Active Learning and Its Implementation for Teaching

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INTRODUCTION

This chapter discusses active learning and its implementation for teaching. Although active learning is a general term in education, the focus of this chapter is on technological means/tools that can enable active learning. The means presented may be implemented in computer-mediated learning either by students operating a stand-alone local personal computer equipped with appropriate hardware and software or in both synchronous and asynchronous distance learning environments. More specifically, the current chapter discusses two technology-based means that can enable active learning—*computerized feedback intervention* and *interactive animations.*

The theoretical foundation of active learning is the constructivist approach. *Constructivism* is a set of assumptions about learning that guide many learning theories and associated teaching methods. The roots of constructivism are found in the writings of many distinguished philosophers and educators including Immanuel Kant, Lev Vygotsky, John Dewey, Jerome Bruner, Jean-Jacques Rousseau, Jean Piaget and many others.

Since the principles of active learning are applicable for both conventional and computer-mediated learning environments, they are presented first, along with the principles of the constructivist approach.

BACKGROUND

What is Active Learning?

Active learning involves students in course material through carefully constructed activities. It is about learning through doing, performing, and taking action and usually contrasts with a conventional lecture method. The action can be either mental or physical. Many face-to-face course teachers would like to move past passive learning to active learning, to find better ways of engaging students in the learning process. In active learning, students construct their own knowledge through interaction with themselves and others.

Fink (1999) offered a model of active learning, which suggests that all learning activities involve some kind of experience or some kind of dialogue. The two main kinds of dialogue are "dialogue with the self" and "dialogue with others." The two main kinds of experience are "observing" and "doing." "Dialogue with the self" involves cognitive concerns and refers to what happens when a learner thinks reflectively about a topic. "Dialogue with others" occurs when a teacher creates an intense group discussion on a topic. Sometimes teachers can also find creative ways to involve students in dialogue situations with people other than students (e.g., practitioners, experts). "Observing" occurs whenever a learner watches or listens to someone else doing something that is related to what they are learning about. "Doing" refers to any learning activity where the learner actually does something (designs an artifact, designs and/or conducts an experiment, critiques an argument or piece of writing, makes an oral presentation, etc.).

Many researchers testify to the efficiency of active learning. For example, Hake (1998) examined 6,542 students who participated in physics courses. He found that the conceptual understanding and the solving problem ability of students who applied interactive-engagement methods in their studies were significantly higher than students who studied according to traditional methods.

THE CONSTRUCTIVIST APPROACH AND ITS IMPLEMENTATIONS FOR TEACHING

Many elements of the active learning are derived from principles of the constructivist approach. This section

briefly outlines the principles of this approach and their application to teaching.

Constructivism is a theory concerned with learning and knowledge, which suggests that human beings are active learners who construct their knowledge from personal experiences and on their efforts to give meaning to these experiences. According to this approach, the learning environment should enable students to construct their knowledge through active learning and trial and error.

In the literature, three modes of constructivism are discussed: radical (Glasersfeld, 1995), contextual (Cobern, 1993), and social (Vygotsky, 1986). The focus in this chapter is on *social constructivism*. One of the better-known researchers who refer to social constructivism theory in education is Vygotsky (1986). He states that learners construct knowledge or understanding as a result of active learning, thinking, and doing in social contexts.

Social constructivism suggests that learners learn concepts or construct meaning about ideas through their interaction with others, with their world, and through interpretations of that world by *actively* constructing meaning. *They cannot do this by passively absorbing knowledge imparted by a teacher.* Learners relate new knowledge to their previous knowledge and experience. A constructivist model of teaching has five characteristic features: active engagement, use and application of knowledge, multiple representations, use of learning communities, and authentic tasks (Krajcik, Czerniak, & Berger, 1999).

The teacher's task, according to this approach, is to tutor students and teach them how to learn. He/she is not a mere "purveyor of knowledge" or "provider of facts", but is, rather, a mentor, facilitator, helper, and mediator for learning. The teacher must create a learning environment that will allow the student to construct his/her own knowledge by experiencing and interacting with the environment (Hill, 1997).

Some Techniques for Implementing Active Learning

The following techniques, as suggested in the literature, are geared toward implementation in face-to-face courses, but most of them can also be implemented in computer-mediated courses:

- Ask students to keep a journal for the course. The student should write about *what* they are learning, *how* they are learning, how this makes them *feel*, and so forth.
- Ask students to develop a learning portfolio.
- Ask students to *do* something (design, conduct, simulate, present, discuss, etc.).
- Create small groups of students and have them make a decision or answer a question.
- Find ways for students to engage in authentic dialogue with people other than fellow classmates who know something about the subject (on the Web, by e-mail, or live).
- Implement cooperative learning, problem-based learning, or project-based learning (these three teaching methods are discussed in other articles of this book).
- Let students participate in the lesson: pose questions, encourage students to ask questions, stimulate discussion and debates, assign short exercises and assignments, ask for feedback (oral or written), conduct short breaks (2-3 minutes) every 20 minutes or so, to enable students to discuss what was taught, and implement the Socratic method of questioning.

ACTIVE LEARNING THROUGH COMPUTERIZED FEEDBACK INTERVENTION

This section discusses feedback intervention provided to the student by the computer both in synchronous and asynchronous distance learning courses. "Feedback interventions are defined as actions taken by (an) external agent(s) to provide information regarding some aspect (s) of one's task performance" (Kluger & DeNisi, 1996). This definition excludes several areas of investigation: (1) natural feedback processes such as homeostasis, intrinsic feedback, or the negative-feedback-loop of a control system that operates without external intervention; (2) task-generated feedback which is obtained without intervention; (3) personal feedback that does not relate to task performance; and (4) self-initiated feedback-seeking behavior. We concentrate here on feedback intervention provided to the student by an external agent (the teacher) as regards to certain aspects and outcomes of the learning process. The feedback