Innovative Technologies and Online Inquiry-Based Learning

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Abstract

Recently, inquiry-based learning has gained renewed emphasis, and has gradually become the central theme in educational research and practice, including the context of online learning. Meanwhile, innovative technologies provide new methods and enhancements of online inquiry-based learning. The purpose of this paper is to discuss key components of online learning and explore how innovative technologies, such as mobile apps, cloud computing and other technologies can be employed to enhance this type of learning.

Introduction

Online learning is currently expanding rapidly at universities, colleges, and even high schools. According to USNews, online course enrollment climbed for the 10th straight year. Out of 6.7 million students, 32% were enrolled in online higher education in 2011, compared to 6.1 million in the previous year. In 2012, 62.4% of colleges offer fully online degree programs, compared to 32.5% ten years ago (USNews, 2013). However, compared to the proliferation of offerings and options of online courses, there are the poor retention rates in online learning. The quality of the online program is one of the contributing reasons for learner dissatisfaction with this type of learning (Ruth, Sammons, & Poulin, 2007).

Inquiry-based learning pedagogies can be used to solve this issue by increasing the quality of online learning, as well as learner satisfaction. Why? First, inquiry-based learning has been proven to have a very positive impact on learning from K-12 to college and graduate level education. The benefits students can gain from inquiry-based learning include: deep conceptual learning, higher-order thinking skills, and positive attitudes towards learning (Blumberg, 2000; Edelson, 2001; Zuckerman, Chudinova, & Khavkin, 1998). Second, inquiry-based learning has many different instructional models, such as the learning cycle (Edelson, 2001), and the authoring cycle (Short, 1996), among others, to meet different learning and teaching needs. Third, based on constructivist theoretical perspectives, inquiry-based learning has many elements that can help best produce learner satisfaction. Using authentic problem scenarios to engage students and collaborative groups to form a community for sharing and exchanging knowledge are two ways that enhance student motivation for learning through inquiry (Chinn & Malhotra, 2002; Hancock, Kaput, & Goldsmith, 1992). Finally, 21st century learners are expected to have information, media and technology skills. Current inquiry-based learning pedagogy emphasizes that learning with technologies can help meet those goals.

The focus on this paper is to explore possible strategies and tools that can be embedded into online course to bring the best practices of an inquiry classroom to an online environment. The suggestions in this paper are based on my dissertation on adult students’ online I-Search inquiry-based learning experiences. Therefore, I will situate the discussion for online adult learning at the college/university level.
Brief Description of My Dissertation Study

In 2006-2007, I designed and conducted my dissertation study. My goal was to understand students’ online inquiry-based learning experiences. Five adult students participated in this study. They used an I-Search inquiry model for their project. I-Search is an inquiry-based model in which students are required to pursue a topic of their interest. They were asked to choose a topic that was interesting to them. Then they designed higher-order questions and researched relevant information from various resources, including the library, Internet, and experts in their field of interest. Finally, they wrote their I-Search paper to report their findings and reflect on their learning (Joyce & Tallman, 1997). The students have one time of face-to-face class at the beginning of the course, and the remaining course time was spent online. Each week, they had a 2-hour online class. They also used a WebCT forum to post their questions and make comments within their small group. Even though this I-Search model is mostly designed for teachers and librarians, this model has many of the essential elements emphasized by general inquiry-based learning. Therefore, the I-Search model can be applied to many other inquiry-based learning situations. Listed below are the components of inquiry-based learning matched with technologies and pedagogical strategies that demonstrate how online learning can support inquiry teaching methods

Selecting Topic

In inquiry-based learning, students are often allowed to select their own topics, as they did in my study. Students do not usually have a hard time finding their initial topics, but often they have difficulty narrowing it down enough for a course project. For example, one student’s topic was the history of the early Christian church. When she narrowed her topic down to researching the first believers, it was still a large topic for a course project. In this step, online instructors need to help students to realize that a topic can be approached from various perspectives. The topic should be narrowed down before the next step of inquiry learning. There are many tools that can be used to help during this step. For example, using online conceptual mapping tools or cloud-based conceptual mapping tools can not only help students brainstorm their potential topics, but also help them to visualize the possible ways to narrow down their topics, such as simply circling one part of their topic on a conceptual mapping tool (please see Table 1 for detail).

Generating Questions

Once a topic is selected and narrowed down, asking questions is the next step in the inquiry-based learning process (Short, 1996; White & Frederiksen, 1998). My study showed that many students had difficulty with this step and needed additional scaffolding for online learning. The assignment was for students to create higher-order questions that assist them in obtaining new knowledge, however, many students only created questions in which they were already familiar with the answers. It was challenging for them to determine what they do not know about their topic and therefore they had trouble determining appropriate questions. For example, a student is creating a travel plan to go to London. She has been there several times before and is knowledgeable about London. Although her questions may have fit the requirement of higher-order questions, she did not develop questions that provided her with new information. Another issue was that students can create inconsistent questions, in which secondary questions were created in a way that could not help answer the primary question. For example, a student wanted to know “How has the addition of man-made organizations taken us away from the model demonstrated by the community of the first believers (church)?” Her secondary questions were: (a) How is the church to be governed, according to Scripture? (b) How did the early church organize? (c) How do these compare? These secondary questions presented no way to help answer her primary research question.

To facilitate generating questions online, teachers can also ask students to try to answer their own questions to discover their prior knowledge about the subject. It is also suggested to discuss questions through social networks or other communication software and to ask students to review questions of other participants in the class for inconsistencies in questioning.

Exploring Information

Searching relevant information is not just one step in the inquiry-based learning cycle, but an ongoing process in inquiry-based learning. My research showed that exploring related information may serve different goals at different phases of inquiry-based learning. For example, at the beginning, students explore information to find a workable topic, make an initial judgment on the difficulty of finding information related to their several potential
topics before they finally decide on their topic. If a student does not have much knowledge about their topic, then
being able to find out good background information is often a necessary step before they can create some research
questions. Once students have gathered initial information about their topic and determine their own prior
knowledge, they can develop appropriate questions. The next step is to search for information around their
questions. Usually, the research starts from a broad search to a more specific search as the learner becomes more
knowledgeable about their topic.

This is a most sophisticated step in which research questions interact with the newly found information.
Sometimes, the new information leads to discarding the old questions and creating new questions. Other times,
students may realize that they need to refocus their research to determine answers to their questions.

Students are very easily frustrated at this step. Online scaffolding is crucial. Online instructors should point
out several things to students. First, the teacher should explicitly tell students search goals when exploring
information. Also, the teacher should remind students to use their questions to guide their search instead of aimlessly
searching through tons of information. Possible tools for this step include social bookmarking collections and
sharing good background resources for students.

Gaining New Understanding through Knowledge Construction

One feature distinguishing constructivist from traditional pedagogies is its emphasis on knowledge
construction instead of knowledge copying (Piaget, 1970). When a knowledge construction view is held:

“Learning is basically a procedure of confronting a specific event, problem, or issue; acquiring and
describing a body of information related to the event, problem, or issue; analyzing causal relationships; and
stating explanations that are logically supported by the data.” (McCollum, 1978, p. 73)

In our case, knowledge construction occurs while students explore information and make sense out of it.
With the process of exploring more and more topic-related information, learners interact with those resources.
According to my research, there are several types of interactions: 1) eliciting prior knowledge, 2) adding new
understanding about the topic, 3) deciding what information that can help answer research questions, 5) identifying
their knowledge gap, e.g., they found out they needed to know more about a topic in order to answer their questions,
6) validating resources, 7) evaluating conflicting information. These interactions between a learner and the resources
are essentially various mind activities that lead to new understanding.

A good strategy for online instructors is to explicitly list the possible interaction types. They should also
ask students to pay attention to the types of interaction, such as whether the resources can be validated and whether
the resources can help answer their questions, etc.

To facilitate such knowledge construction online, ask students to use blog or other Web 2.0 tools to
document their knowledge, encourage them to refine their knowledge for any discrepancy between a claim and its
supporting evidence, to reflect on the origin of that knowledge, and to organize it into a more coherent system
(Coleman, 1998; de Vries, Lund, & Baker, 2002). In addition, social networks can provided opportunities for online
discourse, because knowledge construction is socially situated and can be supported in a community (Lim, 2004;
Topper, 2005).

Presentation

Presentation is usually the last step in the inquiry models discussed above. In this step, the knowledge gap
is filled in around the inquiry topic. Students have discovered meaning within their posted inquiry questions, and
solutions have been found to address the inquiry problems. Students are ready to present and discuss their findings.
Research has found online communication through written text (email, discussion) often facilitates deep thinking
and clear expression (Song, Singleton, Hill, & Koh, 2004). Therefore, in the online context, presentations can take
various written forms instead of face-to-face presentation. Students can publish their inquiry findings on websites.
Comments and feedback from peers or instructors can also add discourse and reflection (Rosebery, Warren, &
Conant, 1992; Topper, 2005). In short, implementing presentations online through written forms and promoting
discourse around the students’ presentations can foster reflection and critical thinking in the students’ online inquiry-
based learning processes.
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**Implications**

This paper is an effort to explore how to use different strategies and technology tools to support online inquiry-based learning. I hope it can expand our understanding about the important elements that constitute the online inquiry-based learning process and environment design.

**References**


