Learning Software, Constructing Knowledge


Q. I think I understand the idea that students “construct” their own knowledge. How does this fit in with computers in education?

Over the past decade and more, constructivism has drawn the support of many leading educators. The basic idea is that a person builds new knowledge and skills on the knowledge and skills he or she already has. The learner's mind actively constructs knowledge and skills. This is quite different from the "empty vessel" idea in which the learner is merely passively waiting to have new knowledge and skills “poured in.”

The "empty vessel" theory fits well with a top-down determination of curriculum content and with an industrial age, mass production model of instructional delivery. However, it is increasingly evident that this approach to education does not adequately fit the needs of learners in the Information Age.

Personal Examples

Recently I had the time and inclination to learn two new pieces of software Quicken™ and PowerPoint™. Quicken from Intuit, is a home finances package, useful for keeping personal financial records. PowerPoint, from Microsoft, is a desktop presentation package, useful in preparing and doing presentations.

The manual for Quicken is more than 400 pages long, while the manual for PowerPoint is more than 600 pages long. The essence of both manuals is captured by the following quotation from page xi in the PowerPoint handbook: "PLEASE!!! Don't read this book from cover to cover!" Both manuals contain directions for quickly getting started and suggest a learn-by-doing approach.

The assumption is that people acquire one of these pieces of software because they have a task they want to accomplish. Each person has knowledge, skills, previous experiences, and goals that have led him or her to want to learn to use the software. Each learner has a different background and different specific goals. Each learner is intrinsically, internally motivated.

Certainly, the preceding paragraph describes my situation. My doctorate in mathematics and previous work with spreadsheets helped as I approached the learning of Quicken. My experience in using a variety of graphic arts programs and my experience in preparing slides for talks helped me as I approached the learning of PowerPoint.

I found the learning of each piece of software to be a significant challenge. I don't easily learn new pieces of software. However, I am tenacious. Eventually—after about a day on each piece of software—I developed levels of skill and knowledge that suited my immediate needs. In neither case did I really begin to scratch the surface in "covering" the manual. However, in both cases I made significant progress and I laid groundwork for additional learning in the future.
The feedback mechanisms in my learning endeavors were a combination of the computer and myself. I posed questions and tasks for myself. Often I had trouble conveying my ideas to the computer. The error messages and the computer output display provided me with feedback on my lack of understanding. As I progressed, these overt errors decreased. More of the feedback came from within, for example, "Does the graphical layout of this slide really help convey my message?"

As an aside, in this overall learning experience, I gained increased insight into the overall process of learning new pieces of software. I integrated this knowledge with my current knowledge of constructivism and our educational system. These insights and integration of knowledge helped prepare me to write this editorial message.

Some Observations

The lengths of the two manuals I used are similar to the lengths of many textbooks used in high school and college. The complexity of the topics covered in these manuals is comparable to the complexity, of topics covered in high school and college texts.

I didn't have to take a test of my new knowledge and skills. Rather, the test was whether, I could accomplish the tasks I had in mind when I started the learning process. For example, I wanted to prepare the overheads for a talk, and I wanted these overheads to be distinctly better than the overheads that I prepare using a word processor.

Contrast this with what most students face as they first open a text for a course in high school biology, math, or some other course. A prescribed syllabus has been developed by the teacher and people who set curriculum. The curriculum is closely tied to the text, slowly winding its way through as it "covers" the book. There will be assignments. Under the best of circumstances, feedback from these assignments will occur the next day. Often the feedback is merely a check mark or some other indication that the assignment has been recorded in a gradebook. There will be quizzes, tests, final exams, and perhaps competency exams. These will be graded, and a final grade is entered into a permanent record to reflect the student's achievement in the course.

Some Conclusions

Interestingly—and sadly—there is an increasing number of high school and college courses that use essentially this same "traditional" model of instruction to teach students to use a piece of software. A piece of software becomes the focus of a course, and students are lock-stepped through a curriculum that covers the software.

What a waste! The learning environment a student encounters when faced by a new piece of software is a golden opportunity to learn to learn, to gain experience in accepting personal responsibility for learning, and to practice the general ideas of constructivism. It seems obvious to me that schooling should be designed to facilitate students in constructing their own knowledge.

Retrospective Comment 8/30/08

The following is quoted from material I wrote in August 2008 and that is available in: http://iae-pedia.org/Improving_Math_Education.

Here are two challenging and thought-provoking math education question areas that are relevant to people of all ages. Begin by asking yourself the questions and forming mental answers. Then, in the future, explore how other people of all ages think about and answer these questions.
1. Can you do and use math at a level that meets your personal current needs and the current expectations you have for yourself? What about needs and expectations that believe you may have in the future? This is a question related to intrinsic motivation.

2. Can do and use math at a level that meets the current needs and expectations of various stakeholder groups such as parents, our schooling system, potential employers, politicians, our government, and so on? What about needs and expectations that that are likely to have in the future? This is a question related to extrinsic motivation.

These questions are part of the general ideas of giving more power to students and helping students to learn to take more responsibility of their own education. Learn more about my thoughts on these issues in the documents:
