helping future teachers learn how to teach better in general and, in particular, to cope with the simultaneous opportunities and challenges that the Web itself presents. Inquiry-based instruction also entails the teacher taking an active role in inquiring about the processes of teaching and learning, and using that knowledge to improve curriculum and instruction.

While there is general agreement on the goal of helping future teachers employ inquiry approaches, teacher educators need more information on how to enact this form of teaching and how to prepare future teachers. First, there is the need to synthesize existing research on inquiry teaching and learning, particularly research on how technology can be used to facilitate thinking and learning. Second, flexible tools are needed to help educators plan inquiry learning experiences for students. Third, research needs to be conducted that describes and analyzes inquiry-based planning and curriculum construction using technology. This project resulted in a prototype [Inquiry Page](#), which currently offers background information on inquiry-based teaching, examples from classrooms, lesson plans, an interactive inquiry unit plan generator, and links to many Web resources.

Specific Objectives

Our objectives for this project were to develop the [Inquiry Page](#), assess its usefulness, and disseminate it to other CIC institutions, more specifically:

- a. To develop the Inquiry web site further so that it can be used by professors in various teacher education programs as they prepare both future and practicing teachers. This includes,
 - a. An interactive, web-based Inquiry Unit Generator to be a guide for future and practicing teachers as they design inquiry units for specific content area instruction.
 - b. Protocols/models of inquiry units constructed by expert teachers and teachers-in-preparation that demonstrate inquiry-based instruction principles "in action."
 - c. An online resource of information about research on inquiry-based instruction.
 - d. Resources to support inquiry-based instruction, e.g., books, museum sites, simulations, literature collections, and science information sites.
- b. To assess the effectiveness of the web site for improving inquiry-based teaching and learning.
- c. To develop mechanisms for sharing the web site with other CIC institutions to facilitate the use of inquiry-based teaching in areas outside schools or colleges of education.

Outcomes

Significant successes associated with the project included the creation of a cross-university research and implementation team. This team of university professors, staff, and graduate students met periodically, travelling between the University of Illinois and Purdue, to update the [Inquiry Page](#), design new ways to use the site, and research its effectiveness. The team comprised individuals with expertise in technology, literacy, science, educational psychology, and teacher education.

Cross-disciplinary discussions resulted in reconceptualizing portions of the site and improvements to the [Inquiry Page](#) as well (e.g., making the format more user friendly; soliciting a broader range of contributors and inquiry unit topics). In addition, we successfully introduced the [Inquiry Page](#) to school-based teachers in Indiana and Illinois (preservice and inservice). One setback was that many teachers could not easily post their inquiry units to the site. We still need to better ways to interface the technologies in various school districts with the University of Illinois system.

Pedagogy

The University of Illinois in Urbana-Champaign graduates about 300 students each year in its early childhood, elementary, and secondary teacher certification programs, as well as about 50 students enrolled in inservice masters programs. Purdue University graduates about 450 undergraduate elementary and secondary teacher education students per year. Each of these students take multiple courses, which could each make use of the [Inquiry Page](#). Teacher education is a priority of equal importance and magnitude at other CIC institutions.

The [Inquiry Page](#) is now a tool that can be used by professors teaching all preservice preparation courses, particularly the "methods" courses, where future teachers create lesson plans and often teach these lessons to K-12 students in school sites.

The project has produced a web site that can be accessed and used by educators across CIC institutions, as well as other institutions internationally, complete with the inquiry unit plan generator (the tool that guides the planning process for inquiry teaching), sample plans and documentation describing the plans, links with other information sources, and references on inquiry teaching and learning.

The [Inquiry Page](#) has now been used in the following courses:

- Fall 1999-Spring, EDCI 591D, Using Inquiry and Writing to Develop Reflective Practices, Purdue
- Spring 2000, EDCI 306/314, The Literacy Block, Purdue
- Spring 2000, C&I 407 ITL, Inquiry Teaching and Learning, UIUC
- Fall, 1999, C&I 335, Computer Assisted Instruction, UIUC (distance education)
- Fall, 1999, Physiology 490, Biology Workbench, UIUC
- Fall, 1999, C&I 332, Mathematics Education, UIUC
- Fall, 1999, EDCI 306/314 The Literacy Block, Purdue
- Summer 1999, C&I 440 CS, Theory and Practice in Classroom Science, UIUC
- Spring 1999, C&I 407 ITL, Inquiry Teaching and Learning, UIUC

Technical

The project identified several technical issues. Among these, three stand out.

One is that the idea of the [Inquiry Page](#) as a collaboratory has been developed and refined. See Robins (1999) for a detailed account of this. Essentially, we are using member profiles and software agents as a way to facilitate connections among people, for example, teachers to other teachers, teachers to researchers, or students to content experts. Using the same profiles, software agents can manage linkages of individuals to organizations, meetings, newsletters, email groups, web boards, and other interactive media. Moreover, they allow users to find content resources, curriculum units, research articles, tools, and other materials more easily and effectively. Through these mechanisms the *Inquiry Page* is beginning to serve as the collaboration component for a variety of [educational R&D projects](#).

Second, we have begun to use the Resource Description Framework (RDF) as a means for automatic updating and coordination with the Open Directory Project, and other resource repositories. [Open Directory](#) is a massive web search directory (1,529,266 sites; 224,447 categories) developed by a global distributed consortium of 22,591 editors (as of Feb. 22, 2000). Open Directory maintains the site but the editors manage specific categories. The search tree is

downloaded regularly to Lycos, Hotbot, Netscape, and other major search engines.

RDF allows for the integration of a variety of web resources including digital library collections, content ratings, search engine data bases, and site maps. It uses metadata with XML as an interchange syntax. These metadata formats facilitate accessing the large number of existing lesson plans and units, which are located both on web sites and in web-accessible data bases, as well as content resources, such as science reference materials.

We are also exploring the use of **VisIT** (Visualization of Information Tool). VisIT constructs a two-dimensional image showing the user the results of a web search. The structure displayed can then be stored, manipulated, and communicated to others. We are investigating how this tool can be used within the **Inquiry Page** to locate curriculum resources.

Third, the interactive inquiry unit planner has been demonstrated to be a viable tool to aid in building more innovative and effective approaches to support learning. We are now exploring how users of those units can give feedback. We are also looking at multi-level vetting processes, such as the three-level method developed by the Bioquest Consortium. Our aim is that the unit planner serve as a way for professors to develop coherence in the manner that they prepare future teachers to think about teaching and learning processes.

Collaboration

A collaborative relationship was formed between Professors Bruce and Dillon and numerous graduate students and professional staff from the University of Illinois and Purdue University. Dr. Bruce brought his expertise in technology and learning together with Dr. Dillon's expertise in teacher education and reform programs. Building from this partnership, a broader collaboration was formed to create web-based materials for use by teacher educators and future. In addition, within each of the respective teacher preparation programs the proposed web site project has become a potential site for collaboration across all teacher education coursework. Specifically, the inquiry unit planner can serve as a way for professors to develop coherence in the manner that they prepare future teachers to think about teaching and learning processes. This project has also created a web site available for others to use (e.g., professors in social studies education and curriculum theory).

Products

On the **Inquiry Page**, we now have:

- **50 Inquiry Units**. These are full web sites developed by inservice or preservice teachers for the **Inquiry Page**.
- **118 Resources for Inquiry-Based Learning**. These have been merged with Open Directory so that they have a much larger potential impact. At the Inquiry-Based Learning site, the **Inquiry Page** project created the following categories (and number of links): Content Resources (11), Courses (3), Curriculum Resources (23), Discussion Sites (2), Implementation (2), Inquiry About Learning (0), Instructional Models (11), Journals (5), Organizations (13), Projects (14), Schools (2), Software (3), Teacher Inquiry (7), and Theory. There is also a simple online interface for users to add their own URLs.

Presentations and publications on the **Inquiry Page** now include,

Bruce, Bertram C. (1999, October 2). *The Inquiry Page*. Dialogues in Methods of

Education meeting, Urbana, IL.

Bruce, Bertram C. (1999, March 19). *The Inquiry Page and Project Chickscope*. The 8th Annual "Engaging the Future of Education" TECH Conference, Charleston, IL.

Bruce, Bertram C. (1999). [Overview of the Inquiry Page project](#) (1999).

Bruce, Bertram C., & Benson, Alexis P. (2000, April 28). *Using the web to promote inquiry and collaboration*. American Educational Research Association. New Orleans. (accepted)

Bruce, Bertram C., & Dillon, Deborah (1999, September 23). *The Inquiry Page. Learning Technologies Initiative Committee*. Committee on Institutional Cooperation. University of Illinois at Urbana-Champaign.

Dillon, Deborah (1999, July). *Reconsidering how to meet the literacy needs of all students*. Featured speaker at the University of Southern Mississippi Reading Conference, Hattiesburg, MS.

Dillon, Deborah, & Bruce, Bertram C. (1999, March 2). *Effectiveness of web-based technology in preservice and inservice teacher education programs*. The 1999 Teacher, Learning, and Technology Showcase Conference, Purdue University, West Lafayette, IN.

O'Brien, David, & Dillon, Deborah (1999). [Engaging at-risk adolescents: Adventures into the mediasphere](#). Paper presented at the Annual Meeting of the National Reading Conference, Orlando, FL, December 3.

Robins, Jenny (1999, May 5). *Stone soup: A distributed collaboratory using software agents*.

Tiska, Cami (1999). [A formative evaluation of inquiry-based learning and teaching for K-12: Chickscope and the Inquiry Page websites](#).

Evaluation

Evaluation of the project has been primarily formative throughout the project and continuing today. Questions include:

- Are the inquiry questions guiding the inquiry unit plan generator useful in supporting teachers as they move toward implementing an inquiry approach to teaching?
- Is the setup of the web site helpful to teachers as they think about teaching and learning issues?
- Are appropriate resources pertaining to the inquiry approach available on the web site?
- What do teachers do [thinking processes/actions] when they work with the inquiry unit plan generator?
- What sorts of inquiry units are produced and how do these differ from traditional lesson plans created in teacher education programs?
- Is the inquiry unit plan generator a useful tool for teacher educators to use at the elementary, middle school, and secondary levels and in all content areas?

- What might adaptations to the generator look like?
- What are the similarities and differences in inquiry units constructed by teachers using the generator (across grade level and content area)?

Data have been collected in the form of focus group interviews with individual professors and students (see Bruce & Benson, 2000), and inquiry unit plan products constructed for and placed on the web site. In addition, we have received numerous email messages from users of the site. These provide insights into its strengths and weaknesses, but more importantly suggest future directions for development.

Analysis of data has occurred in an ongoing fashion providing immediate feedback about the quality of the web site, how it is used, and improvements necessary for future use (Tiska, 1999). In addition, the web site has been piloted with teacher education classes to obtain detailed feedback from professors and students as the new approach is used during a semester-long course. The "Inquiry Group" meets every Wednesday to discuss this feedback and incorporate it into plans for further development.

Funding

All funds were expended. The final expenditure report will be forwarded from the UIUC College of Education.

Plans for continuing development of the page can be seen on our [punch list](#). We are currently exploring funding from both the Illinois State Board of Education, the US Department of Education, and the National Science Foundation.

References

Beyer, Barry K. (1971). *Inquiry in the social studies classroom: A strategy for teaching*. Columbus, OH: Charles E. Merrill.

Loucks-Horsley, Susan (1997). Teacher change, staff development, and systemic change: Reflections from the eye of a paradigm shift. In S. N. Friel and G. W. Bright (Eds.), *Reflecting on our work: NSF teacher enhancement in K-6 mathematics*, 133-149. Lanham, MD: University Press of America.

Murnane, Richard J., & Levy, Frank (1996). *Teaching the new basic skills: Principles for educating children to thrive in a changing economy*. New York: Martin Kessler.