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Learning by Design: Constructing Experiential Learning Programs

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How can we assure that our students really learn? If we want to improve the learning process, we'll have to decide what we mean by "learn." Recall a time when you learned something new -- a new skill, a new technique, a new word, a new hobby, a new way of interacting with people -- and consider the following three questions:

First, why did you bother? You knew that learning would change you, and that change meant stress. Why would anyone volunteer for additional stress?

Second, how did you feel during the learning process? Was it difficult or easy? Was it a delight or a bore?

Third, what was the outcome? Did your behavior change? Did it stay changed or did it fade? Would you consider it a successful learning experience?

A Typical Learning Experience

Our most recent learning experience has been how to use a word processor. Let's consider Dani's answers to the three questions.

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Why bother? Jerry and his secretary, Judy, made a quick transition from the typewriter to the new machine. Dani observed the process and felt curious about this new addition to the family, as well as increasingly excluded by the new language around the office. Not to be conquered by a glorified typewriter, she asked for instruction.

How did you feel? Dani's first reactions to the new technology were mostly negative. The keyboard was not laid out exactly like a typewriter's, nor did it have the same "feel." There was no carriage return, the familar typing sound was absent, and the small video screen had a nasty habit of displaying cryptic error messages such as:

62, FILE NOT FOUND, 00, 00

And with all her intelligence, she could not seem to memorize the simplest formatting commands but had to look up everything in the manual, over and over. No question about it, this was a stressful situation that made her feel lost, dumb, and angry!

What was the outcome? With time and practice, Dani's irritation gradually gave way to excitement, which she noticed when she found herself actually looking forward to the next session at the machine. She knew she had mastered it when she realized that she no longer referred to the manual, or even to her little sheaf of penciled notes.

Piaget's Model of the Learning Process

How can we explain this process of learning? And, once explained, can we generalize the model to apply to other kinds of learning?

Jean Piaget, the Swiss philosopher and psychologist, proposed that learning was a process of constructing--not receiving--new knowledge. The learner could not simply sit back passively, and obtain learning through the manipulations of another person--a "teacher." The learner was neither an "empty vessel" to be filled with knowledge nor a "blank slate" on which knowledge could be inscribed, but a system that learned through its own interaction with its environment.

What we like best about Piaget's model is the way it makes the learner an active participant in the learning process. The process begins when the learning is provoked--the learner examines his or her existing cognitive models because of some pressure from the outside environment. It might be provoked by necessity, as when a businesswoman struggles to learn Japanese to retain a major overseas client. It might be simple curiosity or, as in Dani's case, a feeling of being left out of the group. Whatever the case, learning doesn't just happen. Learning is the result of decision and action by the learner. (And not learning can also be a conscious decision and action.)

Once the decision is made, the learner plunges into an unfamiliar sea filled with unknown flora and fauna. At

first, nothing fits or even makes sense in the learner's vision of the world. The world seems filled with cryptic messages. Piaget called this stage disequilibration. The learner is literally off balance in the new environment.

What to do? From the disequilibrated state, we may try to restore equilibrium without learning by changing the environment. When Dani said "this is nothing more than a glorified typewriter," she was bending the environment so she could retain her own model of the world. Piaget called this process assimilation, which was one pole on a continuum of choices we can make to restore equilibrium.

At the other pole, we can throw out our old model and embrace the new one totally. Piaget called this choice accommodation. Jerry is closer to the accommodation pole because he can no longer type competently on the typewriter without ruining 50 sheets of paper.

Generally, neither pole by itself provides a satisfactory outcome. Instead, we move between these poles in a dynamic equilibrium that Piaget called self-regulation. We partially surrender our earlier models of the world, and at the same time we twist the world into their static shape. In the process, we build for ourselves a new model of reality that somehow reconciles the old and the new. Although Dani no longer calls the word processor a typewriter, she still needs a printout and a red pencil before she can "really" edit her work.

When we complete the self-regulation process, we have constructed new knowledge. And then the process begins anew--moving from a state of comfort, into a provocation, through a state of discomfort, and finally into a new region of comfort.

The Learning Cycle

As trainers and educators, we can use the Piaget model to design teaching strategies that allow this process to develop. We must first put our students into a provocative environment. We must encourage them to experiment--to play with the materials in that environment. We must challenge some of their preexisting notions of the world--to provoke disequilibrium, but without utterly frightening them away. We must support and guide them through the self-regulation process. And finally, we must provide opportunities for them to consolidate and feel comfortable about their newly-constructed knowledge.

The teaching design we use to accomplish all this is called the learning cycle. The original learning cycle was developed by Robert Karplus of the University of California at Berkeley to assist students in the development of logical thought. Robert Fuller worked with Karplus at Berkeley and brought the learning cycle idea back to the University of Nebraska, where it was modified for college instruction by the ADAPT faculty. In our own work, we have adapted the learning cycle for adult learners. In all its variations,

the learning cycle has three phases, called exploration, invention, and application.

The Exploration Phase

In the exploration phase, students--usually working in small groups--are permitted to explore a new environment on their own, with minimal intervention on the part of the instructor. The exploration phase is the learner's personal encounter with the new material.

Working with these materials, the students attempt to complete an apparently simple task. They soon find, however, that there is some fly in the ointment. Resolving the difficulty requires even more interaction with the materials, as well as active discussion with peers. Eventually, the students complete the task and possess a set of data about the new environment.

Here's an example of an exploration taken from one of our workshops for systems analysts. We want the students to learn a new way of designing questions, one that will be effective at extracting information from users in the fuzzy early stages of the system development process. We give them a work order for a new system, with instructions to prepare a list of questions for the user. The user is played by one of the instructors, who carefully answers their questions without volunteering anything not covered by their questions. The students are aware of some difficulties as they interview the user, but other difficulties become apparent only after

they are given a complete list of all the information they might have obtained if their questions had been better framed.

The instructor's principal role in the exploration phase is designing a task that will force the students to call their existing models into question. Sometimes these tasks work too well, so the instructor may have to encourage a student who feels unable to proceed, but this is rare. Sometimes the instructor plays a role, as in our fuzzy-question simulation. Mostly, however, the instructor simply observes the explorations, gathering data to be used in the next phase.

Invention

The invention phase brings the entire group together, with the instructor playing a leading role. The group tries to make sense of the data generated during the exploration phase. They are now working in an analytical mode, trying to generalize from their data by inventing new concepts or tools. The instructor may provide the standard technical terms for these "inventions," or present a model in current use, or even deliver a mini-lecture to illuminate or integrate the students' inventions.

For instance, in our fuzzy question simulation, the instructor might guide the discussion by listing students' examples of information that their questions failed to elicit. Alongside each piece of information, the students

write questions that might have succeeded. The instructor then asks the students to identify systematic differences between the successful and unsuccessful questions. Out of ten principles that the instructor had in mind, the students might develop seven on their own, get two more with tiny hints from the instructor, and need a bit of a push to catch the last. The instructor might then finish the invention by relating all ten principles to a model based information theory.

Regardless of the instructor's contribution, the knowledge that emerges has been constructed by the students themselves, rather than provided by the instructor. The instructor may have provided conventional names, or accelerated the convergence of invention, but has in no sense filled the empty student vessels with knowledge. That is done by the student's own active involvement.

Application

The application phase completes the learning cycle by creating the opportunity for the students to interact with the world once again--this time using their newly acquired models. As in the exploration phase, the instructor merely provides a structure and observes the students working in their small groups. In our fuzzy-question learning cycle, the application involves a work order for another system, more or less repeating the structure of the exploration phase.

In many cases, the application phase for one learning cycle becomes transformed into the exploration phase of the next. The fuzzy-question learning cycle is actually a series of case studies. In each case, the students progress a bit further by applying their learnings from the previous case--then run into trouble on the next type of difficulty. Such a series of linked learning cycles makes learning more efficient, but, more important, integrates different conceptual models.

Experience with the Learning Cycle

We have used the learning cycle approach in a great variety of educational settings, ranging from undergraduate college courses to intensive residential workshops for technical leaders in industry. Whenever principles are to be learned, rather than simple procedures, the learning cycle is appropriate and effective.

Virtually any subject can be learned using the learning cycle approach. Our experience, and the experience of our colleagues, has included anthropology, computer science, management, English, systems analysis, philosophy, logic, economics, communication skills, and leadership training.

We have used the learning cycle effectively in groups ranging from 5 to 150. Learning cycles may be designed for a variety of available resources, including what the students carry around in their heads. A learning cycle may be built into a one-hour class meeting or planned to run for a full

16-week semester or 6-day workshop. It may be integrated with readings, films, field trips, laboratory experiments, guest experts, and even lectures.

Learning versus Teaching

Piaget's model highlights the difference between learning and teaching. In other educational approaches, the "teacher" acts on the "student," hoping to transfer knowledge from one to the other. As one wag described the lecture method, "It's a way of getting material from the teacher's notes into the student's notes--without passing through the brain of either one." Not all lectures for all students may share this characteristic, but it's certainly a frequently observed phenomenon--one that's simply not possible with the learning cycle. In the learning cycle approach, the material must pass through the student's brain because the student acts on and interacts with the material to be learned--transforming the material rather than mechanically copying it.

In the learning cycle, the student has responsibility for her or his own learning, which is virtually a requirement for success with adult learners. And through this responsibility, all students, whatever their age, develop a greater sense of ownership of the products of the learning process. Not only is understanding of the material much deeper, but retention is far better than in other approaches. Experiments show that most of what is taught is rapidly

forgotten, but what is learned stays learned--until it's unlearned in some new disequilibrating environment.

References

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Berkeley, CA 94720

This is the original publication containing the idea of the learning cycle as developed by Karplus.

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A compendium of articles on the application of Piaget's models in college teaching. In addition to updating this compendium on a more or less regular basis, the ADAPT faculty conducts workshops on Developing College Students' Reasoning for college teachers, administrators, and instructional development personnel.