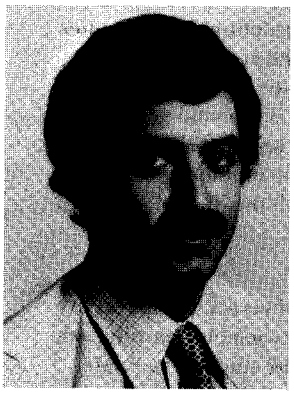

AUTONOMOUS LEARNING*
(Or, "Must We Find a Solution? Can't We Just Enjoy the Problem for a While?")

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Learning in the 1980's

In these pragmatic 1980's, it is at least old-fashioned, if not altogether suspicious, to talk about self-realization and growth of human potential through group processes, as I shall be doing in this article. The "Me Generation" of the 1960's and 1970's, which flourished in Tom Wolfe's "era of every man an aristocrat," is now replaced by a college student body preoccupied almost exclusively with acquiring skills that are marketable and getting a fair return on their tuition investment. Yet I find it ironical that the multitude of the currently popular, so-called "Japanese Management" seminars have surprising similarities to the human potential teachings of the past two purportedly sybaritic decades. As the subtitle above, which was found scribbled on the wall of a Big Ten engineering school, suggests to me, perhaps a challenge for educators is still there.

Two student trends: those seeking 1) large flow of information transfer 2) independent acquisition of knowledge

Changes in societal priorities affect the orientation of the educational system, and in the case of professional schools, the given response time is all too short. Among engineering students, two trends can be currently identified. One is a stronger interest in learning the skills perceived as explicitly useful in the marketplace. This often takes the form of student demand for a large flow of information transfer. Counting the textbook pages "covered" and the number of homework sets completed are typical measures of the amount of information imparted to the students during a course. Students in that trend may become excellent engineers in technological status quo maintenance, but I would hardly expect any innovations from them, if left unchallenged. Another trend, though, is the appearance of students who do not fit the traditional engineering stereotype (this includes women). These students who have drifted into engineering for reasons of job security, will still seek a broader intellectual stimulation and a more independent acquisition of knowledge — although not necessarily within the engineering curriculum. I will argue that it is very important to truly attract these students to the engineering practice, not just for the sake of plurality but because they may bring true sparks of innovation. My point then is that there are convincing arguments, for students in both trends, in favor of a curriculum supporting what we will call *autonomous learning*. Perhaps some of the same arguments may also appear convincing for us educators.

Autonomous Learning is a term that Jonathan Laitone and I have coined to signify a learning process that broadly satisfies the following two theses and corollary needs:

1) Learning by definition is an individual human process. Yet learning occurs most often in a group environment. Therefore, group interactions should be such as to promote individual learning.

2) Learning is not a need imposed from the outside, but is experienced at a personal level of involvement. Individuals must be able to relate the object of their learning to their own selves.

Why autonomous learning?

Our concern here is a practical one. I believe that the autonomous learner, in our case an engineering student experienced in autonomous learning, will be one who is prepared to deal successfully with at

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The need to adapt to changes and advancements in one's own field

least two major career problems. One is that of coping with the organizational structure and dynamics of modern companies: realizing, for instance, the vast interdependence that often goes into decision-making and task-performance, as well as the frequent dominance of interpersonal relations and emotional issues over rational responses and decisions. The other problem is the vital need to adapt to changes and advancements in one's field, in the face of the formidable technological rate of change that is likely to occur over a career life of forty years. As obvious as these problems may be, what can we educators do, if anything, to provide our engineering graduates with the kind of education that will equip them to deal successfully with these problems?

The following report summarizes the activities that I organized (with the aid of several colleagues) in a senior mechanical design course, conducted over the past four years, with autonomous learning as my educational goal. The basic need underlying the course goal was allowing the students to relate their object of learning to their own selves, and to experience that learning in an appropriate group environment. Success in meeting this need would mean that our graduate might have a better chance to go beyond professional survival throughout their lives, and achieve both personal satisfaction and social contribution.

Course Structure

Traditionally, design courses have always been objects of educational experiments. It is hard to find two educators who will agree on what design should be, so the matter is usually settled with a general statement vague enough for easy interpretation. The book description of our senior design course says that students are expected to "work on a design project and integrate knowledge from all areas of the curriculum into a coherent synthesis representing a working design."

Students pick their own project

The students were required to work in teams, preferably three members in each, on a project of *their own choice and formulation. All members of a team had to agree on the choice of a project.*

Approximately three weeks from the beginning of the term, each team had to submit a project proposal conforming to given guidelines. Progress reports followed at four-week intervals with a final report at the end. All reports were accompanied by oral presentations. The class met twice a week for a period of three to four hours. Usually half of the period was used for a general lecture, the other half devoted to the projects.

Guidance and benevolent feedback are provided throughout the design project

The instructor acted as consultant to the teams. The students had to learn what they needed for their project on their own. This sometimes meant finding "experts" inside and/or outside the university, including faculty and industrial people. The ultimate goal of *project completeness* was a set of specifications and drawings from which the design could be made readily. The goal of the *course* was to give students an experience of the design process in a controlled environment with guidance and benevolent feedback, something they could not fully expect in an actual industrial environment.

Classroom Activities

A large variety of activities took place over the several times the course was taught, not all of them during the same term, the same activities often differing in presentation or format. For the same activity, differences in the collective response of each class was noticeable. Activities successful in one class left another class indifferent or even negative. Activities and techniques were introduced and conducted in class almost on impulse, based on the instructor's estimation of how the class felt in any one week of instruction. I found that feedback from the class and individual students, as well as my own sense of mood, very often dominated my deciding on a particular activity.

The four activities in the classroom:
1) acceptance
2) exploration
3) communication
4) learning

Classroom activities could be grouped into four categories. The first category contained activities aimed at the generation of an atmosphere of *acceptance*. We wanted to see the students accept each other, the instructors, and the goals of the course, in a personal way and not as an accidental result of university scheduling (that being most often the case for required courses). The second category contained activities that dealt with the *exploration* of the self and its relation to others. Creativity techniques, conditioning, stereotyping, and leadership skills were included in this group. The third category contained activities for the development of *communication* skills. Oral presentations of the project and written reports were part of this group, together with specific exercises aiming at interpersonal communication. Finally, the fourth category dealt with an explicit understanding and interpretation of *learning* techniques. Problem-solving and decision-making were examined through exercises and interpreted through the current theories in the psychology of learning and organizational psychology.

A complete description of the individual activities and the motivation behind them can be found in the report cited. Here I would like to limit the discussion to a few observations:

Maintain structure

1) It was extremely important to maintain a feeling of underlying discipline and structure in the free atmosphere of the course; otherwise an impression of chaos and of "nothing happening" might easily develop. A rigid set of project deadlines and a fast pace of events during class meetings are highly recommended. The autonomous learner must recognize the difference between freedom and irresponsibility.

Grading

2) An unconventional grading scheme was used and worked very well. Grading criteria were established early in the term by the class. After the final report, a joint conference of each team with the instructors took place. Each member discussed his/her own contribution and that of the others, and proposed grades. Final grades were arrived at by consensus, with some finetuning from the instructors. This scheme forces the students to take more responsibility about their learning and also gives them a first taste of the unpleasant task of evaluating others, perhaps good friends.

Credibility of instructor

3) The apparent prestige of the communicator/instructor was an important contributor to the amount of attitudinal change observed in individual students. For the more rigid-minded students, prestige confers legitimacy to the unconventional.

Rigid deadline

4) The formation of the design teams was a complex process, but it was not difficult to achieve. The non-negotiable deadline for specific team proposals was very effective. The three-member size team is optimal.

Avoid fear of criticism

5) It is important in many ways to let the students express something very personal without the fear of criticism or ridicule. A technique to achieve this is through a "game." For example, we asked the students to compose and present a script about their educational experience and characterize it as a motion picture or a television show. Fear of criticism is a well-known inhibitor of creativity and it stifles the interpersonal communication needed for autonomous learning.

Leadership

6) The role of leadership is very important in group dynamics. In the design teams, a leader with wide responsibilities was elected on a rotating basis. When these responsibilities were stressed by the instructor, the leader turned out to be the hardest-working person in the group! This experience enhances the capability of the students to work effectively together and appreciate the role of a leader in any organizational structure.

Feedback

7) The class feedback to the speakers after the oral presentations included criticism on style and nonverbal communication. Students universally agreed that presentations and feedback were one of the most important experiences in the course. This feedback is particularly useful in autonomous learning, not only because of learning more about one's self but also because of recognizing how others see one.

Try new ideas

8) This senior course was particularly suitable for trying out ideas. For most other courses, introducing a very few ideas in autonomous learning would be easy, but structuring a "regular" course in the setting I described is indeed a major undertaking.

Looking Back

I made the case that *experiences in* personal growth and group processes are very important in our engineering curriculum, particularly for the coming decades. I described how these ideas can be put in a learning context and be applied to the conduct of a senior design course. Although I claim success, this by no means signifies that there were no problems or that all students were satisfied. Patience helps though: two of my most dissatisfied students wrote me two years after graduation that they now realized what they had learned and how it helped them. I should confess that I often felt as if I were performing a balancing act and I can remember one or two near crashes. Yet all of the observations I described are useful in their own right and I would recommend trying them out where appropriate.

Caveat

As a parting remark, I should insist that no attempt was made to settle any issues, but rather to stimulate ideas and indeed to provoke some argument. For myself, I do like to "enjoy the problem for a while" and that (I suspect) is why I happen to still be at school.

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