WHAT IS PROGRESS IN EDUCATION?

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There is one thing that to my mind is particularly significant about the 1985 Underwood Award. Through last year, the Underwood Award could be deemed as what the business world calls "closely held". Past Underwood award scholars could simply be thought of as a group of persons perpetuating the memory of a dear friend and colleague. This year is different, however. I did not know David Underwood personally. But my selection is thus all the more meaningful. It demonstrates something that I think would make him very proud: that David Underwood’s influence at the College is going to outlive not only him but those who knew him well.

When Bill Miller followed me into my office one day last March and closed the door, my mind was racing. What athlete had I growled at too loudly recently? When he told me that I had been chosen to receive the 1985 Underwood Award, it was a stunned moment before I could reply, "You mean I have to give a talk in the fall?" He nodded and replied that I did indeed need to deliver a lecture and also to serve as grand marshall at commencement. And he did not think it would be sufficient to send the talk on a postcard from Hawaii.

Bill Miller also told me that, with the exception of my family, I would have to keep my award a secret until the official announcement. That is awfully difficult when one is going around with a stupid grin on one's face. Fortunately, I had two colleagues to talk to during the month between Bill's news and the official announcement. Steve Stephenson, who had the office next to mine and happened to be in at the time, heard all that Bill Miller said to me. Steve rushed in after Bill left to congratulate me and to say that we should not talk so loudly if we did not wish to be overheard. Ron Eldringhoff, a past recipient of the award, happened to see Bill Miller enter my office and, being the resident genius in the department, quickly deduced why. Ron, Steve, Carl Bruns, who is a good friend, and a hectic schedule helped me get through the month before the announcement. So, Bill, in case you have any more secrets you want to tell me, I've moved to a different office.

My husband and son were very helpful in keeping my secret. I did not tell my mother, who lives in Hawaii, until after the announcement, because mothers can never keep such secrets from their friends.

The day before the official announcement, Ken Smith, last year's recipient, asked me to have coffee with him in the cafeteria. I guess he felt I needed to have my hand held in order for me to be calm and collected the next day. We had to meet in the cafeteria, arriving separately, to make sure his secretary did not figure out what was going on. As we sat and chatted about the announcement, I began to
feel like the Fugitive. Pete Zei, Chief of Police, wandered over to our table. Pete never did tell me if he knew what was happening. In any case, in spite of Ken's thoughtfulness, I was not too calm nor too collected the next day. Fortunately, I had a heavy teaching schedule which kept me occupied for the morning since I had been deserted by Steve and Ron who were both off campus that day.

Five minutes before the announcement I was in Bob Limburg's office. By that time he knew that the recipient was a member of his department, and he was trying to guess who it was. While we were in his office, Carl walked by. Bob wondered what Carl was doing in so early that day. Carl's the department werewolf and usually does not surface before 3:00 p.m. It took a great deal of effort not to give away my secret. A few minutes later as I entered the library, Dave Risch congratulated me, and I wondered how he knew. Later I found out his secret for seeming omniscient. I was the sixth person he congratulated that day. Since then I have heard from almost all my colleagues how they deduced my name for the award. We have so many clever detectives among us it's surprising that anybody except Bob showed up for the announcement.

When Ken Smith said in his lecture last year, "It's not too soon to think about next year's talk," he was right. The talk is an important part of the award and to me was a source of anxiety. I'm a numbers and symbols person—not words. It also does not help one's anxiety when one's friends and colleagues call, write, or stop in and say, "Congratulations. I'm sure glad I didn't get it so I don't have to give the talk. I know you'll do a good job." And you still have no idea at this point what you want to say.

At graduation rehearsal, Ann Brand said to me, "Don't ask me for ideas. Every year I get asked and then I'm mentioned in the talk." So I told Ann that I would not ask her or mention her name. So I won't.

After a meeting of the Instructional Programs Strategic Planning Task Force, I told Betty Duvall that I probably would not be of much use to the committee in August. I also told her that I was going to find it difficult to stand in one place to talk since I was so used to running about in front of a blackboard. She suggested that I have one on stage as a prop. Chalk dust is the mathematics teacher's security blanket.

So, next year's honoree, your turn will come sooner than you think, and it will not be long after the announcement before you receive a phone call from Jerry Schaeffer that he needs the title for your talk in order to print it in the opening week's calendar. It is very difficult to invent a title when you have not yet decided on a topic.

You will notice that my title is a very flexible one. Almost all of the things I hear people complain about today came about as someone's idea of "progress" at one time. In recent years, progress in education seems to be measured by the number of computers available to students, and I plan this morning to make a few remarks about computer use in education.
Let me preface my remarks by pointing out that I am a computer scientist. My doctorate in mathematics is in automata theory, the mathematical theory of machines. Many of my course requirements were computer science and electrical engineering courses. In fact, I was probably programming computers and teaching programming long before any of our faculty were. My first experience in programming required actual wiring of electrical boards—no keyboards, no cards, no tapes. These wiring boards are seen only in museums these days.

I first taught FORTRAN programming when I was on the faculty of the University of Hawaii at Hilo when FORTRAN II was first beginning to be a requirement for engineering majors. The only available computer was 200 miles away in Honolulu—there was no distance hookup in those days—and the only keypunch machines were available from a local sugar company on Saturday afternoons. After my students had keypunched their cards, I rushed to the local airport to airfreight them on the last flight of the day to Honolulu. The student programs were then batch-processed—lowest priority, of course—and sent back to me. Well, on the first try, Bounhoua Bounkeopraseuth’s program and those of his fellow Laosians did not get past the first job control card. The computer center had neglected to tell us that only 20 spaces were reserved for the name field! I am sure it is easy for you to visualize the trauma of committing the simplest syntax errors, such as forgetting a comma, when the turnaround time was one week!

Later during my years as a St. Louis University faculty member, I was instrumental in designing and implementing their mathematical computer science program. I taught courses in automata theory, applied Boolean algebra, switching circuits, and COBOL. Life was much easier then. Turnaround time on student batch-processed programs was measured in hours, not days or weeks.

I have even taught courses for the data processing department here at Florissant Valley. And contrary to popular belief that I spent all this summer lazing under palm trees, I did spend some time learning Pascal. How fortunate we are to have instant feedback.

So, as you can see, I am acquainted with the computer.

The use of computers in schools varies widely from school districts such as Ladue, which has one computer for every twelve students to those which have none. It varies from Dartmouth which requires every entering student to purchase a computer (that’s probably because John Kemeny, co-inventor of BASIC, is professor and former president) to Harvard which adamantly refuses to commit money even to computerize its vast library system.

Microcomputers can and do make many valuable contributions to education. Decker Walker of the School of Education at Stanford has pointed out seven features that will have a positive impact on learning.

1. Computers can be programmed to call for repeated input from users and to respond immediately to that input. They
are interactive.

2. Microcomputers provide more varied sensory and conceptual modes. They can display letters and simple shapes in color; they can play single tones of varying pitch, duration and loudness; they will accept input from typewriter keyboards, game paddles, joysticks, light pens, digitized drawing pads and even aural stimuli such as the human voice; they can be connected electronically with any device that can be made to generate or respond to an electronic signal.

3. Microcomputers reduce mental drudgery in the learning process. Such drudgery eats away at the enthusiasm and energy we bring to otherwise interesting projects. Utility programs such as a spreadsheet for numerical calculations, a word processor (How I wished I had one while I was writing this talk!), and a data search and retrieval program can eliminate enough drudgery to make realistic problems manageable for students. Learning to use such utility programs will give students a powerful set of tools for analysis, and they can then concentrate on planning and strategic skills.

4. Microcomputers enable students to learn nearer the speed of thought. Properly programmed, computers can match the pace and timing of a presentation to a learner's requirements at a given moment.

5. Microcomputers can provide learning better tailored to individuals. It is possible to program a computer to compose a lesson on the spot, tailored to the responses of just one student, using rules for selecting and combining preformed components according to the student's prior responses. Creative applications for deaf or blind or other handicapped students are now being developed. Students learning a foreign language can communicate with a native student through distance technology.

6. Microcomputers offer students new possibilities for independent verification of their own progress. For the highly motivated student, such help can make the difference in being able to learn independently.

7. Microcomputers can offer better aids to abstractions. The act of programming itself can be an aid to understanding abstraction.

The potential of computers in education is great. It is not the unlimited potential that some have claimed, however. There are numerous problems which must yet be solved before the computer will replace even a fair teacher, much less a fine one. Attempts to circumvent the need for a teacher were made long before the microcomputer became popular. Independent study, home learning, and
distance learning all have low rates of completion. Their chief problems are to sustain motivation and participation in the absence of a learning group, a social structure and particularly, a teacher. With the increased infiltration of the computer into the classroom and into the lives of all of us, conscious attention must be paid to human values. Teachers bring such values into the classroom, injecting them into every subject taught—at least good ones do. When a student learns a subject from a computer, human values are absent. Software that starts by asking you to type in your name and then uses it as part of the feedback routines are selling phoney humanism, a poor substitute. Conscious efforts by educators will have to be made to fill this void.

Another concern is that teachers prepared to use microcomputers to teach programming or to use the computer creatively in the classroom are in short supply. Alan Kay, chief scientist at Atari, has gone so far as to state that "What we now have is a bunch of people attempting to teach violin who have had a six-week course in what the violin is and who have never heard violin music before." The amount of arbitrary but essential detail that must be mastered to use any piece of microcomputer hardware or software is large enough to be intimidating to many, infuriating to nearly anyone. A school computer consultant described a typical call she received from a principal. The call went something like this: "I need your help. We just received our first shipment of computers. But, before we take them out of the boxes, I want you to come over and tell us what we should do to get the kids on the computers as soon as possible. Come as soon as you can, because our parents helped purchase these machines, and we've got to show them that their kids are using the computers they helped us buy."

In recent years I have received frantic phone calls of this nature, particularly from elementary school teachers. It is difficult to gently point out that the schools put the "CRT before the course." The computer consultant, incidently, was tempted to tell the principal not to unpack the boxes and to have the students sit on them. The students would then immediately be "on" the computers.

Each new round of products is more "user friendly", but it will be years before microcomputers are as easy to use as movie projectors—machines that are already too complex for some people.

Another problem is that new products and systems are being created and marketed in such profusion, with such speed, and with so little standardization that systematic long-term planning is nearly impossible. The return on the investment of time and energy in learning to use the system is low. As soon as one has mastered one system and become comfortable with it, another one becomes available that does ten times as much at one-tenth the cost. Most schools do not have the resources to provide continuous inservice training for ever-changing computer systems.

The paucity of effective teaching software is a major problem. Good programs are difficult, time-consuming and expensive to develop. Much of the software available today does not take advantage of the many
capabilities of the expensive hardware in which schools invest. The
capabilities of the hardware have hardly begun to be exploited by the
simple, unimaginative, gimmicky software presently marketed.

My experience with software written and presented by teachers at
professional meetings is that although many of the programs shared by
them are beautifully written, they do little in providing useful
instruction to students. More would be gained by challenging students
to write these programs rather than to hand them ones already
written.

We are only beginning to understand how to use microcomputers in
education. Therefore, it is easy for a school or teachers to err,
look foolish, or do harm.

Most educators remain convinced that computers are a valuable learning
tool. The National Diffusion Network, under the Research and
Improvement arm of the U. S. Office of Education, identifies
exemplary programs and assists schools to implement them. Asbury Park
Board of Education in New Jersey, Project HOSTS (Helping One Student
to Succeed), in Vancouver, Washington, and Project CAISH
(Computer-Assisted Instruction and Support for the Handicapped) in
Arkansas are examples of projects which focus on a variety of uses of
technology for secondary school age children.

Harriet Bernstein, senior associate at the Council for Basic Education
in Washington, D.C., in a scathing article, "The Information Society:
Byting the Hand That Feeds You," states that information society
pundits "have induced any number of school districts to make computers
the centerpiece of their school improvement efforts, lest their
students miss the last opportunity for a golden future." The near
panic over high technology, she believes, is being generated by a
serious misreading of the 1980 forecasts developed by the Bureau of
Labor Statistics. High-technology occupations, as a group, will
account for only 7% of all new jobs in this decade. While this is a
significant number, it has fooled schools into setting up "high-tech"
training programs at public expense to prepare students for
entry-level jobs that will probably disappear over the next decade as
technology becomes more sophisticated. Narrowly trained students are
being deprived of the basic intellectual skills that they will need in
a rapidly changing technological and economic environment. As Alvin
Toffler observes in his book, Previews and Promises, we need "more
creativity, less rate." The real challenge is teaching students how
to find information and how to use it to solve problems.

As more studies are conducted on students whose academic experiences
include computer work, it is becoming apparent that the transfer of
computer training to other areas is not necessarily automatic. For
example, one study of sixth-grade programmers shows that while 70% of
them could instruct a computer to draw a 90 degree angle, less than
20% could actually construct one on paper.

It is difficult to use microcomputers to teach subject matter that
involves judgment, intuition, improvisation, and creativity.
Literature, the arts, mathematical invention, scientific applications, and the humanities which require a broad and deep understanding of human interaction cannot be reduced to the formal rules and procedures necessary for computers.

Critics such as Robert Sardello, Director of Studies at the Dallas Institute of Humanities and Culture, are questioning the entire idea of using computers to teach young people. Sardello states that, "Computers will create a generation and a nation of psychopaths, people who can manipulate their own psychological processes, as they do the computer, without thought for others." Joseph Weizenbaum, an eminent computer scientist at MIT, adds that the children who learn the complicated numerical and alphabetic computer languages such as BASIC and FORTRAN to communicate with a classroom computer "are in danger of gaining a poverty-stricken perception of the outside world. You cannot explain an apple in FORTRAN."

Famed behavior modification psychologist, B. F. Skinner, himself, once confessed, "It could well be that a technology of teaching will be unwisely used. It could destroy initiative and creativity; it could make men all alike (and not necessarily in being equally excellent); it could suppress the beneficial effect of accidents on the development of the individual and on the evolution of culture."

Microcomputers will not solve (and may aggravate) several of the most serious current problems confronting education—notably equity, school finance, and divergent public expectations. Computers will not bring racial balance to segregated schools or racial harmony to integrated ones. Many educators fear that computers may actually widen the gap between rich and poor Americans. David Bourland, a computer scientist at the University of Oregon and editor-in-chief of The Computing Teacher, says, "Most poor minority kids are drilled on remedial skills. The computer tells them what to do. Rich kids learn programming—they tell the computer what to do."

Seymour Papert, the MIT professor who invented LOGO and authored Mindstorms, believes that all children should be taught to program computers but admits that even to allow each child one-half hour of computer use per day would require 3 million additional machines at a cost of $4.5 billion. Many schools fail to realize that funds are also needed for maintenance and upkeep once the hardware is in place.

Market research shows that computers in the homes of children outnumber computers in the schools by a ratio of 10 to 1. The message parents are buying is that one way another—both in school and at home—computers will help American education pull itself up by its bootstraps at a time when, according to the rash of reform reports, it badly needs to do so. As a result, parental expectations for a high-tech quick fix for what ails American education are rather high.

Educators are then in a kind of high-tech Catch-22. On the one hand, if they assume the full burden of fulfilling the potential of educational computing, they are undertaking a task for which, in most cases, they are ill-prepared, understaffed and underfunded. On the other hand, if they do not commit themselves fully to the task and if
the great potential of educational computing ultimately goes unrealized, those very educators will inevitably be criticized for failing to fulfill their responsibility to prepare students for the future.

Institutions of higher learning should be able to provide leadership and models to help schools solve some of the problems facing them in this regard. However, in order to do this, we need to know first where microcomputers fit in our educational mission, aside from the teaching of programming courses.

According to Larry Andrews, provost of the University of Nebraska in Lincoln, when an educational unit (department, campus, or college) faces the opportunity of entering into a new application of technology, one of the simplest questions to ask first is, "What is our primary business?" More often than not the unit's primary business is knowledge--its teaching, creation and dissemination. Given an answer like this, academic computing, for example, is more than an inventory of hardware and software. It is more than providing students and faculty access to a machine. Given this answer, academic computing becomes an integral part of a curriculum. True, students may need to learn the facts of operating a computer, but in this context they do so for a larger purpose; to satisfy an objective considered to be important in a course.

Too often the planning preceding the purchase of technology to support the teaching mission of the organization consists of vendor's presentations of their hardware capabilities. Unless these capabilities are evaluated in terms of the intended curricular outcomes for students, the unit cannot be certain that it is making the best investment of its limited resources.

Similarly, the decision to buy any one of several available distance learning technologies without first assessing what learning activities are going to be delivered to which audiences, for what purposes, and by whom on the faculty, is a decision which will very likely yield to mixed reviews. This problem deepens when the technology is a selected "top-down" and unit administrators, such as department chairs, face the unpleasant chore of recruiting (or drafting) a faculty member to plan and implement a mediated instructional activity conducted by a Technological True Believer highly placed in the administration.

If any institution expects to utilize effectively any of the new instructional technologies, their uses will be enhanced if they are considered along the same procedures established to accommodate other curricular changes. Following these procedures will help to evaluate the technology as it ought to be evaluated; as a means of helping faculty and students achieve desired learning outcomes. If the established procedures for considering curricular change are not followed, then the technology selected for (or literally, forced upon) the faculty and students becomes ad hoc and tangential, leaving almost all of the participants with a firm resolve to avoid technology in the future.

This outcome is reminiscent of the "Law of the Hammer", which goes
something like this: give a child a new hammer, and everything the child encounters will need hammering. The potential benefits of the hammer still exist, but they are overshadowed by immature judgment and subsequent misuse.

We must not let the Technological True Believer lead us to the scenario seen by Robert Snider of the National Education Association who took a computerized look through a screen darkly. "...A new kind of learning service will emerge. It will be private, painless, popular, and profitable. National chains of locally franchised learning centers will take full advantage of both tuition tax credits and computerized instruction. Colonel Tweedmoor’s Tennessee Tried and Tested Teaching, with more than 4,000 local franchises, will be the most popular purveyor of what by 1994 will come to be known as ‘junk learning.'

"In the best tradition of American business, the junk learning industry will give the public what it wants. There will be full-service learning centers and self-service learning centers; both will be available with or without grades, credits, and transfer options.

"Permanent student records indicating such human characteristics as aptitude, intelligence, and achievement will have disappeared by 1994, when it will be possible for anyone to get a near-perfect score on any machine-graded multiple-choice test. This disturbing state of affairs will be the result of a new process called CAT (computer-aided thinking), made possible by yet another generation of extremely small, easily concealed computers...".

Florissant Valley can serve as an example of how technology can be integrated into education or it can fall victim to the current trend of installing fashionable technology and promoting junk learning.

The choice is ours to make.

Thank you for your attention.