Unteaching Uncreativity

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If someone were to come up to you and ask "what is the fastest way out of town?" you would probably feel compelled to say "it depends on where you want to go." In a similar way, to answer the question before us today, "What should be taught to Engineering design students?," we should know what we would like our students to be able to do. In turn, it is reasonable to ask what our students are going to need to know, or what they will be asked to do in the future. Since we are surrounded by thousands of problems, we can be confident that designers will be asked to work on solutions to some of them. Which ones the student will actually be asked to solve is largely a function of what direction society takes in the future. This may sound like the unanswerable dead end of this series of questions, but it is not. In his book Personal Space, Robert Sommer pointed out that because man is capable of adapting to most anything we design, the ultimate question is what kind of society, or what kind of man do we want?

This is an excellent question, worthy of many hours of discussion. It could lead to a complete rethinking of what we would like to teach our students. Whatever is decided, it should be clear that imaginative solutions to these problems will require designers to be as creative as possible.

Let us examine for a moment those attributes that distinguish creative persons. Creative persons are open to new experiences; exhibit long-range thinking and prolific idea generation. They combine information in new ways and often think in a non-sequential fashion. They use metaphor freely. They are curious, constantly asking questions about everything. Often these questions are so simple as to appear foolish. Creative persons are often preoccupied with a pet project and will pursue it wherever it takes them. They display an independence of judgment, and do not blindly accept authorities' dicta. Creative persons are willing to take risks and, perhaps most importantly, have a good sense of humor, which not only helps them generate new ideas but also enables them to cope with the many failures they experience as a result of taking those risks.

Now think back to this past semester, or this past year, or even as far as you care to remember. What percentage of your students has fit this description? If your experience is similar to mine, we may come to the conclusion that more could be done to encourage creativity.

Returning again to the question before us, you may think I am going to suggest we teach creativity to our engineering students. There are at least three interrelated reasons why I don't think this is a good idea.

The first is that to think that such a course or any other course is just what the student needs to complete his education is to misunderstand what school is all about. This approach is like saying that a student is a racecar and that life is a race. Then to win there surely must be some last minute preparation or ingredient like a quart of STP that will top off this racecar and make him a winner. But what if it rains? What if he runs out of gas? Would he have to make a pit stop in school for a fill up or a tire change? Perhaps a quick course in psycho kinetics or interstellar tectonics?

Second, the idea generation techniques and design methods usually encouraged in such creativity courses are means to an end rather than an end in

themselves. They only make sense in the context of real problems that a person is genuinely interested in solving. Even the man who is probably our country's most well known methodologist, Christopher Alexander, has stated in his book Synthesis of Form "I reject the whole idea of design methods as a subject of study since I think it is absurd to separate the study of designing from the practice of design."

Finally, assuming a course like this was worthwhile, imagine trying to teach a course which encourages spontaneity, independence of judgment, making order out of chaos, willingness to take risks; which must meet from 9:00 to 9:40 on Monday, Wednesday, and Friday, with quizzes every other week. It would be ludicrous. The very structure of such a course would destroy the points you were trying to make. I have never heard of a creative university course on creativity.

Numerous people have been making a similar point for many years. The most famous of these are John Dewey with his observation that "students learn what they do" and Marshal McLuhan's catch phrase "The medium is the message." These thoughts expand the observation just made about creativity courses to all courses. That is, what schools teach in the aggregate isn't so much their individual subject matters as it is the way in which they are all taught. The medium says learning involves a group of students listening to one person in a special room on weekdays and periodically demonstrating the retention of what they heard during examinations. The behavior that is rewarded in the United States is doing your work on time, being quiet, courteous and obedient, accepting the judgments of others (especially experts), being liked by your peers and doing as you are told. One of the many things this process also says is that if you want to do well don't be creative. To quote Ivan Illich in his book Tools for Conviviality:

> Schools... teach people the accountant's view of the value of time, the bureaucrat's view of the value of promotion, the salesman's view of the value of increased consumption and the union leader's view of the purpose of work. People are taught all this not by the teacher but by the curriculum hidden in the structure of school. It does not matter what the teacher teaches so long as the pupil has to attend hundreds of hours of age-specific assemblies to engage in a routine decreed by the curriculum and is graded according to his ability to submit to it. People learn they acquire more value in the market if they spend more hours in class. They learn to value progressive consumption of curricula. They learn that whatever a major institution produces has value, even such invisible things such as education and health. They learn to value grade advancement, passive submission and even the standard misbehavior that teachers like to interpret as a sign of creativity.

When one comes to realize the extent to which this is true in our schools, and engineering schools are certainly no exception, then one realizes that today's question would be better stated in reverse.

Instead of asking what should engineering designers know that they don't know and how can it be taught, we should be asking what should they not know that they already do know and how can it be untaught? The easiest way for me to approach this question is to recall the things which school taught me which I have subsequently had to unlearn.

The first of these is that information falls neatly into subjects. If there is any notion antithetical to the process of design it is the idea that subjects are not

connected to each other. Subjects are artificial constructs originally devised to help us think about what we observe. Many boundaries are less useful presently than when they were first thought up. Design necessitates drawing freely from all one's experience. If information has been stored by subject matter and is retrievable only in the same way (a condition Whitehead termed inert information) then innovative design will be impossible.

Another thing I learned in school is that in order to learn something, one must always begin with the basics. In other words, there is one correct order to learn every subject which holds true for all students. There are several reasons why this isn't so. One is simply that you cannot wait until you know all about life before living it. We all do hundreds of things without knowing the basics. For example, most of you know how to ride a bicycle but probably none of you know the four don'ts of correct cycling: Don't sit on the seat, don't steer with the handlebars, don't push on the pedals, and don't bend your back. If you had heard these basics before starting to ride you may not have learned at all.

One of the most exciting areas of engineering for students is computers. I'm sure the reason for this is that in a short period of time, like an hour, they can learn how to get on one and proceed to use it to do their own work. When they make the inevitable mistakes, they can go back as many times as they must to fill in what they didn't know, i.e., debug their program. When problems get more complex, or the student's interest has been piqued, he can go back to the basics and learn machine language or even learn solid-state electronics in order to design his own circuits. A moment's reflection will confirm that every "basic" has something more "basic" behind it which continues to be true until one reaches some ultimate "basic" which is often a cosmic issue.

Because many students learn computers by themselves this example also illustrates that a teacher isn't always needed to learn a course, nor is a course needed to learn a subject. Another related point is that as there isn't a correct order for learning one course, there can be no correct order for learning a whole curriculum. There may be a favored order—usually the one that the faculty feels to be the most efficient from a pedagogical point of view, but this again usually does not take into account how individual students learn.

John Holt makes a good point when he says that teachers often think of teaching as taking students on a trip which the instructor has well in mind, but which the students don't have any idea of where it is going or why. Perhaps part of the reason for this is that most teachers assume all their students are going to become what it is that they are teaching, that is, that the students all want the course for the same reason. This is obviously incorrect for most courses, and probably even about 50% wrong for any given program of studies. Twelve years out of school almost half my graduating class are no longer in engineering; they have become lawyers, doctors, business men, are in the military, or are doing something else.

Engineering school gave the impression that engineering was all math. Furthermore it implied that the engineering greats of the past were all mathematical geniuses. While it is undoubtedly true that math is engineering's most important tool one must not confuse this fact with the actual concepts that this math is intended to represent. An examination of the past reveals that many of the big names of science got their ideas from other modes of thinking and filled in the mathematical details later. Einstein is famous for his comment that after the mathematicians got done with his theory of relativity he couldn't understand it. Apparently it takes too much time to discuss hang-ups, misconceptions, and failures of these men, or the conditions of society and the

mental set of their professions which caused the problems. Yet it is this kind of information from the history of science and technology that one begins to understand the nature of invention and discovery. Science as taught, without reference to these lives or even the professional life of the professor in front of the room, leaves students with two distinct impressions. First is that the students will never be able to match the achievements of these great men. The second is that science is completely determined, cold, matter-of-fact and lifeless—as if all the great discoveries have been made and that all that is left to do is clean up. Textbooks seldom if ever hint at any of the activity at the expanding edge of knowledge, or allude to any uncertainty in the facts being presented. We can do without such textbooks and such sanitary classroom presentations.

Another sacred item we can do without is grades. When I got out of school I had to unteach myself that I was a C student, and by extension a C person. Fortunately this didn't take long as my personal experience confirmed what numerous studies have also demonstrated, namely that there is no correlation between student grades and their success in the so-called "real world." If we were to believe school, we must conclude that engineering is done in one-hour bursts of energy every two or three weeks under top secret conditions after sleepless nights and is usually accompanied by the growling of stomachs due to the ravages of diarrhea. Emergencies in industry seldom require an answer within one hour.

Even more important, questions in industry almost never have only one right answer. Real engineering questions are open ended. They require more of a good sense of judgment than the ability to use a slide rule or calculator quickly. We should make the reason for going to school getting an education rather than stringing together a series of passing grades. The only learning which grades insure is devising clever ways to cheat.

There are many more things that I had to unteach myself, but the point should be beginning to come across: if we want creative engineers we must provide a creative environment for them to learn in. Supplying this requires that a distinction be made between skills and education. Skills may be drilled in traditional ways, but education requires the asking of open-ended questions. Such questions inevitably demonstrate the oneness of knowledge by cutting across individual course and departmental boundaries. Fortunately for those of us here today, open-ended questions are easier to ask in design courses. Asking them however will only make the lack of learning in other classes even more evident.

The need for creative teaching must be recognized. Good teaching is barely recognized on campuses today, let alone truly creative teaching. There is little reward for it, and certainly none from a financial standpoint. Making teaching rewards equal to those for research would be the best first step towards improving existing conditions.