COLLECTED EDITORIALS

A 1985 book by

Dave Moursund

1/14/05 (Minor corrections 8/1/05)

This is a reprint of a 1985 book. The 1985 book contains some of the history of the organization that eventually became the International Society for Technology in Education, and of the publication that eventually became *Learning and Leading with Technology.* It also contains a complete collection of the first editorials (and editorial-like messages) that I wrote for the *Oregon Computing Teacher* and *The Computing Teacher.* In 1995, the name of *The Computing Teacher* was changed to *Learning and Learning with Technology.* I served as editor-in-chief from the beginning of the *Oregon Computing Teacher* through the publication of the March 2001 issue of *Learning and Leading with Technology.*

The original book was scanned and converted to digitized text. I then read it carefully, correcting the obvious errors. I also found a few errors in the original manuscript, such as a date that was supposed to be 1974 actually entered as 1984. So, I corrected this type of error. I also reformatted the text and added a Table of Contents. Other than those changes, what you see here is the same text as was published in 1985.

This is an interesting "historical" document. It captures part of the history of the International Society for Technology in Education and of *Learning and Leading with Technology,* its flagship periodical.

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Dave Moursund

January 2005

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Preface to the 2005 Reprint

I have found it exhilarating, depressing, and a bit annoying to work my way through the 1985 book. I'll comment on these three sets of feelings in reverse order.

I am annoyed at myself and the staff who aided in the publication of the editorials and other content the book contains. I found a number of examples of sloppy writing (on my part). Better proof reading and copy editing would have helped. I am embarrassed that no one caught the error that I skipped over the number 36 in numbering the editorials. I found that the quality of my grammar sometimes left much to be desired. I use Microsoft Word, and it generously provided a wavy green underline for text that it considers to violate common grammar rules. It identified quite a few such places. The most common was my use of the word "witch" in places where I should have used the word "that." Microsoft Word also found some spelling errors. Spelling has always been one of my weaknesses, but I would have expected that the production staff would have found these errors.

As an aside, I am impressed that the grammar and spelling checker software in Microsoft Word is so good! This represents substantial progress over that years. Both the grammar checker and the spelling checker were quite useful in the overall task of cleaning up the scanned test. I was particularly intrigued by the fact that the Hewlett-Packard scanner I used employs a software package that is about 123 megabytes in length. Downloading the newest version of this software over my DSL line (about 45 K bytes per second) took a long time. However, the 123 megabytes hardly made a dent in my available hard drive space. I thought about my first 300 baud (30 characters per second) modem I bought about 20 years ago and the fact that the first Macintosh computer I bought about 20 years ago made use of a 400K byte, 3.5 inch floppy drive. (Less than a month ago my wife added an internal 200 gigabyte internal drive to her Apple G4 computer, at a cost of about $165!)

It has been fun to be involved in the computer in education field during much of its early development and during a time of rapid progress in hardware and software. In reading over the "old" editorials (from 1974 to 1985), I was struck by how many of my ideas have proven to be good ideas. (And, of course, I was struck by how many of my ideas have proven to be bad ideas. But I won't dwell on these.)

The October 1977 issue of the Oregon Computing Teacher contained two position papers that I had written and sent to the Oregon Department of Education (and also used in other endeavors). At that time, Oregon may well have been the top state in the nation in its progress toward effective use of computers in precollege education and in education of preservice and inservice teachers. Certainly it had made good progress and had a sense of direction. However, even by then it was evident that there was little leadership coming out of the State Department of Education and the Office of the Superintendent of Public Instruction. Thus, those two editorials made me feel both good and bad at the same time!

One of my all time favorite editorials in the February 1981 *The Saber-toothed Curriculum.* This editorial took ideas from a 1939 book by J. Abner Peddiwell in which he discussed significant failings in our educational system. My editorial took his ideas and recast them into the computer era. In my opinion, they are as fresh today as they were in 1981. Our educational system is doing a poor job in providing students with an education suited to the world they will face as adults.

The absolute core of the "good" ideas is the focus on computers as an aid to problem solving in all disciplines and integrating such use of computers throughout the curriculum. I was absolutely convinced that this was both a right idea and a key part of the future of computers in education well over 20 years ago. I am still more convinced today.

But, the past 20 years have seen rather modest progress in the endeavor to integrate powerful computer tools into the everyday curriculum I find this depressing! My December-January 1983-84 editorial *Logo Frightens Me* editorial captured the essence of the problem that still exists. In that editorial I discussed the difficulties that most teachers who were learning to program in Logo were facing as they were trying to learn to teach problem solving in a Logo environment. There difficulty stemmed mainly from their poor understanding of problem solving and how to teach problem solving.

At the current time, most preservice and inservice teachers still have poor insight into uses of computers as an aid to represent and help solve challenging problems. Our educational system is doing a poor job in helping teachers and their students learn to view the world through "problem-solving-colored-glasses." To a large extent the problem-solving aspects of the content of the preK-12 curriculum have not been changed much by computers.

As I read through the editorials I found a few that made me feel proud. I am especially proud of my October 1984 editorial NEA and Educational Software. There I strongly criticized the National Educational Association for its efforts to enter the software evaluation and sales field. I like to believe that my editorial helped to eventually drive them out of this business.

I find the writing in the December-January 1984-85 editorial *More Harm Than Good* rather interesting. The article talks about recent action in Texas, where a number of Physical Education Teachers were given a two-week computer course in the summer, and then were assigned as the computer literacy teachers in Junior High Schools. I carefully failed to identify the state or any of the specific people who brought about this travesty of education. Indeed, I tried to put myself in the position of this person and provide some possible justification for such a terrible decision. At that time, Texas had recently implemented a computer literacy requirement at the Junior High School level.

I want to comment on my April 1984 editorial that has the title *Equity.* By 1984 it was already evident that there was a significant equity problem in the area of computers in education. According the (Accessed 1/6/05) http://en.wikipedia.org/wiki/Digital_divide, the term digital divide came into use in the early 1990s. This proved to be a good term to use in promoting action to attach a problem that had been evident to many for a number of years.

Many of my editorials addressed the need for substantial increased in teacher education and teacher training in educational uses of computers. I repeatedly have expressed concern that the weak link in the overall system is teacher education. In my opinion, that is still the case.

I believe that this book helps to capture a little bit of the history of the field of computers in education. The data I have seen indicate that in 1983 our schools had about one microcomputer or computer terminal per 125 students. The past 21 years have changed this ratio to perhaps one per 4.5 students. Moreover, the more current of these microcomputers are more than a thousand times as powerful as the 1983 microcomputers. And, we now have Internet connectivity to our schools, and the Web.

Although the field of computers in precollege education has been with us for well over 40 years, in most ways it is still in its infancy. It has a long way to go to reach its potential. In some sense, a summary of our limited progress to date is provided by the following quote from the *Executive Summary of the National Education Technology Plan 2004*, U.S. DEPARTMENT OF EDUCATION, released January 7, 2005.

> This report was undertaken by the staff of the U.S. Department of Education in response to a request from Congress for an update on the status of educational technology. As the field work progressed, it became obvious that while the development of educational technology was thriving, its application in our schools often was not. Over the past 10 years, 99 percent of our schools have been connected to the Internet with a 5:1 student to computer ratio.
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> Yet, we have not realized the promise of technology in education. Essentially, providing the hardware without adequate training in its use – and in its endless possibilities for enriching the learning experience – meant that the great promise of Internet technology was frequently unrealized. Computers, instead of transforming education, were often shunted to a “computer room,” where they were little used and poorly maintained. Students mastered the wonders of the Internet at home, not in school.

Dave Moursund

January 2005

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About the Author

David Moursund, the author of this book, has been teaching and writing in the field of computers in education for the past sixteen years. He is a professor at the University of Oregon, holding appointments in the Department of Computer and Information Science and in the Department of Curriculum and Instruction.

Dr. Moursund's accomplishments and current involvement in the field of computers in education include:

- Author or co-author of eleven books and numerous articles.
- Chairman of the University of Oregon's Computer Science Department, 1969-1975.
- Chairman of the Association for Computing Machinery's Elementary and Secondary Schools Subcommittee, 1978-1982.
- President of the International Council for Computers in Education and Editor-in-Chief of The Computing Teacher.

This book is published by the International Council for Computers in Education, a non-profit, tax-exempt professional organization. ICCE is dedicated to improving educational uses of computers and to helping both students and teachers become more computer literate. ICCE publishes *The Computing Teacher*, a journal for teachers and for teachers of teachers. It also publishes of booklets of interest to educators. Write for a free catalog at the address given below.

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Introduction

The Computing Teacher was born with the publication of the Volume 1 Number 1 Issue of the *Oregon Computing Teacher* in May 1974. At that time Tim Kelly, a Southern Oregon State College professor, was president of the Oregon Council for Computer Education (OCCE), and OCCE was ending its third year of existence. In his president's message Tim Kelly speaks to the role of computers in education as it moves from being the "sideshow of educational freaks" into the mainstream of education. Kelly indicates that, "The Oregon Council for Computer Education has as its overriding mission to bring about in Oregon the realization of the potential that computers have to benefit us as a society."

During its first three years (1971-74), OCCE held annual statewide conferences, developed regional groups and had an Executive Committee that met regularly. Various attempts were made to begin a newsletter or some other type of regular exchange of information among OCCE members. But all were relatively unsuccessful, due mainly to nobody being willing to do the necessary work on a continuing basis.

The National Science Foundation support of summer institutes and academic year institutes for science and mathematics teachers began to wind down in the late 1960s. A new idea emerged—the idea of statewide "systems" grants. Delaware received the first such grant, for science education. Oregon received the second grant, for mathematics education at the K-12 levels. This was a five-year grant, with a one year extension, roughly covering the time span 1971-1977. In those days computers and computer education were generally considered to be part of mathematics education. Thus, the grant had a computer education component. Over its lifetime the grant supported a variety of summer institute and academic year inservice work In computer education. It provided about $3,000 per year to support the work of the Oregon Council for Computer Education. And the grant supported me (Dave Moursund) about half time to be the computer education component director.

Due to this NSF grant, I had the time to foster a large number of computer education projects throughout Oregon as well as funds to help support such projects. I had the time to be actively involved in the work of OCCE. And I had the time to begin the Oregon Computing Teacher.

The first issue of the Oregon Computing Teacher lists Keith Garrett, David Moursund, Mike Neill, Kay Porter and Rusty Whitney as editors. I served as editor-in-chief and did the work of drawing material together, preparing it for publication, and getting it published. The first issue of 42 type-written pages contained a variety of articles, including two by me. I consider them to be my first two editorials and they are included in this collection. They provide interesting insight into what were considered to be the critical computer education issues of 1974. The contrast, or lack of contrast, with more recent times is instructive.

Indeed, that is one of the major reasons for collecting, adding some comments to, and publishing the editorials I have written for the *Oregon Computing Teacher* and *The Computing Teacher*. They provide an historical perspective that might otherwise be lost. When this project was first conceived, the idea was to add comments to each editorial. However, that has not proven to be feasible under the time constraints imposed on the project. Retrospective comments have been added to the first few editorials. Future editions of this material will likely contain additional comments on the editorial materials.

The first issue of the Oregon Computing Teacher closed with the following quotation from Grace Murray Hopper.

> One of the things that bothers me is the way that people regard minicomputers. They are only mini in size. A 12K mini is exactly equivalent to a Univac I and that cost $3 million—a 12K mini costs $3,000—they've forgotten that Univac I handled some of the biggest computations ever done in the Government.
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> From: An interview with Captain Grace Murray Hopper, USNR, Computing, October 10, 1973.

The Univac I was the first commercially available computer (the first one was delivered in 1951). Grace Hopper was an early pioneer in developing the ideas of higher level programming languages, and she is especially known for her work with COBOL. Now, of course, one could substitute “microcomputer” for “minicomputer” In Hopper's statement. We have come a long way since 1951!

This book is dedicated to the computer education pioneers.

Autobiography

When I was in the tenth grade my high school French teacher required each student in her class to write a brief autobiography. As I recall, I didn't enjoy having to do it. I was still more unhappy a year later when I learned that these autobiographies had been placed in our school's student records file, accessible to all teachers and some other people. Thus, it was with some fear that I started on this project to produce an autobiography to accompany my ICCE editorials collection.

Over the years a number of people have provided me with positive feedback about these editorials. Those who know me well recognize that many of these editorials come from deep within me—they represent me. I feel that your understanding of these editorials will be increased by knowing me better. Thus, I have been motivated to work on this autobiography project in the hopes that it will contribute to your understanding of some of the editorials.

The next paragraph contains a summary of the autobiography. The rest of the autobiography covers some of the key events in my professional career and discusses them from a computers-in-education point of view. In it I make a strong suggestion that good self-knowledge is an essential part of being an effective teacher and leader.

Brief Summary

I am the father of four children, the younger two being mixed race adoptions. I have learned much from all of my children and from my wife, who is a psychotherapist. I am currently a professor in the Department of Computer and Information Science and in the College of Education at the University of Oregon. In addition, I am editor-in-chief of *The Computing Teacher* and chief executive officer of the International Council for Computers in. Education. Besides my formal and informal training in mathematics, computer science, education, and administration, I have had considerable informal training and experience in psychotherapy. My professional career is dedicated to improving education. In working to improve education I bring to bear my knowledge and experience in mathematics, computer science, education, administration, psychotherapy and in helping to raise a family. I have a strong work ethic and dedication to making a significant positive difference in the world.

The essence of education is communicating with people. To do this effectively takes good knowledge of people. Among all people, the one you know best is yourself. You can increase your ability to communicate by increasing your knowledge of yourself. The type of introspection involved in writing an autobiography may help you; it has helped me.

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I was born on 3 November 1936 as the second of four children. My father was a PhD mathematician and professor at the University of Oregon. My mother had a master's degree in mathematics and taught as an instructor at the University of Oregon. My father taught me a binary logic approach to almost everything (“Either it will or it won't.” “Either it is or it isn't.”) and a Protestant work ethic (“Do the best that you can.” “Try hard.”). Meanwhile, my mother quietly laid the foundations for my eventually becoming a people-oriented human being.

One of my earliest childhood memories is solving a math problem by counting out the numbers on the slats of a fence in our yard and excitedly running to my father with the answer. It seems clear that I was raised to be a mathematician.

> It is hard to overestimate the value of being raised by a pair of loving parents in a secure and intellectually stimulating environment. Try as they may, our schools cannot begin to duplicate such an environment. The percentage of children having this type of home environment has decreased over the past two decades. This may well help explain declines in standardized test scores.
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> We all bring a legacy from our childhood, from our parents or others that raised us. For many people this legacy includes a set of "drivers" which often work at a subconscious level. Psychotherapists may work with their clients in identifying and dealing with drivers such as Be Strong, Try Hard(er), Hurry Up, Please Me, and Be Perfect. For most people in our particular culture, such drivers are appropriate and useful when followed in moderation. It turns out, however, that many people are indeed "driven" by these drivers and need professional help to open up their adult-life options.

My earliest memory of enjoying school is when I drew a bird while in the first grade. That bird was high point of my artistic development, since over the years my artistic talents have proven to be minimal.

My first memory of real success in school is of the sixth grade. All students in my grade school took some Iowa standard achievement tests, and several of my ratings were at the grade eight or nine level. I was good at math, and proud of it.

In the ninth grade all students had to do a "vocations" unit. In that unit I indicated a goal of earning a PhD in mathematics and becoming a math professor. By that time I had become an avid fan of science fiction — especially space opera. "Doc" Smith (the Lensmen series) was my favorite author. Science fiction continues to be one of my major forms of entertainment.

In the summer after my ninth grade, I took a University of Oregon intermediate algebra course, and in subsequent summers I continued to take university courses. I began to work part time tutoring younger students, and I became involved in grading mathematics correspondence course lessons. My parents graded the mathematics correspondence courses run through the University of Oregon, and they paid me to take over part of this task. Thus, I have been a professional educator since age 14.

> Children are capable of achieving far more than they actually achieve. With appropriate opportunities and encouragement they can progress much more rapidly than otherwise would occur. Here we see major advantages accruing to children who grow up in a supportive and intellectually-rich environment that provides the types of opportunities a typical school cannot provide. Money for private lessons in music, gymnastics and other areas can make a significant difference. Of course, if schools had twice as many teachers (half the current class sizes) they would do much better.

I graduated from high school in 1954 and immediately continued as a full time student in the University of Oregon summer session. The speech course I took that summer was especially valuable in preparing me for the required English composition course in the fall, and for my current career which involves extensive speaking and writing. I recall that writing was not my strong suit, and that it took me nine hours a week to produce the required weekly composition themes during fall term. Spelling was, and still remains, one of my weak points. But my ability to write effectively has steadily improved with practice.

In my undergraduate work at the University of Oregon, I took two years of chemistry, four years of physics and majored in mathematics. At that time I firmly believed that all non-science courses were a waste of time. I was a very good student, graduating near the top of my class.

My social development during high school and college was slow, and it wasn't until my senior year in college that I dated seriously. My image of myself during those years is of a socially-inept egghead.

My first exposure to a computer came in 1959. The University of Oregon did not have a computer, but I got a chance to play tic-tac-toe with a vacuum tube computer located on the Oregon State University campus. The machine was programmed so that it could be beaten, and I won a game. I have a feeling that this early success with computers was quite important. Whatever computer anxiety I might have had was quickly alleviated, since I had demonstrated I could beat the machine.

> It is standardly quoted that "Nothing breeds success like success." I believe that most educators understand this idea. However, most of us are poor at creating environments in which students succeed. Especially in secondary schools and at a higher level we tend to be more concerned with a filtering out process than with helping each student to achieve full potential. It has troubled me to see this occur in mathematics education, and now it is occurring in computer science education.
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> From early on I was a very successful student. For me this had a rather restricted meaning. It meant that I could make an "A" in almost any course. It had little to do with scholarly or informal explorations of anything that was not part of the required school curriculum. Even now I tend to judge people on their academic records, often paying little attention to their broader interests and accomplishments. This is in spite of the fact that I know that academic record is only vaguely related to accomplishment outside of he academic world.

After a short stint in the army (via college ROTC and six months active duty for training), I began my graduate studies in mathematics. The National Science Foundation supported me for three years while at the University of Wisconsin, Madison. My PhD was in mathematics (numerical analysis), completed in January 1963. During that time I audited the first half of one computer course, taught myself to program in FORTRAN, but did not earn any credits in the computer science coursework area. My research involved extensive use of library programs; later I wrote some quite long programs to solve similar and more complex problems. Large scale, second generation computers with extensive libraries of software were readily available at major universities at that time. The computer had become a standard research tool.

It was while I was at the University of Wisconsin that I met and married Janet Peck. We met over a bridge table, and I still enjoy playing bridge. She completed a master's degree in clinical psychology (that is, counseling) under Carl Rogers and a PhD in educational psychology while we were at the University of Wisconsin. Jan and I are still married, and we have four children. Jan is currently a licensed psychologist with a private practice, and she is a professor in educational psychology and counseling at the University of Oregon.

My first computer education experience came in the summer of 1963. I helped teach in a summer computer/math program for gifted high school students. Some of my younger readers might think that 1963 is practically prehistory—certainly at the beginnings of computers in precollege education. That is definitely not the case. For example, Richard Andree, of Oklahoma State University, published an article in 1958 describing his computer work with high school teachers.

> Ten years ago I used to lament the fact that I didn't get a chance to study computer science as an undergraduate and that I chose not to take computer science courses while in graduate school. I could have been involved back in 1954, when computers were only about ten years old, if only I had attended the proper schools and taken the right courses. Now, with increased maturity, I am more appreciative of the education I did receive. It was good.

Upon completion of my doctorate, I received a number of job offers, and I decided to accept an offer to teach and do research at Michigan State University. Key characteristics of that job offer included the following:

1. It was a 12-months job, with half-time teaching and half-time research during the academic year, and with full time research during the summer.
2. It was a joint appointment in a Mathematics Department and in a Computing Center.
3. It allowed me the immediate opportunity to teach graduate courses and to establish a doctorate program in numerical analysis.
4. It paid considerably more than any of my other job offers.

I like to believe that the fourth characteristic was not the dominant one; certainly the other three have been far more important in my life. The opportunity to devote a lot of time to research was an opportunity to study, to sit in on courses, and to continue to make rapid academic progress.

While at Michigan State University, I taught a variety of graduate courses in numerical analysis and helped establish a doctorate program in that area. I was the major professor for the first three students to complete that program. Also, I began to informally audit computer science courses and I learned BASIC. The terminal I used while learning BASIC was hooked up to a computer in Chicago via long distance phone lines. Fortunately, I didn't have to pay the phone bill! Although BASIC is quite a bit like FORTRAN, only simpler, I noticed that it took me a long time to master the language. I am impressed by people who can carry several languages around in their heads, easily switching among them.

But two other more important things happened. First, I taught an undergraduate numerical analysis course for engineers a number of times. I don't recall what book we used, but I found it unsatisfactory and began to write my own. Eventually I joined with a fellow professor Chuck Duris (with additional help from a third professor, Jim Day) to produce a numerical analysis textbook published by McGraw-Hill in 1967. My writing career was begun!

Second, I became bored with full-time summer research. In my second summer at Michigan State University I volunteered to teach a numerical analysis course for high school math teachers in a summer institute program. I distinctly remember the arrogant attitude I had, and my unhappiness with the students who seemed to have forgotten their freshman calculus. Several weeks into the course my boss called me into his office to report that a large group of students had come to him with an ultimatum. The ultimatum was that either David Moursund radically change his expectations or the group would all drop the course. Needless to say, that would have been embarrassing both to me and to my department, and it would have made it difficult for the department to receive further federal funding for such institutes.

Clearly, my first experience in teaching teachers was not too successful. But the next summer I was my own boss, running my own summer institute supported by the National Science

Foundation. That was in the summer of 1966. My heavy involvement in teacher education has continued from that time. From time to time I still run into teachers who participated in these early computer/math summer Institutes. Many are now well-established leaders in the field.

> I do not take lightly to failure ("Do the best you can."). I try to learn from my experiences and to do better the next time. Unfortunately, I often avoid the chance of failure by only doing the things that I know I can do well. I have found this to be a major personal handicap to coping with life in our society.
>
> One driving force in my life is a belief that essentially anything that is being done can be done better. When I attend a lecture, I immediately start thinking about how the material might have been better organized or presented in a more effective manner. More important, I think about how the ideas fit in with my teaching and how to help others acquire the essential ideas of the lecture. I have learned to build upon the work of others.

In 1967 I got the chance to move back to the University of Oregon, with a joint appointment between the Mathematics Department and the Computing Center. I continued to spend my summers running computer/math summer institutes. In the next few years I published a book on flow charting and one on FORTRAN programming. The book on flow charting was specifically based upon my experiences in teaching teachers. It emphasized problem analysis as being at the heart of computer programming. The FORTRAN book was based upon a course that I taught repeatedly at the University of Oregon; its major emphasis was on problem solving.

In retrospect I feel that it was during 1968 that I first began to realize that there Is more to the world than academic research and writing/teaching. Those were troubled times both on campus and in the rest of the world, and I was one of the "silent generation." During the summer of 1968, I organized and ran an intensive two week computer workshop for Eugene teachers. I donated those two weeks' pay to a charitable organization. The change that occurred to me during that time later helped make it possible for my wife and I to decide to adopt two mixed race children. I feel that was one of the best decisions I have ever helped make.

During 1969 I was one of the people who helped start the Computer Science Department at the University of Oregon. I was appointed as its first chairman, serving for a six year period ending in 1975. During that time I administered, studied computer science, taught computer science courses, wrote, ran summer Institutes for teachers, and was extensively involved in both math and computer education on a statewide basis. The state of Oregon had a five-year Centers of Excellence grant from the National Science Foundation for mathematics education that began in 1972. I received half-time support to be the computer component director. I was involved in dozens of computer and computer/math projects throughout the state and at all grade levels.

In 1970 I was responsible for the University of Oregon's establishing a master's degree in computer science education. I believe this was the second such program established in the United States. The next year, as a consequence of my computer education work, the University of Oregon admitted its first student to work for a doctorate in computer science education. I have had a steady stream of very high quality doctoral students since that time.

> One of the joys of my life is working with graduate students in computer education. The quality of computer education students attending the University of Oregon is outstanding. These students, along with the faculty and general university environment, create an intellectually stimulating and very enjoyable place to work. Certain views from the ivory tower are beautiful.

In the summer of 1971, I was one of the people who attended a small meeting to talk about forming a statewide computer education group in Oregon. That meeting led to the creation of the

Oregon Council for Computer Education during a fall, 1971 conference. Bill Dorn of the University of Denver was the keynote speaker at that conference. I distinctly recall my feelings that Dorn said what I had been saying, and that I could have said it as well as he did. At that time I made a conscious and reasoned decision to become involved on the national scene, so that I could become an "out-of-state expert."

This was definitely a major turning point in my professional career. It lead to my becoming actively involved with the Association for Computing Machinery and getting to know many national leaders in computer education. This ACM work continued for many years and led in 1979 to their creating an Elementary and Secondary Schools Subcommittee. Under my leadership this subcommittee ran off in all directions, but eventually managed to produce some useful reports. I served as chairperson of this subcommittee from 1979 until 1982.

During 1972-77 the National Science Foundation Centers of Excellence grant provided about $3,000 per year to the Oregon Council for Computer Education and provided me with half time support to work on computer education activities. I decided to start a publication to help support the work of the Oregon Council for Computer Education. The first issue of the *Oregon Computing Teacher* was published in May 1974. At that time I did not even dream that this publication would become *The Computing Teacher* in 1979, and that I would found the International Council for Computers in Education.

> I am very strongly devoted to the International Council for Computers in Education and its work. I expect that my work with ICCE will turn out to be my most important academic accomplishment.

The years 1975-77 were bitter sweet but full of personal growth. In 1975 I was denied promotion from the rank of associate professor to the rank of full professor. My interpretation of this was that the University of Oregon administration had little appreciation for my work in computer science education. Although reconsideration of my case led to promotion in 1976, I was definitely alienated toward the university. I began to spend less time working directly on university-specified projects (such as teaching, committee work, etc…) and much more time on participating in national meetings, writing and speaking. In 1977 I began the writing of two books for junior high school students, and I "practice taught" for a short while in a junior high. Karen Billings was my mentor in learning about junior high teaching as well as co-author of these two books.

During the 1976-77 academic year, I became involved in the personal growth/human potential movement. This was another major turning point in my life. My involvement in the personal growth/human potential movement has been mainly through a nonprofit organization called Quest. Through Quest I have received many years of training both as a participant and as a leader. I have had extensive training and experience in Active Listening, Transactional Analysis, Gestalt Therapy, Neuro Linguistic Programming, Stress Reduction, and various related topics. All of this has been at an amateur, "volunteer" level. It has changed my life, and it has given me considerable insight into roles that non-professionals can play in this and other fields.

I first tried to use some of my personal growth/human potential knowledge and skills in a computer workshop during the summer of 1978. I led the participants in a "guided fantasy" trip experience, moving through a precalculator/precomputer world to the present to a future in which calculators/computers were readily available. A guided fantasy bears a resemblance to a guided daydream. It can be an effective aid to communication, instruction and personal growth.

My 1980 book, *Teacher's Guide to Computers in the Elementary School,* contains several exercises patterned after ideas I learned in Quest. These simple guided fantasy exercises are designed to help teachers overcome calculator/computer anxiety. In the past couple of years I have begun to draw more of these personal growth/human potential ideas into my teaching and speaking. I have become convinced that it is appropriate and fruitful to do this in leadership development workshops and graduate seminars for computer education students.

> A computer education leader must be a skilled communicator. My work in psychotherapy has added to my communication skills. More important, however, is that a leader must continue to learn and to grow. Whatever the direction, this increased knowledge and skill can contribute to one's effectiveness as a leader.

By 1979 I had grown weary of publishing the *Oregon Computing Teacher.* The problem was the amount of work involved relative to the audience reached. The paid circulation was about 300, and the total circulation less than 500. I suggested to the Oregon Council for Computer Education that they should begin looking for another editor-in-chief. Then Robert Albrecht of *Calculators/Computers Magazine* phoned me to say that that periodical for educators was ceasing publication. We worked out an agreement that resulted in the May 1979 issue of the *Oregon Computing Teacher* having the word “Oregon” crossed out and replaced by “The.” This was the first issue of *The Computing Teacher.* It carried paid advertising and some of the articles from the *Calculator/Computers Magazine.*

During the summer of 1979, the International Council for Computers in Education was officially incorporated. One of the main reasons was to provide a corporate structure for dealing with the financial aspects of *The Computing Teacher.* The second goal was to create an international organization that could foster appropriate Instructional use of computers throughout the world. The Oregon Council for Computer Education became the first Organization Member of ICCE, and the Computer-Using Educators (California) became the second Organization Member. During the early 1980s very rapid progress occurred in paid circulation of The Computing Teacher, in the number of Organization Members, and in the quality of the publication.

The University of Oregon has been actively involved in precollege computer education for many years. My work has contributed to the gradual involvement of many College of Education faculty. During the early 1980s this interest blossomed and gained the support of the Dean of the College of Education. The Dean's support led to the creation of a Center for Advanced Technology in Education and to the “Computers: Extensions of the Human Mind” conference offered in the summers 1982-1985. The University of Oregon is now internationally recognized as an excellent place to study and do research in computer education. It is attracting very high quality graduate students and visitors. It is exciting to be involved in this work.

The International Council for Computers in Education grew very rapidly from 1979 through 1983. Then it entered a period of much slower growth—and then a period of consolidation. Over all of this time period my goals have been to make ICCE and *The Computing Teacher* into a successful, self-sufficient operation. That is gradually occurring. ICCE has a high quality professional staff that is responsible for day-to-day operations and for its publications. Bobby Goodson took over the ICCE presidency from me during the summer of 1984. (I was president 1979-1984.) The ICCE Board of Directors is now elected through the Council of Representatives and is broadly representative of computer educators throughout the United States and Canada.

During 1983 I suggested and began to implement the idea of ICCE having Special Interest Groups. I expect that the SIGs will continue to be my major interests for many years to come. Through the SIGs, ICCE will be able to involve a great many computer educators in ICCE's overall operations. This will further strengthen ICCE and make a significant contribution to education.

During 1984-85 I have been on sabbatical leave from the University of Oregon. This has allowed more time for writing, travel and thinking. I have devoted substantial effort to designing and implementing a “Leadership Development Workshop” for computer education leaders. In this type of workshop I get to work with many of the top computer educators in a state, province, or other large region. I find it tremendously exciting and rewarding. Through such workshops I feel I can continue to grow professionally and I can make a significant contribution to education.

David Moursund (May 1985)

Editorials And Comments

Editorial # 1. Where is Instructional Computing Headed? V1 N1

David Moursund

Editorial # 1 (Vol. 1 No.) May 1974

Oregon Computing Teacher

The *Oregon Computing Teacher* is designed to help foster the growth and development of instructional uses of computers. In this article we will discuss briefly some of the major goals, and major problems, of the instructional computing field. Many of the articles appearing in the future issues of the OCT will be designed to help solve some of these problems.

The instructional uses of computers can be divided into teaching about computers and teaching using computers. The Oregon Council for Computers in Education has addressed the problem of appropriate goals for the instructional computing field. At its December 1, 1973 annual meeting, OCCE approved a general goals statement.

1. All students should become "computer literate" at a level commensurate with their overall level of education.
2. All students having a personal and/or professional need for additional knowledge in computer science (such as computer programming) should have adequate opportunity to gain the desired skills and knowledge.
3. Teaching using computers (computer assisted instruction, computer augmented learning, and computer managed instruction) should occur whenever computers are an appropriate and educationally sound aid to the overall instructional process.

The first two goals have broad implications, especially at the pre-college level. Computer literacy refers to a general (non-technical) understanding of the capabilities, limitations, and implications (social implications, vocational implications, etc.) of computers. Work toward developing a student's level of computer literacy should begin in the grade school. As a simple example, when a child is learning to add, subtract, multiply, and divide, the child could also be learning that machines (for example, electronic calculators) can perform these same operations, often cheaper and more accurately than people.

The Conference Board of the Mathematical Sciences, in its April 1972 publication, "Recommendations Regarding Computers in High School Education," recommended that a junior high school course in computer literacy be designed and become part of the regular junior high school curriculum; alternatively, the teaching of computer literacy could be integrated into secondary school courses at all levels.

It is standardly accepted that is possible to teach computer programming and other aspects of computer science at the grade school level. Such courses are not uncommon in junior high schools, and are very common in high schools. What should the content of such courses be, and what are some of the necessary qualifications to teach such courses?

Teaching using computers is one method of helping to develop computer literacy as a byproduct of teaching some subject matter. Currently, in Oregon, there is considerable use of computers in simulations, gaming, and "canned program" problem-solving modes. Eventually, projects like PLATO (see the article by Tim Kelly in this issue) promise to have massive impact upon education. To date, however, teaching using computers has not proven economically feasible on a wide scale basis and thus is having a relatively minor impact on education.

The problems of instructional computing are many. A few are listed below:

1. There are no precise, generally agreed upon, detailed goals for instructional computing at the various educational levels.
2. Hardware and software facilities availability for instructional purposes are grossly inadequate in many schools, both at the pre-college and the college levels. We do not have good insight into what constitutes adequate facilities at various educational levels.
3. Most teachers have very little "computer literacy" themselves and thus can do very little to raise the level of a student's knowledge of computers.
4. Few school administrators (especially at the pre-college level) have an understanding of the computer instructional field, and thus cannot provide leadership in this aspect of their school's activities.
5. There are very few good quality instructional materials in the computing field designed for use at the pre-college level.
6. Many aspects of teaching using computers are not yet economically feasible. Those aspects which are economically feasible are not being fully exploited due to lack of trained teachers, adequate materials, and adequate computer facilities.

What You Can Do Now

Probably the most important short term goal should be to attempt to raise the overall level of students' and teachers' computer literacy. As a teacher, administrator, or person interested in instructional uses of computers, you can help by:

a) Increasing your own knowledge (for example, by reading this publication).

b) Convey your knowledge to others. Talk about computers on an everyday basis in all of your classes, in your home, to your colleagues and friends, etc. Set as a personal goal that you will bring up the topic of computers at least x times per day (where x is a positive integer).

Retrospective Comments Written in 1985

The comments below were written in 1985, and refer to the May 1984 article, *Where is Instructional Computing Headed?*

While not actually designated as an editorial, this article which appeared in the first issue of the *Oregon Computing Teacher* has the characteristic pattern of many of my editorials. It contains solid, current information for computer education leaders, and it suggests problems faced by the world of computer education. It suggests things the reader can do to help solve these problems.

The list of three goals for computer education is particularly interesting. The first student to enter my doctorate program in compute science education was admitted in the fall of 1971. During the 1972-73 academic year I ran a graduate seminar in computer education that included three students who eventually completed their doctorates in computer science education. During the spring quarter this graduate seminar addressed the topic of what are suitable goals for computer education. The resulting goals were adopted by the Oregon Council for Computer Education and appear in the "Where is Instructional Computing Headed?" editorial.

The three goals, with slight modification of vocabulary, have been adopted by innumerable school districts during the past ten years. Goals 1 and 2 have remained virtually unchanged. Goal 3 is typically split into two goals. Computer-assisted instruction and computer-managed instruction are often combined into what we now call computer-assisted learning. The computer-augmented learning is what we now call use of computer-as-tool. Robert Taylor popularized the "tool" terminology in this book *The Computer in the School: Tutor, Tool, Tutee*, published in 1980.

The use of computer-as-tool has grown as computers have become more readily available. The list of problems mentioned in the article/editorial are still amazingly current.

Editorial # 2. Computer Education's Paradox. V1 N1

David Moursund

Editorial # 2 (Vol. 2 No.?) February 1975

Oregon Computing Teacher

There is a standard pun based upon the fact that the word paradox sounds somewhat like "pair of dogs." The computer education field has innumerable problems; two of them (a pair of dogs) will be discussed here.

1. How much dependency upon electronic computational devices is appropriate for the typical student?
2. What does the typical teacher need to know about computer education?

One manufacturer of electronic calculators estimated that 7.5 million calculators were sold in the United States in 1973, that 15 million will be sold in 1974, and that 30 million will be sold in 1975. This manufacturer predicts that the "replacement" market for calculators will be 30 million per year after 1975.

Problem 1 above has many aspects. With respect to electronic calculators we are finding a very rapid growth in dependence upon these machines. It is seriously suggested by some leading mathematics educators (for example, Eugene Maier, Director of the Oregon System of Mathematics Education) that every student be provided with an electronic calculator. This would produce an immediate and revolutionary change in the nature of mathematics education, particularly in the grade schools.

It will not be too many years before we can make a nearly similar suggestion with respect to electronic digital computers. A significant percentage of what is taught in secondary school and beginning college mathematics is straightforward manipulation of symbols (numeric and algebraic) of a sort that a computer can generally do more accurately, faster, and cheaper than a person working by hand. I will cite two examples of current typical uses of computers in this mathematics education setting.

First, it is common to have students learn Cramer's rule and to write computer programs to solve a system of two simultaneous linear equations in two unknowns using Cramer's rule. Part of the paradox here is that Cramer's rule is almost a useless tool when one gets to the computational aspects of real-world-sized linear systems. But consider also that linear system solvers (subroutines in the program library) or simple use of the MAT instructions in BASIC) are readily available to anyone who has access to a computer. Moreover, computers are readily available to anyone in the "real world" (in the US, at least) who would need to solve a linear system.

As a second example, consider the quadratic equation. As an exercise in writing computer programs, solving a quadratic equation has some merit. But so does solving a cubic, quartic, or a general polynomial equation; indeed, maybe one should look at nonlinear equations. The point is, we have a tool that can be used to attack "real world" and worthwhile type problems. We have general methods, some of which are quite easy to learn, which are suited to attacking these problems. But we persist in teaching the same old stuff! We do not build upon, or hardly begin to use our super powerful computer tool.

The problem of teacher knowledge also has many aspects. It is evident that eventually computer assisted instruction and computer managed instruction will require very little teacher knowledge about computers. But consider some of the other aspects of computer education, such as computer augmented learning, teaching computer literacy, and teaching computer science. Thus it seems reasonable that study of the capabilities, limitations, current and future uses, and implications of computers would be standard in every science and social science course. That is, every teacher in these fields should know enough about computers to make a "data based" decision about what aspects of the computer field to bring into his courses of instruction. Very few teachers, nor the writers of their textbooks, have this level of knowledge.

Finally, consider the fact that in Oregon we have formal courses about computers (typically these are computer programming courses) available in over half of the high schools. The analogy that comes to mind is that we also have courses in general science, biology, chemistry, and physics. How much does a teacher need to know to teach an adequate, modern course in biology, chemistry, or physics? How many teachers of computing at the secondary school level have a comparable knowledge of computer science???

Retrospective Comments Written in 1985

The comments below were written in 1985 about the article, *Computer Education's Paradox.*

To a large extent this short article, which appeared in the first issue of the *Oregon Computing Teacher,* is merely a continuation of the previous editorial/article. It contains the now-classical argument that the teacher of computer courses should have training and experience in computer science comparable to what other high school teachers have in the disciplines they teach. In 1984 the Association for Computing Machinery adopted recommendations for the proper preparation of secondary school teachers of computer science. These recommendations strongly parallel the certification requirements most states follow in other academic disciplines.

As noted in my autobiography, my doctorate and early research work were in the branch of mathematics called numerical analysis. In numerical analysis one studies how to develop effective computerizable procedures to actually solve a wide variety of mathematics problems. The solution of polynomial equations and of systems of equations are classical problems numerical analysis. This editorial/article suggests that calculators and computers could have a significant impact the content of mathematics instruction. (Remember, computer-as-tool used to be called computer-augmented instruction.)

Progress in integrating computer-as-tool into mathematics instruction has been painfully slow. A comparison of 1974 and 1984 high school mathematics texts suggests almost no progress. An analysis of calculator usage is instructive. Initially people argued against calculators because they were too expensive and not readily available. Eventually those arguments became baseless, but schools did not rush to adopt calculators. Rather, there has been continued resistance to their formal integration into the curriculum. This is true in spite of the strong backing of the National Council of Teachers of Mathematics for integration of calculators into the mathematics curriculum.

However, calculators have come into general use. Many students use them at home. Use is often allowed (even encouraged) in science courses. And many secondary school math teachers allow or encourage calculator usage. It is sometimes suggested that this same (backdoor approach) will also occur for computers. Calculators are quite cheap relative to computers, so it is not so obvious that this analysis will prove correct. However, in 1985 the number of general-purpose microcomputers per student in homes seems to be about ten times the number available in schools. An April 1985 study showed that 31 percent of Eugene, Oregon high school students have access to a general purpose microcomputer at home. This figure is about ten times the computer availability in Eugene's high schools.

Editorial # 3. President Reports. V3 N1

David Moursund

Editorial # 3 (Vol. 3 No. 1) October 1975

Oregon Computing Teacher

The organizational meeting which officially brought OCCE into existence was held November 5-6, 1971 at Lane Community College. The agenda for that meeting included:

1. OCCE Structure - Mike Neill
2. The Systems Approach and OMEC - Dave Moursund
3. Oregon Board of Education and HB 1103 - Jim Henderson
4. The Need for a Computer Instruction Specialist Marv Covey
5. Information Dissemination - Rusty Whitney
6. Computing Curriculum - Jack Allan
7. Teacher Training - Jim Norton
8. Evaluation Criteria - Jim Gunderson
9. Computing Position Paper - Jerry Cody

Four years later we find that considerable progress has occurred, but that many of the initial problems still persist. A few of the continuing problems include:

1. What should the structure of OCCE be? (Is it strong enough to last after OMEC funding ceases?)
2. Will and/or can the state provide leadership in the computers in education field? (The latest effort is the Oregon Department of Education's Commission on computers which was discussed in last May's issue of the OCT.)
3. Most school districts, and the state, still do not have an instructional computing specialist.
4. Information dissemination has been helped by the creation of Creative Computing, PCC, and the OCT. Many new books and other publications (for example, newsletters from H-P and DEC) have also helped. But it is evident that this problem is not solved.
5. Although we have better insight into suitable computer curriculum for pre-college levels, little uniformity of implementation exists, and many, many schools still make little or no instructional use of computers.
6. Teacher training has made giant strides in Oregon, partly due to substantial OMEC funding. But Oregon's system of higher education still produces new teachers who are immediately in need of remedial

training in the instructional computer field. The problem of teacher certification in the area has not been seriously attacked.

The list could be continued, but is long enough to make the point that OCCE's task has just begun. Let me end by focusing on a specific and immediate problem. The *Oregon Computing Teacher* can be an important unifying factor and information dissemination tool for Oregon educators interested in instructional use of computers. To make this continue to happen over a period of years we need some semi-permanent, serious contributors. A few examples, of possible OCT sections or features which are in need of such volunteers includes

1. The Problem Corner. Each OCT issue should include several problems of possible interest to students and teachers at a variety of levels.
2. Computer Personalities. Each issue of OCT could contain an extensive interview with one or more educators who are
3. Computer Curriculum. There are several schools in Oregon that have good instructional computing programs. These should be written up in some detail, including course descriptions, hardware and software, teachers, etc.
4. Sources of Information. We need regular contributions of movie reviews, book reviews, etc.

Again, the list could be continued. If **you** have ideas of what belongs in OCT, why not volunteer to make it happen??

Retrospective Comments Written in 1985

The comments below were written in 1985about the article *President Reports.*

I served as president of the Oregon Council for Computer Education during 1975-76, while continuing in my position as editor-in-chief of the *Oregon Computing Teacher.* While not strictly an editorial, the “President Reports” captures the flavor of some of the key issues faced by computer education in 1975.

The Oregon Department of Education's Commission on Computers was important news in those days. Eventually the Commission was established and held a sequence of meetings. It adopted a set of goals for computer education quite similar to those listed in Editorial Number 1. Then the Commission asked the Superintendent of Oregon Education to allocate funds to begin to implement the statewide goals. His response was to abolish the Commission! That was my first solid introduction to the political realities of our educational system. I remember the feelings I had—I was amazed, angry, disappointed. How could any educational leader be so short sighted?

Creative Computing, David Ahl's publication, began in the fall of 1974. David Ahl was one of the pioneers of computer education, and *Creative Computing* has been a fantastic success. It has been a pleasure to know David Ahl and to see his contributions both to the computer field in general and to computer education.

I find it interesting that this editorial/report mentions the idea of districts having instructional computing specialists. There were very few such positions at the time. Even now there are relatively few people who hold a paid position as computer coordinator for a school district in Oregon. But gradually this idea has gained acceptance, so that nationwide there are quite a few paid computer coordinators. ICCE has recently started a Special Interest Group for Computer Coordinators. A number of local computer coordinator groups now exist, and some of them are in the process of becoming chapters of ICCE's Computer Coordinator SIG.

Also of interest is the question of the structure of the Oregon Council for Computer Education and possible contents of the Oregon Computing Teacher. By fall of 1975 the original editorial help had faded, and I was carrying most of the publication burden. My plea for help went largely unanswered. It seems to be quite difficult to organize volunteer help to publish a good quality, statewide newsletter.

Finally, we have the relatively optimistic comment about computer-oriented teacher education in Oregon. This was at the height of the five-year National Science Foundation grant for math education in Oregon. In its peak year, that grant funded about twenty small computer education projects in Oregon—mainly teacher training activities. Eventually, of course, the funding ran out. The long-term legacy was a core of leaders, educators who had been involved in helping other educators to learn about computer education. Added to this, of course, were the large numbers of educators who had been exposed to computer education.

By 1975 few people had given serious thought to the possible certification of computer teachers. Oregon, through its Commission on Computers in Education, could have led the nation in addressing this issue. Instead, now ten years later, Oregon has not yet seriously addressed the computer education of teachers at a statewide level. Meanwhile, teacher education institutions in Oregon continue to graduate many computer illiterate teachers.

Editorial # 4. President Reports. V3 N4

David Moursund

Editorial # 4 (Vol. 3 No. 2) February 1976

Oregon Computing Teacher

I spend essentially all of my academic time working on computers in education ideas, materials, curriculum, etc. Recently I received a copy of *Computer Power and Human Reason* by Joseph Weizenbaum. I was very impressed by this book, and feel that all computer educators should read it. A review is given later in this issue of the OCT.

In looking back at the year so far a few notable events come to mind. Perhaps most significant is the continued rapid change in electronic digital hardware.

1. The OCCE-OAEDS annual meeting held this last fall at Lane Community College seemed to be very successful. I was particularly impressed by the two feature speakers. Keith Britoon gave several presentations on microcomputers while Donn Parker gave several presentations on computers and crime. The general message is that the cost of microcomputers is decreasing very rapidly, and hence that millions of them are being (will be) sold, while computer assisted crime is on the increase.
2. The OCCE-OAEDS annual meeting next fall will be held in Portland during the NAUCAL conference. What this means is that the line up of speakers activities, etc. should be bigger and better than ever.
3. Electronic calculators are still decreasing in cost and increasing in features. A hardware engineer at Tektronix recently predicted that the 8-digit models would eventually sell for under $5. Last week I read a similar prediction by a high official in a large company that manufactures calculators.
4. The $20 electronic digital watch is here. Texas Instruments recently announced this retail price on a new line of electronic digital watches. This very drastic decrease in price has occurred more rapidly then predicted, and more rapidly than occurred for calculators.
5. Microcomputers are rapidly decreasing in price and increasing in capability. Although more complicated than a calculator or watch, the analogy is good. We can look for complete computers to become very cheap; BASIC seems to be the standard higher level language of microcomputers.
6. Elementary schools are beginning to purchase classroom sets of calculators. What happens when every student is given a calculator? Although little is known about the answer, it is clear that we are moving in that direction. Two of the articles in this issue of the OCT deal with calculators in the elementary school.

7. Tektronix is marketing a 65 pound computer graphics system. It is a graphics terminal with a built-in microcomputer. Its language is BASIC, and its price is $6,995. This puts computer graphics into a price range where many schools can afford it. Indeed, the purchase price for this BASIC system with magnetic tape cartridge auxiliary storage compares very favorably with current per-terminal costs of *METCOM, OTIS,* etc. Add to this the interactive graphics capability which is not currently supported by the Hewlett-Packard systems in Oregon, and we see that a significant new factor has entered the computer education world.

Retrospective Comments Written in 1985

This editorial/report gives an historical glimpse of certain aspects of computer hardware and computer education. In retrospect, I believe it also is reflective of a major turning point in my life. The book *Computer Power and Human Reason* by Joseph Weizenbaum had a profound impact on me. In the book Weizenbaum expresses fears about current and possible future misuse of computers. More important to me, perhaps, is that Weizenbaum was willing to express such fears in public. For me he provided a model of a well-established scientist taking a stand on important national issues and expressing his feelings on these issues. It is all right for scientists to have feelings and to express their feelings.

The editorial/report mentions the planned October 1976 NAUCAL/OCCE/OAEDS conference. NAUCAL was the National Association of Users of Computer Applications in Learning, while OAEDS is the Oregon Association for Educational Data Systems. NAUCAL was a group of people who split off from the national AEDS group in order to better foster instructional uses of computers. Eventually NAUCUL was absorbed back into AEDS. This is historically quite interesting because NAUCAL existed well before the International Council for Computers in Education began. If

AEDS/NAUCAL had been more successful in meeting the needs of instructionally oriented computer users, ICCE would never have been established.

From quite early on, OCCE and OAEDS cooperated closely and considered the possibility of merger. Eventually merger was considered and a vote was held, in which OAEDS voted for merger but OCCE did not. There was a perceived schism between the administrator-dominated OAEDS and the teacher-dominated OCCE, and OCCE members were fearful that school administrators might come to dominate the proposed organization. That was despite the fact that OCCE was at least a half dozen times as large as OAEDS.

The issue of calculators was a hot topic in 1975-1976, and the editorial/report mentions a prediction that calculators would eventually sell for under $5. That prediction proved quite accurate. Indeed, one can now sometimes find a sale on solar cell-powered calculators at under $5. And remember, we have had a lot of inflation since 1976.

The $20 digital watch was a major breakthrough. Previous minimal prices had been in the $50 range. Now one can purchase such watches for well under $5.

Microcomputers were just beginning to hit the market place. A few Apple I microcomputers were sold in 1975 and the Apple II came out in 1976. By the end of 1977, about 7,000 Apple microcomputers had been sold. The eventual overwhelming success of Apple and others tends to make us forget some companies that were also involved during those early years. The Tektronix system mentioned in the editorial/report was a microcomputer that provided a major breakthrough in the price of computer graphics. But at $6,995 it was priced well above the Apple and other early microcomputers that eventually won substantial market shares.

Editorial # 5. Calculator and Computer Education for Elementary School Teacher Certification: A Position Paper. V5 N1

David Moursund

Editorial # 5 (Vol. 5 No. 1) October 1977

Oregon Computing Teacher

Note written in 1985: This paper was prepared in January 1977 for several purposes. It was presented to the Commission on Computers in Education, which is an Oregon State Department of Education commission concerned with the use of computers in grades K-12 and in the community colleges. It was presented to the Oregon Teachers Standards and Practices Commission, which sets teacher certification requirements. It was¯presented to a committee at the University of Oregon that is revising the elementary teacher education program. This paper was also distributed to the ACM Teacher Certification Subcommittee. Finally, this paper is an appendix in a report presented in June 1977 to the Education Board of the ACM. That report was approved "in principle." A more easy-to-read version of that report will be presented to the ACM Education Board in Fall, 1977.

The time has come to require a substantial study of calculators and computers by all preservice elementary school teachers. This document presents arguments to support that position and a discussion of the major content that should be included in the teacher training program. Two approaches to implementation are also discussed.

Why?

Calculators and computers are readily available in the "real-world" to all who have need of them as aids to problem solving. Their cost is now such that they could be made available to elementary school students without imposing an undue burden upon the school budget. We will discuss the cost issue briefly, since in the past it tended to dominate in a discussion of possible roles of calculators and computers in elementary school. Then we will give a sequence of arguments supporting the position that preservice elementary teachers should be required to study calculators and computers.

The cost of calculators and of computer hardware has dropped very rapidly in recent years, mainly due to progress in the area of large scale integrated circuitry. Twelve years ago an electromechanical desk calculator that could add, subtract, multiply and divide cost about $1,500. Now a pocket electronic calculator with equal or greater capability costs less than one percent of this.

Until recently the cost of having one computer terminal in a classroom was approximately $4,000 per year. Now one can purchase a portable self-contained computer for under $2,000. A factory-built self-contained computer with keyboard, CRT, and BASIC software for $595 is now available, wit first deliveries expected in late 1977. Such a machine will give years of service, at a relatively modes upkeep and repair cost per year.

To put these figures into some sort of perspective, suppose that an elementary school of 500 students could put 1% of its budget each year into calculators and computers. In the first year, it could purchase four to five classroom sets of good quality calculators, and two or three complete computers. In subsequent years, it could maintain or increase this number of calculators, replacing worn out ones as needed. And it could maintain the computers, adding one or two new ones per year until a stable level of perhaps 6 to 8 machines was reached.

We will present seven arguments to support the position of requiring preservice elementary teachers to study the computer field. No attempt has been made to arrange them in order of importance.

1. College graduate computer literacy. An elementary teacher is a college graduate, and should be at least well educated as the average graduate. There is substantial support among people knowledgeable in the computers and education fields that all people should become computer literate at a level commensurate to their level of education. Thus, for example, there is strong support for computer literacy instruction at the secondary school level. A significant percentage of college students are now taking one or more computer courses. But these students tend to be clustered in business, the sciences, librarianship, engineering, etc. In Oregon at least, preservice training of teachers has largely ignored the computer field.

2. Because calculators exist. There are changes that could/should occur in the elementary school mathematics curriculum merely because calculators exist and are readily available in the real-world. A high level of paper and pencil arithmetic computational skill is of considerable less importance than it once was. Now more important is increased skill in understanding problems, formulating procedures for solving problems, and utilizing the results of computations involved in the problem solving process. Exact and approximate mental arithmetic, and good “number sense” have increased in relative importance. The preservice elementary teacher needs to study the calculator and role of calculators in problem solving to clearly understand the ideas just expressed. Also note that calculators emphasize decimal arithmetic, as does the metric system. These suggest a decrease in importance in learning to do arithmetic on fractions.

3. Teaching using calculators. Argument number six concerns teaching using computers, which is a fairly well understood concept. A calculator is merely a limited-purpose computer. It can be an inexpensive and effective aid to instruction. One can design a calculator-like device specifically for instructional use. For example, for under $20 one can buy a machine designed to function as an automated flashcard machine, to provide drill practice on number facts. Alternatively, one can use an ordinary calculator. Even the simplest 4-function inexpensive calculator can serve as a feedback mechanism. Possible uses here include “trial-and-error,” and “examine special cases and make a conjecture.” These are very important ideas in mathematics. More mundane is use of a calculator as an answer checker. For example, suppose one were practicing making mental estimates on the product of two 2-digit numbers. A calculator could be used to determine

exact answers and percentage errors. In total there are a large number of places in the math curriculum where an inexpensive calculator can be an effective instructional aid.

4. Teaching about calculators. A calculator is a device that can automatically carry out various mathematical procedures (such as x, +, –, ÷, %, sin, cos, log, etc.) The concept that an inexpensive machine can serve as the agent to execute a mathematical procedure is very important. Since those machines are a common part of the real-world, it follows that students should learn about their capabilities, limitations, applications and implications. That is, they should become calculator literate. This sort of instruction is most effective if it is integrated into other instruction — in particular, into the students' entire career-long mathematics curriculum. Keep in mind also that the word calculator refers to a range of devices, including the simplest $5 4-function pocket calculator and ranging up to programmable multifunction machines that rival early computers in capability. Programmable calculators are now available for well under $100, and multifunction calculators are available for under $20. The calculator is not a trivial item of study.

5. Because computers exist. The computer is an aid to problem solving in every academic disciple. Through its use there have been massive changes in existing disciplines, as well as emergence of new fields like computational linguistics and artificial intelligence. The computer could/should have a significant impact upon the elementary school curriculum merely because it is a readily available tool in the real world. To cite a specific example, many elementary schools include some career or vocational orientation/exploration. But by the time elementary school students come to seek a career, massive changes will have occurred due to computers (among other things). The teacher should be aware of how computers are affecting careers and educational training needs, and orient students to this changing world concept. To cite another example, computers and related telecommunications equipment have had a massive impact upon communication, and upon information storage, processing and retrieval. Elementary school students should be oriented towards a world in which computer assisted communication and information retrieval are commonplace.

6. Teaching using computers. The computer can be viewed as an interactive educational medium, incorporating a combination of ideas from printed material and TV. The field of teaching using computers has been studied and experimented with for many years. The PLATO project, which is undergoing wide scale national testing now, began in 1959. Overall, the field is divided into three parts. In computer assisted instruction (CAI) the computer is used to present new material and/or for drill and practice in material students have previously studied. In computer augmented learning (CAL) the computer is used as an aid to problem solving as one studies the problems and tools in a variety of disciplines. In computer managed instruction (CMI) the computer is used for diagnostic testing and prescription, and for record keeping. The main barriers to extensive use of CAI, CAL, and CMI at the elementary

school level are cost, teacher knowledge, and courseware. The cost of computer hardware continues to decrease, while the cost of teachers using computers will be commonplace, and already it is not at all unusual to find an elementary school making instructional use of computer.

7. Teaching about computers. It is not yet clear what elementary school students should learn about the capabilities, limitations, applications and implications of computers. We do know they are capable of learning a great deal—either of correct information or of incorrect information. Currently most of what they learn is incorrect, since it comes from TV, movies, and comics. Most elementary teachers do little to correct the misconceptions that develop, since their own knowledge is very limited. General aspects of computer literacy (capabilities, limitations, applications, implications) could/should be included in each topic studied at the elementary school level, since the computer is an aid to problem solving in every academic discipline. More difficult is the question of whether students should be taught to **use** a computer as an aid to problem solving, and/or to actually program a computer. There are plenty of studies to show that this can be done, and that it has a positive impact upon the school program. However, this is not apt to become commonplace in the near future.

What Teachers Should Know

The elementary teacher should be calculator and computer literate, especially in those areas related to education. The teacher should be able to understand each of the arguments given in the previous section. If he agrees with the argument he should be able to expand upon it. If he disagrees, he should be able to refute it. In any event he should have had a considerable amount and variety of experience with calculators and computers in an educational environment. He should be familiar with some of the computer hardware and software available for instructional use, and with some of the courseware (books, units of study, etc.) that are available.

Implementation

There are two standard approaches to developing calculator and computer literacy. One approach is via integration of all the desired materials and experience into existing courses. The other is through a self-contained "Computer Literacy for Elementary Teachers" course.

The former approach is theoretically possible, and would probably be the most desirable if it could be done. The preservice teacher would be immersed in a calculator/computer rich environment, and taught by computer literate teachers. Use of CAI, CAL, and CMI would occur in various courses taken by the preservice teacher. The Education Media course required of the preservice teacher would include a substantial study of calculators and computers as media. The Math for Elementary Teachers courses would use calculators and computers regularly, and they would be a fully integrated part of the course. Science courses taken by the preservice teacher would discuss the role of computers in science, and make use of calculators and computers when appropriate. Social studies courses would discuss social implications of computers. Textbooks used by the preservice teacher would include material on calculators and computers and would contain exercises that require their use. Computerized information retrieval systems would be as readily available as are other aspects of a modern university library.

An environment somewhat like this exists at Dartmouth College and perhaps at a few other select schools. But it certainly does not exist at any teacher training institution in Oregon, nor at most schools in the country. Thus, for the foreseeable future the only reasonable alternative is the self-contained computer literacy course for teachers.

The development of such a course has already occurred. A detailed course outline was developed by five Oregon teachers during summer 1974, and published as a January 1975 Oregon Council for Computer Education Special Report [1]. Under a grant from the Oregon System for Mathematics Education (supported via National Science Foundation) variations on the course were tried out on five campuses during winter term 1975. Approximately 100 elementary teachers, some preservice and some inservice, were involved in the courses. They were offered at Southern Oregon State College, Oregon State University, Portland State University, Eastern Oregon State College and the University of Oregon. A similar course is also offered at Blue Mountain Community College, by one of the authors of the OCCE Special Report.

The five experimental versions of the course were fairly successful. They were taught by a wide variety of computer science, mathematics and education faculty, often in team teaching situations. A statewide conference was held in May, 1975 to discuss and disseminate the results. The proceedings of this conference were published in a May 1975 OCCE Special Report [2].

The Office of Independent Studies of the Oregon State System of Higher Education now offers a 2 credit (quarter hours) correspondence course for elementary school teachers. The course was developed by David Moursund and is designed to help inservice elementary teachers to become calculator and computer literate. Since the correspondence course students do not have access to computers, the course is not as comprehensive as would be desirable for preservice teachers.

The Department of Computer Science at the University of Oregon is offering a computer literacy course for elementary in summer and again in fall. The text to be used listed in reference 3.

Conclusion

Calculator and computer literacy for elementary teachers is a very important issue. It is one in which the State Department of Education and/or Teachers Standards and Practices Commission could be providing aggressive leadership. Without aggressive leadership from the top it is likely that change will be very slow, and it will be many many years before any substantial fraction of pre service elementary teachers receive adequate computer oriented instruction.

Resources to implement a Computer Literacy for Elementary Teachers course are probably available at every teacher training institution in Oregon. The key resources needed are a computer education literate faculty member and some reasonable student access to computers. The former has been helped by a large number of NSF supported teacher training projects held in Oregon over the past ten years. Student access to computers in higher education is gradually improving. At all major community colleges, colleges, and university campuses in the state computer access is certainly adequate to support a preservice teacher education course.

1. Computers in Elementary School: A Course for Teachers. OCCE Special Report, January 1975.

2. Computers in the Elementary School: Report of the May 17, 1975 Conference, May 1975.

3. Moursund, David, Calculators, Computers, and Elementary Education, Mathematics Learning Center, 325 13th Street NE, Unit 302, Salem, Oregon 97301, June 1977.

Editorial # 6. Computer Science Education of Secondary School Mathematics Teachers: A Position Paper. V5 N1

David Moursund

Editorial # 6 (Vol. 5 No. 1) October 1977

Oregon Computing Teacher

Note: This paper was prepared in January 1977 for several purposes. It was presented to the Commission on Computers in Education, which is an Oregon State Department of Education commission concerned with the use of computers in grades K-12 and in the community colleges. It was presented to the Oregon Teachers Standards and Practices Commission, which sets teacher certification requirements. It was distributed to the ACM Teacher Certification Subcommittee. Finally, this paper is an appendix in a report presented in June 1977 to the Education Board of the ACM. That report was approved "in principle." A more easy-to-read version of that report will be presented to the ACM Education board in Fall, 1977.

Calculators, programmable calculators, and computers are now a well-established "fact of life." They are not about to go away. Instead, the proliferation of computing equipment continues. The inexpensive pocket calculator is now as common as the TV set, with sales of approximately 20 million calculators in the U.S. during 1976. The programmable calculator has many of the characteristics of a general-purpose computer, and costs more than the simple non-programmable pocket calculator. An inexpensive programmable calculator is now available for well under $100, and prices have been decreasing rapidly. More expensive models contain a secondary storage mechanism that permits the storage of programs and easy access to a program library.

Trying to count the number of computers is no longer a worthwhile pastime, since the widespread introduction of minicomputers and microcomputers. The heart of a microcomputer is a single large-scale integrated circuit, used for the central processing unit. Other chips are now commonly used memory units. The result is that a general purpose computer is now within the price range many hobbyists can afford to pay. Perhaps 20,000 computers have been bought by hobbyists in the past two years. In addition, millions of the microprocessor circuits are being installed in TV games, microwave ovens, cars, scientific instruments, etc. Whole new industries, such as electronic digital watches, computerized games, and pocket calculators have been spawned by the microprocessor.

The related questions facing education include:

1. What should students learn about computers?
2. Who should help them learn it?
3. How can and/or should computers be used as an aid to instruction?

The Oregon Council for Computer Education is the leading professional organization in Oregon concerned with educational uses of computers. It has recommended that all students should become computer literate. Computer literacy refers to a knowledge of the capabilities, limitations, applications, and implications of computers. OCCE also recommends that computers be used as an aid to instruction when their use is educationally and economically sound. A similar set of recommendations have been voiced by the Oregon State Department's Commission on Computers in Education.

Computer Literacy

There are two standard approaches to computer literacy instruction. One approach is to include teaching about computers in every course where it is relevant. Thus, elementary school students would acquire substantial knowledge and experience about calculators. Science courses at the secondary school level would teach the role of calculators and computers in science. Social studies courses would discuss social and vocational implications of computers. Business courses would discuss business aspects of computers. And, of course, math courses would include substantial content showing the role of calculators and computers in mathematics. .

Added to all of this might be substantial use of computers as an aid to instruction. Computer assisted instruction, computer augmented learning, and computer managed instruction are educationally sound, and are increasingly becoming economically feasible. Students educated in a CAI, CAL, CMI environment will acquire considerable computer 1iteracy via this exposure to computers.

Alternatively, computer literacy courses can be created and added to the secondary school curriculum. This is now fairly common in higher education. For example, the University of Oregon offers a computer literacy course every term (including summers) and 1976-77 enrollment will total about 500 students.

Math Teachers

The computer knowledge needed by secondary school math teachers falls into three general categories.

1. Using calculators and computers as an aid to instruction.
2. Teaching about calculators and computers as a part of mathematics.
3. Changes to the current math curriculum content because calculators and computers are so readily available:

We will discuss each of these briefly.

1. **Instructional Aid:** Considerable has been written about computers as an educational medium—CAI, CAL and CMI. Many of the applications are especially suitable to mathematics instruction. Computer augmented learning requires the least computer facility, and the teacher knowledge required is not high. It is a fairly common thing now in many secondary school mathematics classes in Oregon.

Use of calculators—calculator assisted instruction and calculator augmented learning—have not yet been carefully explored. The assumption tends to be that if calculators are made available, teachers will "automatically" know how to make effective use of them as an aid to' instruction. This assumption is false.

In total, then, there is considerable material on CAI, CAL, CMI (both calculator and computer) that preservice secondary school math teachers should be learning.

2. **Teaching About:** Initially, computers were designed strictly as an aid to mathematical computation. Eventually, it became clear that computers were also an important aid to more general problem solving, particularly in business, government, and industry. Most calculators are designed strictly to serve as an aid to mathematical computation. In total, then, calculators and computers are more closely related to mathematics than to any other secondary school subject matter area.

If instruction about calculators and computers is going to be integrated into the secondary school curriculum, then much of the burden will fall upon the math teachers. The need is to integrate instruction about calculators and computers into **every** math course. They are not isolated tools, to be taught about in isolation and used only in a single course.

The issue of whether all secondary school **students** should be exposed to computer programming is s till up in the air. It is possible to give an entire computer literacy course that contains no computer programming, but such a course tends to be somewhat unsatisfactory. Many of the concepts of computer programming are closely related to mathematics. Ideas learned in programming fit in well with ideas taught in mathematics In any case, there is an obvious need for all secondary school mathematics **teachers** to be exposed to computer programming. The preservice mathematics teacher needs to become computer literate; computer literacy instruction of he teacher should include considerable hand-on experience with computers, as well as an introduction to programming.

3. **Because They Exist:** The mathematics education curriculum is changing, and will change considerably in the future, merely because calculators and computers exist. Certain topics need not be taught, and others require less emphasis. Others require increased emphasis, and new topics need to enter the curriculum.

The mathematics teacher needs to understand computers in order to understand the changing emphasis in mathematics. There is increased need to understand the general nature of the types of problems mathematics can solve, and how math is used as a tool in general problem solving. There is increased need to understand the processes of problem analysis and creation of procedures to solve problems. There is less need to develop good skills in carrying out solution procedures by hand. For example, is there much value at being good at computer square roots using pencil and paper? The study of logarithms as a computational aid is of decreasing importance. Computational aspects of fractions are of decreasing importance. Finally, there is increased need to understand what to do with the results of computations. Machines can carry out computations, but people must interpret and make use of the results.

Recommendations

The need for understanding calculators and computers in mathematics is at least as great for teachers handling pre-algebra, general math, and remedial students as it is for teachers handling the more advanced courses. Calculators and computers are not tools just for the intellectually elite. Calculators, in particular, should prove to have more impact upon the lower level courses than upon the advanced secondary school math courses.

Secondary school math teachers need to become competent in the three aspects of computers which we have discussed. Teaching using computers (and calculators) could be partially covered in a general educational media course, and partially covered in a math methods course. Thus, there is a need either to substantially change the Secondary Teacher Educational Media course, or to add a new required course on computers as an aid to instruction. The most economical approach is to make a substantial change/addition to the existing required course. Similarly, the use of calculators and computers should become a standard part of the required Mathematics Methods course.

Teaching about computers and calculators requires that teachers be knowledgeable about these topics. Currently a one quarter course in computer science with programming is required of math teachers seeking the Basic Advanced Mathematics (#43) endorsement in Oregon. It is not required of people seeking the pre-algebra endorsement. Such a course should now be required of every preservice mathematics teacher. Those seeking the more advance endorsement (Basic Advanced Mathematics) should be required to take a two or three term sequence introducing them to computer science and computer programming.

Finally, what should happen merely because calculators and computers exist? College and university math courses designed for teachers should give careful consideration to the existence of calculators and computers. They should be taught by a faculty who are computer literate. Calculators and computers should be integrated into the curriculum (instead of ignored, as is often currently the case). No change in numbers of courses or lengths of courses would be required by this recommendation. But the recommendation does suggest a significant change to the content and process of the math courses currently required of math teachers.

A New Norm?

Four states (Minnesota, Ohio, Texas, Wisconsin) now provide for secondary school certification in computer science. They recognize the need to allow and to encourage preservice teachers to specialize in this field.

There are two general arguments as to why a compute science norm seems appropriate. First, there is a need to have teachers competent to teach secondary school computer literacy courses, and computer science courses. The former is typically a semester in length. It is likely that eventually many schools will offer a year long computer science course (as they do in chemistry and physics). The teacher of such. a course needs a level of preparation comparable to the chemistry or physics teachers.

Second, there is the whole field of computers in business, and business data processing. In Oregon's high schools most students in business education programs are being woefully short-changed. Most are learning very very little about computers and related equipment. A person with a teaching norm in computer science should be qualified to provide courses appropriate to business education needs.

The Oregon Council for Computer Education has commissioned a study into the question of a computer teacher norm, and other aspects of computer instruction for teachers. A pilot study was conducted in October 1976. The pilot study indicated over whelming support, among educators who are computer knowledgeable, for a computer teacher norm to be established in Oregon. The results of the full study are due to be published in a 1977-78 issue of the *Oregon Computing Teacher,* a publication of OCCE.

Editorial # 7. The Computing Teacher V6 N4

David Moursund

Editorial # 7 (Vol. 6 No. 4) May 1977

Oregon Computing Teacher

In the summer of 1971 about two-dozen Oregon educators met to discuss problems encountered while trying to make instructional use of computers. A number of pressing needs were identified, such as lack of appropriate hardware, software, instructional materials, funding, and administrative support. It was decided to form a statewide computer education organization.

On November 5, 1971 forty-seven educators met in Eugene, Oregon and established the Oregon Council for Computer Education. Its mission was to identify and to help solve problems in the area of instructional use of computers. The major emphasis was placed upon pre-college education and upon teacher training, although all levels of education were included.

During its formative years the O.C.C.E. organization received funding at the rate of several thousand dollars per year via a large National Science Foundation Mathematics Education grant in Oregon. This mathematics education grant also supported a substantial amount of computer-oriented teacher education in Oregon during 1972-1977.

The first issued of The Oregon Computing Teacher was published in May 1974. The journal has been published regularly since then. Its circulation has gradually increased to its current level of nearly 350, with subscribers in more than 30 states and in many foreign countries.

In the past few years the O.C.C.E. Executive Council has frequently talked about "going national." The Council has expanded to include representation from the state of Washington, and the publication has frequently carried articles from out-of-state authors. The recent demise of *Calculators/Computers Magazine* has served as the impetus for the 0.C.C.E. to take the big step.

At the March 31, 1979 Executive Council meeting it was decided to change the publication's name to *THE COMPUTING TEACHER*. A committee was established to begin revision of the organization's constitution and to make suggestions for a new name. The general idea is to have an organization somewhat like the National Council of Teachers of Mathematics. This serves as a national "umbrella" and publishes journals of nationwide interest to educators. At the same time it strongly supports statewide and regional organizations. That is what the "new" computer education organization intends to do.

At the same meeting it was agreed that *THE COMPUTING TEACHER* would carry ads and would appear more regularly, with six issues scheduled for the academic year 1979-90. A free copy of the May 1979 issue is being sent to each paid-up subscriber of *Calculators/ Computers Magazine.*

The decision to carry advertising was a mayor one. It will provide funds for secretarial, editorial, and technical assistance. The format of the publication will change in the future. The quality of its articles will improve as the journal will seek articles from teachers nationwide.

THE COMPUTING TEACHER is specifically designed for educators who are interested in the instructional use of computers. It carries articles of interest to elementary, secondary, and teachers in higher education The emphasis ranges from materials of immediate use in the classroom to material designed to increase the knowledge of teachers.

During the next few years *THE COMPUTING TEACHER* will probably grow rapidly and change substantially. If you have ideas on format or content, send them to the editor.

Note added 2005: The material given below was included in the 1985 book. It was on the editorial page, but not part of the editorial.

> As many of you know, *Calculator/ Computers Magazine* has ceased publication. The materials on pages 35 to 56 of this issue of *THE COMPUTING TEACHER* were originally scheduled for publication in *Calculators/Computers Magazine.*

Technical consultant and production supervision for is issue of *The Computing Teacher* was provided by Greg Osborn. Manuscripts were typed by Barbara Korando.

This issue was printed at the University of Oregon Press using a 'quick copy' process. Future editions *will* use offset printing processing.

Note added in 2005 reprinting of the editorial in Volume 7 Number 2 October-November 1979. The Table of Contents material given below appeared at the top of the page containing the editorial. It was included in the 1985 book.

Contents: *cont.*

Editorial # 8. Welcome to V7 N2

Editor's Message

(Dave Moursund)

Editorial # 8 (Vol. 7 No. 2) October-November 1979

The Computing Teacher

Good news! On August 31, 1979 a new nonprofit corporation was established. It is the International Council for Computers in Education (ICCE) and is the owner/publisher of The Computing Teacher. The corporation was established for two reasons. First, it provides a corporate/legal structure under which the publication business can be carried on and expanded. Second, the new company is not limited to Oregon in its scope. It is dedicated to the increased and improved use of computers in education throughout the world.

ICCE is a natural outgrowth and creation of the Oregon Council for Computer Education. Indeed, ten of the initial eleven people on the Board of Directors of ICCE are on the Executive Committee of OCCE. But this is a temporary arrangement. Eventually ICCE and OCCE will be quite distinct organizations, each working in its own way to promote the field of computers in education.

What is the future of ICCE? Right now it mainly depends upon the success of this publication. Our paid circulation is growing rapidly, but we are still giving away a goodly number of copies of The Computing Teacher. So, if you received this copy free, please subscribe! If your subscription is running out with this issue (which is true for several hundred OCCE members) please renew!

A frequently asked question is “What happened to *Calculators/Computers Magazine,* and won't it happen to you also?” *Calculators/Computers Magazine* decided to cease publication because it was a continued large financial drain on its parent organization. This was because of the paid staff—a payroll of a couple thousand dollars a month. *The Computing Teacher* doesn't have that problem. Almost all of the work in publishing this journal is being done by unpaid volunteers (yours truly and others). Thus we have a monthly payroll of $zero. If advertising revenue holds up and paid circulation continues to increase, as it has been, we will make a profit for the year.

As far as the longer term future is concerned, I expect that *The Computing Teacher* will be a considerable success and that it will begin to have some paid staff. I expect that ICCE will get involved in the production and distribution of slide sets and other materials useful to educators involved in the instructional use of computers. In the very long run I expect that ICCE will have several publications. For example, we might eventually have a publication aimed at computer education in the home and in other non-traditional educational settings.

Finally, let me comment upon the name International Council for Computers in Education. Our goal is to be a blanket organization, with local, regional, and state organizations as affiliated members. Details of this are still being worked out, and will be reported on in the next issue. If you would like to start a computer education organization in your city/region/state/country please contact me. I will provide whatever help I can. Minimally I can provide you with a number of free copies of *The Computing Teacher* and some encouragement.

Editorial # 9. Welcome from ICCE. V7 N4

(Editor's Message)

Dave Moursund

Editorial # 9 (Vol. 7 No. 4) Feb./March 1980

The Computing Teacher

In this message I will report on the state of ICCE, and I will share my recent insights into the state computers in education in this country.

You are now reading the fourth issue of The Computing Teacher to be published by ICCE. The publication is steadily growing in quality, and has financially been in the black on each issue. This highly desirable financial situation has occurred because of the continued support of our advertisers, and because of continued growth in paid circulation. There are three things that you can do to help this progress to continue:

1. Read the ads. If you do decide to purchase items displayed in an ad from *TCT,* mention us where you make your purchase.
2. Put a little effort into increasing our paid circulation. If you have received this copy of *TCT* free, please subscribe! If you are already a subscriber, sign up one or two of your friends.
3. Give some thought to writing some material for *TCT.* Our authors are teachers; people like you. If you are doing something which others would like to know about—write an article about it.

Please take the above suggestions to heart. It is relatively easy and painless to be a passive subscriber to a professional journal. It takes some effort on your part to make a contribution to your professional society and to its publication. A modest effort on the part of each reader would total to a tremendous gain for ICCE and *TCT.* This gain is necessary if we are to continue to improve the quality of the publication and to carry on other activities designed to enhance the field of instructional use of computers.

Over the past few months I have done considerable traveling throughout the United States and talked with many people, both in person and by phone. The picture that has emerged is one of a very rapid increase in interest in the instructional use of computers at the pre-college level. Perhaps a typical example is illustrated by my recent trip to a math conference in Monterey, California. This conference is held each year, and usually draws about 1,500 educators from all grade levels. At the conference held a year ago, according to Bob Albrecht, there were 10 microcomputers present and a modest amount of computer activity. This year the Computer-Using Educators, which is a northern California group of educators interested in educational uses of computers, was out in force. There were computer talks held in each time slot of the conference. There was a software exchange, and there were vendor displays. According to Bob Albrecht, this year there were 66 microcomputers present. This may be an all time high for the number of microcomputers attending a math conference! (Also, about 1,800 people attended!)

Another sign of the rapid progress is illustrated by a phone call I received about two months ago. It was from an assistant superintendent of a medium sized school district. He had put together an advisory committee of about a dozen teachers from all grade levels and disciplines, and they were beginning work on a five year plan for instructional use of computers throughout the school district. They asked me to meet with them, to help begin the planning.

This type of school district-wide interest and systematic planning is no longer uncommon, and it is essential if computers are to have a significant impact upon the curriculum. Every school district has resources that could be diverted toward the instructional use of computers. Typical examples include the time and energy of curriculum specialists, the orientation and content of workshops and in-service day programs, materials and supplies budgets and funds or staff currently devoted exclusively to administrative use of computers. In total, such resources are enough to cause a substantial increase in the instructional use of computers (and calculators).

The calculator issue continues to be a major problem. What I find is that calculators are now a well-accepted tool in advanced math classes. They are still viewed with suspicion in remedial classes and "practical" or business-oriented math classes at the secondary school level. In my opinion, it is these latter groups of students that have the greatest need for calculators, and it is here that use of calculators should be stressed. This would allow a shift in emphasis from calculation to problem solving. It would allow the courses to concentrate upon helping students learn to cope with the types of problems that they are apt to encounter after they leave school.

Calculator usage at the elementary school level is changing only very slowly. Here the main problem seems to be one of teacher knowledge of calculators, and insight into goals of math education. A massive program of in-service training is needed. Elementary school teachers need to learn to use calculators in a problem solving environment, and how to create the same environment for their students. Both teachers and students need guided instruction in the use of calculators and in working on problem solving in mathematics.

Editorial # 10. Welcome to V7 N5

(Editors Message)

Dave Moursund

Editorial # 10 (Vol. 7 No. 5) April/May 1980

The Computing Teacher

This column serves two purposes. Here I try to keep you informed about the progress of the International Council for Computers in Education, and The Computing Teacher. Here also I share some of my latest thoughts and insights into the world of computers in education.

ICCE now has two "organizational" members. Both the Oregon Council for Computer Education (OCCE) and the Computer Using Educators (CUE) (California) are now organizational members. There is no cost to an organization to become an organizational member. Both OCCE and CUE are working towards the same goals as ICCE, and can accomplish more collectively than individually.

OCCE's annual conference was held in Portland, Oregon on February 8, 9. More then 300 people attended, from Oregon, Washington, British Columbia, California, Idaho, Montana, and Utah. The format for such a conference is beginning to become rather standardized. The conference included a variety of talks, some slide shows, films and videotapes, courseware materials exchange, software exchange, and vendor display. People in attendance ranged from beginners, with almost no knowledge of the computer in education field, to the "old pros" who have come to realize that they are still beginners. Planning for next year's conference is already underway. It is expected that the conference to be held next February will have "more of everything" plus some new ideas. One new idea will be discipline-oriented curriculum sessions. For example, a room and time slot will be set aside for social studies teachers, so that they can exchange information and mutual concerns.

OCCE held its annual business meeting, and proposed some major changes in its constitution and bylaws. These will be voted upon by their general membership in the next two months. A major proposal is to change the name to the Northwest Council for Computers in Education (NWCCE). The intent is to serve people from Oregon, Washington, and areas close to these states. This proposal was strongly supported by representatives from both states who are currently on the OCCE Executive Committee.

The idea behind the NWCCE organization is that this area is large enough to support an excellent annual meeting, probably alternating between the Portland and the Seattle areas. Also, the overall organization will support and promote regional "local" groups in eastern Washington, western Washington, eastern Oregon, southern Oregon, etc. Educational software exchange and communication among computer education people during the year will mainly be done via these local groups. The annual, large meeting, will facilitate exchanges among the local groups and bring in people from outside these regions.

A number of other states and/or local regions are giving some thought to starting computer-in-education groups. It you are interested, ICCE is interested in helping you. We can provide copies of the OCCE (likely soon to be the NWCCE) constitution and bylaws. We can provide copies of a recent issue of *The Computing Teacher*, as handouts at an organizational meeting. And, we can provide encouragement.

Now let me report briefly upon progress that ICCE/*The Computing Teacher* is making. Last spring, when the idea of a nationally circulated journal was being conceived, the paid circulation of the current Oregon Computing Teacher was about 350. The typical press run was 500 copies. We began the academic year 1979-1980 with press runs of 3,000 copies. Even though paid circulation began to increase rapidly, initially we gave away about 2,000 copies per issue. The rapid increase in paid circulation has changed this picture, and forced us to increase our press runs. Our press run on the February-March issue was 3,400 copies, and on the current issue exceeds 4,000 copies. Current plans for next fall call for 4,400 copies per issue. This rapidly increasing circulation will support some paid staff, and will contribute to a steadily improving quality of publication.

As many of you know, I am chairman of the Association for Computing Machinery's Elementary and Secondary Schools Subcommittee. The Subcommittee has recently published a hundred page preliminary report. It you are on the mailing list for this subcommittee, then you should have received a copy. If you are not on the mailing list, write to me for a free copy. (Notice the sneaky way we put this free offer clear at the end of the Editors Message. The idea is to reward those who diligently read this editorial material!)

Editorial # 11. Welcome to V7 N6

David Moursund

(Editor's Message)

Editorial # 11 (Vol. 7 No. 6) June/July 1980

The Computing Teacher

This is the last issue of *The Computing Teacher* for this academic year. Next year we will be publishing seven issues, with the first issue going into the mail about the first of September. The increase from six issues during the current academic year to seven issues next year to nine issues the following year is part of our planned orderly expansion. The current year, just ending, has been far more successful than expected. Paid circulation has grown rapidly, ad revenue has held up nicely, and our efforts to encourage organizations to affiliate with use are beginning to bear fruit. I am pleased to welcome the Ontario Society for Microcomputers in Education as our newest organizational member.

I want to comment briefly on three things. First, I recently saw an announcement for a new handheld computer. It is manufactured by Sharp, and evidently is currently only available in Japan. The $123 unit measures 6.9 by 2.8 by 0.6 inches and weighs about a third of a pound. The 59 key keyboard is designed for writing BASIC language programs. An optional interface to a tape recorder allows programs to be saved for later use. A set of three button batteries powers the unit for three hundred hours of use.

Second, I have recently returned from the National Council of Teachers of Mathematics annual conference, which was held in Seattle this year. In addition to the usual fine collection of mathematics talks there was an extensive program of computer talks and workshops. Indeed, if one looked at the vendor displays and all of the supporting computer equipment available one might have thought it was a computer conference. Vendors of textbooks and other materials for math teachers are moving rapidly into the computer field. Math teachers at all levels are more and more receptive to learning about computers and their uses in math education.

Third, I tried out an interesting idea in the Computers in Education course I taught last term. I asked students to imagine that they were teaching some precollege level course in which all students knew how to use a computer quite well and in which computers were readily available for all students to use whenever they wanted. The assignment was to write a paper discussing changes in the content of the course that they would make because of this computer knowledge and availability. The students had a number of weeks to work on the paper, since it was one of the major assignments for the term.

By and large the results were disappointing. Even though the students in the class were all teachers and/or school administrators, few had much insight as to how the curriculum might change. Many suggested how computer assisted instruction might make some difference in teaching the traditional material, even though the directions on the assignment specifically said that the paper was not to be on CAI.

My conclusion is that the computers in education movement faces a very difficult future. Sure, the hardware problem will be of less and less importance. Sure, we will get more and better CAI-type software. But will students learn to use computers as a tool in coping with the problems of their disciplines? Will the nature of what is taught take into consideration the capabilities and availability of computers? Without considerable leadership upon the part of people who are expert in both computers and in the specific precollege disciplines I fear progress will be very slow.

Indeed, it is here that I feel we need federal aid. The time is now ripe to hold some national working conferences on the role of computers in the various subject matter disciplines. How should Math, Business, Social Studies, Science, Art, or English change because of computers? How will the necessary course content revision occur? Who will develop the materials? Who will train the teachers? Serious work must begin immediately on questions such as these if we expect computers to have a significant impact upon the curriculum content in the next five to ten years.

Editorial # 12. Welcome to V8 N1

David Moursund

(Editor's Message)

Editorial # 12 (Vol. 8 No. 1) September 1980

The Computing Teacher

My image of an Editor is a person who can sit at a typewriter, insert a sheet of paper, and have words literally flow from fingers to paper. By that definition, unfortunately, I have a long way to go. But, practice helps, and I am looking forward to another year of practice.

You "long-time" subscribers will notice the new physical makeup of TCT. We have outgrown the small press that we have been using, and have moved up to the big time. The press run for this issue is 6,000 copies. While our paid circulation has quite a ways to go to reach that figure, I am optimistic that we will exceed it before the end of this publication year.

The growth of interest in computers in education is fantastic. The school: system that is not involved in instructional use of computers is now the exception, rather than the rule. Attendance at computer education-oriented meetings is rapidly increasing. I attended the second National Educational Computing conference in Norfolk, Virginia this past June. Interest and involvement in use of computers in precollege education has increased markedly since the previous year's meeting held in Iowa. Next year's conference will be held in Denton, Texas, and should be well worth attending.

Denton, Texas was the site of the organizational meeting of the Texas Computer Education Association, held last May. As of July 14 this organization had 101 members, and membership was growing rapidly. ICCE welcomes the TCEA as its newest Organizational Member. (See the What's New section of this issue for more information on the TCEA.)

Although I am impressed by the rate of change of computers in education in the United States, I am also discouraged by the total progress that has occurred and by the lack of a well-organized national attack on the major problems. Indeed, Minnesota, via MECC, appears to be the only state in which a significant amount of statewide planning and financial support is occurring. This point was especially brought home tome on July 18 when I spent a couple of hours talking with Scott Brownell, from Tasmania, Australia. Precollege education in Australia is strongly controlled at the state level. Tasmania has put computer science courses into their high schools, implemented a computer teacher certification program, set up a statewide timeshared computer network, set up a state wide purchase of Apple microcomputers (much like MECC has done) and run a number of teacher training workshops. The government is putting significant amounts of money into the program; that, plus the central planning, makes the progress of most states in the US look poor in comparison.

I have commented previously upon what readers of TCT might do to further TCT (and, by doing so, contribute to the field of computers in education). Here are a few suggestions:

1. Tell your friends about TCT - show them a copy, and encourage them to subscribe.
2. Get your school library to subscribe to TCT.
3. Write an article for TCT. Or, send in some material for the What's New section, the Software Reviews section, the Film Reviews section, or some other feature of TCT. We do not have a paid staff of writers. If our readers don't contribute material, we won't have anything to print.
4. Read the ads in TCT. If you eventually purchase something from one of our advertisers, mention that you saw their ad in TCT. Currently more than one-third of the cost of producing TCT is being born by these advertisers.
5. If you are in a position of influencing how a computer-oriented company spends its advertising dollars, encourage it to advertise in TCT. Our rates are quite reasonable and the audience we reach is quite influential.
6. Start a computer-using educators organization in your state or local region. If you would like some help and advice on how to do this please contact me.

Editorial # 13. Welcome to V8 N2

David Moursund

(Editor's Message)

Editorial # 13 (Vol. 8 No. 2) October 1980

The Computing Teacher

In a few weeks I'll be 44 years old. That's old enough to have gained some historical perspective, and I feel that it will still be a while before senility sets in. My first involvement with electronic digital computers was in 1959, on an early vacuum tube machine. I began to teach computer science courses for precollege teachers in the summer of 1965, and have been actively involved in this endeavor ever since.

Newcomers to the field of computers in education tend to be unaware of how long this has been an active and challenging field. (I was by no means one of the first people involved. Remember that the ENIAC was built on a university campus and first became operational in December 1945.) Thus newcomers are apt to spend considerable time and effort reinventing the wheel.

One of the key aspects of human intellectual progress is building upon the work of others. In the computer field we do this every time we use a modern piece of hardware. Most of us now take the inexpensive microcomputer for granted, while 20 years ago few could conceive that such computer power could ever be packaged so neatly and made so readily available to large numbers of people. We also see this building upon the work of others in the software we use. While FORTRAN, which was developed during 1953-1957, was not the first high-level language, it quickly became the dominant one. Interactive computing was still a revolutionary idea with BASIC was being developed in the early 1960s. Now we take such languages for granted, and argue the merits of LOGO, PASCAL, and PILOT. With the hardware and systems software currently available, secondary school students can attack and solve certain problems that were beyond the capabilities of research scientists of a few decades ago.

But what have we learned about teaching using computers, teaching about computers, and the potential impact of computers upon curriculum content in the various non-computer areas? Here the collection of knowledge, and the passing it on to new scholars, is not so easy. Knowledge of this sort is stored in the writings of the educators and researchers who gained it bit by bit, often through trial and error. These writings appear in a wide variety of publications, many obscure and many no longer readily available, Only very slowly is this accumulated knowledge being integrated into standard textbooks and course outlines; much of it is not easily available to an educator just now beginning to study about computers in education.

I feel that this unfortunate situation is changing very rapidly. I will cite just a few examples to support this assertion.

1. The Computing Teacher is now a respectable and widely circulated journal.
2. Robert Taylor of Teacher's College, Columbia University, has recently completed a book titled The Computer in the School. It consists of some of the writings of the early (and still continuing) leaders in the field of

computers in education. I have read the book; it is excellent, and well worth reading by all educators. It is being published by Teachers College Press, and will be out later this fall.

3. Many of the major computer magazines have taken to publishing one "education" issue per year. The results that I have seen are excellent. Also, many of these magazines exhibit a continuing interest in education by carrying some education materials each issue.
4. I have had a number of conversations with various people at Scholastic, Inc. They publish a wide variety of educational materials for precollege students and teachers. They are exploring the possibility of publishing computer-oriented materials.
5. The authors of a well-known educational media book are currently producing another revision of their text. They are including, for the first time, a chapter on computers.
6. A friend of mine, Jerry Johnson, spent this past summer writing computer materials for elementary education; he is under contract with a well known publishing company. Indeed, many of the publishing companies are now deeply involved in the development and publication of computer-oriented materials.
7. This issue of *The Computing Teacher* contains a substantial portion of a short booklet on the instructional use of computers, aimed at school administrators and school board members. A second booklet, aimed at elementary school teachers, is currently at the typesetter.

While this list could easily be extended, I feel that the message is clear. There is now substantial, fairly readily available, literature in the field of computers in education. The newcomer to this field should devote time to reading some of this literature.

Editorial # 14. Welcome to V8 N3

David Moursund

(Editor's Message)

Editorial # 14 (Vol. 8 No. 3) November-December 1980

The Computing Teacher

I recently attended the ACM '80 Conference in Nashville, Tennessee. Computer chess, Grand Ole Opry, Turing lecture, good music, computer education talks, high prices, behind-the-scenes meetings, lots of good people to talk to, ...

The Association for Computing Machinery is a 45,000-member society of professionals in the computer field. It is a complex organization, with a couple dozen special interest groups (SIG'S), numerous publications, a modest-sized paid staff, numerous volunteers and chapters. Its Education Board, SIGCSE (Computer Science Education), and SIGCUE (Computer Uses in Education) are interested in a wide variety of educational activities. The Elementary and Secondary Schools Subcommittee, which I chair, is located under the Education Board. The 3,000 member SIGPC (Personal Computing) is also quite education-oriented.

The ACM list of officers and committee members tends to be dominated by “university types.” Thus, while ACM has a long history of involvement in computers at the precollege level, its commitment to this area has been modest. Judging from the ACM '80 Conference, however, the interest in precollege education is increasing significantly.

Peter Denning, the recently elected president of ACM, has indicated that computers in precollege education is to be a high priority item. Thus, the Education Board is stepping up its support and encouragement of the Elementary and Secondary Schools Subcommittee.

The ACM Chapters have created a Computers in Education committee, which has prepared a newsletter of resource information. The committee is also preparing a slide show and is planning other activities to encourage the involvement of local Chapters in precollege education.

The ACM Conference is usually dominated by somewhat esoteric research paper presentations, but that also appears to be changing. At the recent conference, there was considerable emphasis on informative tutorial sessions, and there were a number of sessions concerned with computers in precollege education. It was easy to find people interested in talking about computer literacy, the potential impact of CAL upon public education, and the need to teach teachers about computers.

The ACM represents a tremendous source of knowledgeable computer professionals. Many are interested in computers at the precollege level, but may have little knowledge about the reality of education at this level. They can help you, and you can help them. For a complete list of ACM Chapters (there are about a hundred), write to ACM Headquarters, 1133 Avenue of the Americas, New York, NY 10036.

Contact your local ACM Chapter president. Find out when and where the Chapter meets; encourage the Chapter to increase its involvement in computer usage in the elementary and secondary schools. Let them know how they can help you!

Note added at the time of the 2005 reprinting: The material given below appeared on the same page as the editorial and was printed in the 1985 copy of the book.

Classroom Teachers Administrators Media Specialists

Conference NCCE Feb 6& 7 ’81

ADAMS HIGH SCHOOL * PORTLAND, OREGON

[Contact] Computing Center, EOSC, La Grande, OR 97850

Editorial # 15. Hello to V8 N4

David Moursund

(Editor's Message)

Editorial # 15 (Vol. 8 No. 4) January 1981

The Computing Teacher

It is fun, when beginning a new year or a new decade, to look backwards briefly, and then forward. The last decade began slowly, as far as computers in education was concerned. The minicomputer was still too expensive for most precollege schools, little appropriate software was available, and few teachers knew enough to make effective use of computers. The first big change was the proliferation of timeshared minicomputers. Suddenly timeshared BASIC became available to many hundreds of thousands of students, although only on a very limited basis for most of them. And then came the microcomputer, with its decreased cost and increased availability. Now even grade schools could afford a computer facility!

The Computing Teacher was born during this same time span. It began life in the spring of 1974 as the *Oregon Computing Teacher*. The *Oregon Computing Teacher* slowly grew in circulation, reaching a paid subscription list of about 350 people and a total circulation of about 500 during 1978-79. In the spring of 1979 the name was changed to *The Computing Teacher*, paid advertising was accepted for the first time, and national circulation began. Both paid circulation and total circulation have grown by well over a factor of 10 in the past year and a half. The press run on this issue of TCT is 7,000 copies.

This issue of TCT contains Chapter 2 of a book I am currently writing for elementary and middle school teachers. Recently when I got bogged down in some of the later middle chapters of the book, I tried a bottom up approach, and wrote the last chapter. It is about the future—the next ten to twenty years. In that chapter I discuss the hardware progress that is easy to predict (the next five years) and further into the future. I discuss software, courseware, and expected impacts upon schools. It is easy to summarize the chapter. YOU HAVEN'T SEEN ANYTHING YET! Sure, computers in education have made a lot of progress. Sure, microcomputers are great. But there is much much more to come.

For a small inkling of what is to come, I will use an example I recently used in some talks at Brigham Young University. Right now one can purchase a 10 million operation per second computer system for about 2.5 million dollars. The trouble with such numbers is that few of us can understand them. So, in my talks at BYU, I restated this. The 2.5 million dollars is equivalent to a rental rate of about $5 per minute. And one minute of computer time, 600 million operations, is more than a person could do with a hand-held calculator working 40 hours per week for a lifetime. Now, to add to this, by the year 2000 we may well have portable microcomputers with this type of compute capacity!

Our current educational system has very limited ideas about what to do with computers. Few teachers understand how computers are changing the very nature of the disciplines they teach, the very nature of teaching, and the very nature of what it means to be educated. There seems little doubt but that continued rapid progress will occur in the development of hardware. Moreover, appropriate educational software is becoming available in increasing amounts, so that

Computer Assisted learning will rapidly grow in importance. But teacher knowledge will be the key. If teachers cannot adjust to this new technology, then education will lag far behind its potential, and the needs of society will not be met. Teachers in every discipline need to understand how computers are used to solve the problems of their disciplines. The entire curriculum needs to be reconsidered, and much of it will need to be redone.

And finally, we come to the goal of computer literacy for all students. We must not aim too low. Computer literacy should mean a working-tool knowledge, well integrated into the student's knowledge in each discipline. The student of the year 2000 should use a computer freely and easily, as naturally and as well as the well-educated student of today uses the basics: reading, writing and mathematics. It will be fun to participate in the changes of the next two decades, and see if education can meet this challenge.

It will also be fun to watch *The Computing Teacher* continue to grow in quality and in circulation. Start the new decade out right. Show TCT to a teacher who is not a subscriber. Give a sales pitch, and sell a subscription. Do your bit to help TCT, and TCT will continue to do its best to help you.

Editorial # 16. The Saber-toothed Curriculum. V8 N5

David Moursund

(Editor's Message)

Editorial # 16 (Vol. 8 No. 5) February 1981

The Computing Teacher

I came across an old but quite modern book this past week. *The Saber-Tooth Curriculum* by J. Abner Peddiwell is published by McGraw-Hill and carries a 1939 copyright. The book is short, easy to read, amusing and frightening in its insights. In this book a caveman gets the idea that children can be taught useful skills. Soon a formal curriculum is developed, designed to fit the needs of the times. Children are taught “fish-grabbing” (the bare-handed catching of fish), “horse-clubbing” (clubbing the type of small horse used for meat), and “tiger-scaring” (using fire to scare away the saber-toothed tiger). The book then traces the evolvement of this curriculum, with the eventual development of higher education, teacher training and educational research. The curriculum and educational system gets more and more sophisticated at teaching fish-grabbing, horse-clubbing, and tiger-scaring-although the need for these skills eventually completely disappears. The story ends just before one learns what becomes of a society whose educational system is unable to change in a changing world. But the message is clear, and seems even more relevant now than in 1939.

A computer system is a new way to store accumulated knowledge. A computer can store knowledge in a passive form, much like a book. But there is much knowledge that a computer can store in an active form-the machine both stores the knowledge and is able to carry out procedures to solve problems using the knowledge.

A simple example is provided by a calculator. It “knows” how to add, subtract, multiply and divide. In the December 1980 issue of *The Arithmetic Teacher,* Grayson Wheatley, a well-known mathematics educator, discusses his findings that approximately two years of the typical math curriculum in grades 1-9 is spent teaching paper and pencil long division of multi-digit numbers. He suggests that students instead be allowed to use a calculator and that this time could better be spent on more relevant topics.

We can easily laugh at the idea of teaching fish-grabbing, horse-clubbing and tiger-scaring. But most of us have trouble seeing similar topics in our current curriculum. “What! Not teach long division of multi-digit numbers? But what if one's battery goes dead?”

Computer science is making tremendous progress in developing knowledge-based systems. These are computer systems that contain a large amount of knowledge about a particular type of problem or problem area, and how to solve problems in that area. A calculator “knows” how to solve a long division problem—it merely needs to be told what problem to solve. Similarly, many knowledge-based computer systems know how to solve a wide range of math, science, engineering, medical and business problems. Hundreds of researchers are working to extend the capabilities of these systems. By and large these researchers build upon work that has already been done, so progress is cumulative and the knowledge-based systems become more and more capable.

This progress in computerized knowledge-based systems has had almost no impact upon our curriculum, even at the university level. We see a little progress in some college statistics courses, and we see perhaps more progress in some engineering-oriented programs of study. By and large, however, our curriculum seems very slow to change. It has a tremendous investment in teaching "by hand, traditional" methods.

As a teacher, I am disturbed and somewhat frightened by the fact that skills that took me years to learn and more years to learn to teach are not very important anymore. It is certainly easier to continue to teach what has been taught in the past, from time to time making small changes in teaching methods in an attempt to teach it better. But I am fighting against this tendency in myself, and I am continually working to understand what it is people should be learning in the light of the increasing capabilities of knowledge-based computer systems. It seems clear to me that students need to learn to use these systems, to work with computers rather than in competition with them. We need to examine the entire curriculum in the light of computer capabilities. This must be a continuing process, since computer capabilities are rapidly increasing. We must work to make our curriculum relevant to the needs of our current and future world. The saber-toothed tiger is extinct.

Note added to 2005 reprinting. The following material was on the same page as the editorial given above and appeared in the 1985 book.

APOLOGIES

To AEDS: On page 47 of Vol. 8, No. 4 of *The Computing Teacher,* you will notice a blank quarter page. The Association for Educational Data Systems ad which was to appear here was accidentally omitted by the printer. That ad appears in the current issue of TCT.

To Jean Rogers: On page 40 of Vol. 8, No. 3 of *The Computing* Teacher, near the end of Darlene Myer's article, a copy of four lines of material from page 21 was accidentally included. The material suggests that Jean Rogers reviewed Darlene Myer's article, which is incorrect.

Editorial # 17. The Computing Teacher Needs Your Help. V8 N6

David Moursund

(Editor's Message)

Editorial # 17 (Vol. 8 No. 6) March 1981

The Computing Teacher

The Computing Teacher is published by a non-profit professional organization, the International Council for Computers in Education. Each person subscribing to TCT is a member of ICCE. In addition, ICCE has six Organizational Members and is processing applications from a couple of additional organizations. The Individual and Organizational Members of ICCE represent its strength, and this strength is growing.

Current paid circulation of TCT is about 4,600 and is growing more than one percent per week. Total circulation for the last issue was in excess of 7,000 copies. Income for that issue actually exceeded expenses by about $800! If paid circulation continues to grow, TCT will be able to afford a full time managing editor for next year. This will lead to further improvements in the quality and the usefulness of the publication. It will allow ICCE to provide better support to its Organizational Members. It will allow ICCE to put some effort and money into helping new state and local computer-using educator groups to get started and to grow.

But increased circulation of TCT depends mainly upon the current readers. You are our sales force. Does your school subscribe to TCT? Do all of the schools in your district subscribe? Do your computer-using friends subscribe? Do you know someone who is just getting started in the computing field who could benefit from TCT? You can help TCT by helping to build its circulation.

TCT also needs two other kinds of help from its readers. First, we need articles and feedback. If you are doing things that would be of interest to other educators, write an article about it. If you are enjoying TCT and like to see certain types of material published, write to us about it.

Second, if there is no computer-using educator group in your locality you should think about starting one. Computer-using educators need a support group. They need to share ideas, progress, problems and solutions. They need to share software, courseware, sources of funding.

Starting a local group is not too difficult. Contact some of your computer-using friends and form an informal planning committee. Plan a half-day, full day, or two day conference for people in your community. Draw upon local or state talent. Once you start looking for this talent you will find quite a bit is available. The conference will bring people together and can be the starting point for a local computer-using educators group.

If you need financial assistance to put on a little conference and/or to get a group started, ICCE is willing to help. ICCE is willing to put up the “front” money, provided it appears there is a reasonable chance it will get its money back. Thus, conference fees should be set at a level that will pay back the loan and make enough profit to support the start of a local group. Note that all ICCE wants is to get its money back. However, if the conference is a failure and does not generate enough funds to pay ICCE back, then ICCE will take the loss. You will not incur a financial loss yourself. If you want to follow up on this, contact Dave Moursund.

Note to the 2005 reprint. The following two short announcements appeared on the same page as the editorial and were included in the 1985 book.

DIDACOM BECOMES AN ORGANIZATIONAL MEMBER OF ICCE

DIDACOM (short for DIDACtiek and COMputer) is a computers in education group with headquarters in the Netherlands. It has over a hundred members and is concerned with educational use of computers at all levels. For more information, contact Inno Broekman, Secretary for DIDACOM, Avenbeeck 98, 2182 RZ Hillegom, The Netherlands.

MINNESOTA AEDS BECOMES AN ORGANIZATIONAL MEMBER OF ICCE

The Minnesota Association for Educational Data Systems recently became the sixth Organizational Member of ICCE. MAEDS has about 260 members, mostly from the state of Minnesota. The organization holds periodic educational meetings and annually produces an Educational Computing Journal. For more information, contact Kenneth Brumbaugh, President of MAEDS, 1925 W. Country Rd. B2, St. Paul, Minnesota 55113.

Editorial # 18. Change. V8 N7

Editor's Message

(Dave Moursund)

Editorial # 18 (Vol. 8 No. 7) April-May 1981

The Computing Teacher

This is the last issue of The Computing Teacher for the academic year 1980-81. Next year, with the first issue due about the first of September, we will publish nine issues. Quite a bit of the increased workload this entails will fall on the shoulders of Dick Ricketts, who has been hired as the Managing Editor of *The Computing Teacher*. Presumably this will allow me to have more time to write editorial messages, articles, books, and so on. I may even have time to enjoy a weekend vacation occasionally.

This past year has been a good one for *The Computing Teacher* and for the overall field of computers in education. The rate of growth of microcomputer equipment in the schools has been impressive, especially in light of tight budgets and even budget cutting that is occurring in many schools.

In the past few months I have heard of a half dozen Colleges of Education that are starting computers in education degree programs and/or are looking for faculty with this area of expertise. That seems to be more change than the total I have seen in the past half dozen years. Finally, Colleges of Education are realizing that they must be involved and that there is much to be gained by being involved. There are many teachers looking for inservice courses on computers in education. Preservice teachers are aware that computers are an important and rapidly growing area of education. They will take computer-related courses, provided the courses are designed to fit their needs.

It will be interesting to see how Colleges of Education handle the change that computers can help foster. Most people, even those making extensive use of computers in education, have little realization of what might lie ahead. The hardware will be available, with a continued rapid decrease in price-to-performance ratio. For example, Hewlett-Packard recently announced they have produced a chip containing 450,000 transistors. From other companies a million bit bubble memory chip is commercially available, and a four million-bit bubble memory chip has been produced in a research laboratory. Ten years from now it is likely that quite powerful, easily portable, easy-to-use microcomputers will be readily available to students and educators. A significant percentage of students will have unlimited access to such machines, in the same manner that they currently have unlimited access to pencils and paper.

But that sort of computer availability is a change that few teachers can deal with without considerable help. They need training and materials. The magnitude of the training problem is enormous; indeed, to me it seems overwhelming. Where will we find the resources to develop and staff the courses, or acquire the needed facilities for teacher training? It seems evident that such an effort must involve Colleges of Education, local, regional and state school districts, and the currently established Computer Science Departments. We must combine the resources and expertise of all of these groups.

It will also be interesting to see what role will be played by private industry. Private industry will be the dominant force in the development and dissemination of the necessary software, courseware, and hardware. But the role of private industry in teacher training is not clear. It may well be that people who do consulting and who organize and put on courses to make a living will be able to make a living. (My own approach is to hold on to my job at the University of Oregon. But I am available…)

It also seems to me that in each community a few key individuals (maybe YOU) will playa major role in facilitating change. It is essential that school systems develop district wide plans for the instructional use of computers. It is essential that teachers work together to share their progress and problems. In each community, computer-using educators should be getting together to work on these problems. They should be providing leadership-providing a sense of direction for their schools, fellow teachers, local colleges and universities, and others who might be involved.

My sense is that this is happening. In the past two months ICCE has received a half dozen inquiries from groups of computer-using educators who are just getting started or who have organized in the past year. I was recently involved in the start of such a group. I was in Alaska giving some talks at various meetings. At one of these meetings the Alaska Council for Computers in Education was born. No doubt it will grow rapidly, since Alaska is probably the leading state in the per student access to computers. The Alaska per teacher subscription to *The Computing Teacher* is about four times the national average for the United States.

When I give talks, such as those I recently gave in Alaska, I often ask for a show of hands as to how many people own a calculator. The typical response is usually 95% or higher. At the meeting where the Alaska Council for Computers in Education was born, I asked how many of those present owned a computer. I was amazed to learn that nearly 20% of the 120 teachers and school administrators present owned a computer. (High salaries and long, cold nights. What else is there to do?) I'll bet that if you don't already own a computer you at least know someone who does. Lots of teachers are buying computers for a combination of personal and educational use.

Editorial # 19. It's Up to You. V9 N1.

(Editor's Message)

David Moursund

Editorial # 19 (Vol. 9 No. 1) September 1981

The Computing Teacher

Readers of The Computing Teacher are convinced that students should become computer literate, that they should develop skill in using a computer as an aid to problem solving, and that computers are a useful aid to instruction. "If only we had enough money," is the common lament.

Computer-using educators, as well as most other people, acknowledge that the educational system in the United States is far from perfect; indeed, that it leaves much to be desired. Individuals addressing this problem invariably look for solutions, generally focusing on federal, state, or local government as a source of funding for needed programs.

However, most education budgets in the United States are very tight. Often they are cut in terms of real, uninflated dollars. Federal, state, and local governments are no longer in a position to respond easily to monetary requests.

Many people involved in the field of computers in education believe that their specific problem is particularly important and should receive special consideration from some level of government. Certainly, they argue, the problem of achieving universal computer literacy in the U.S. is very large in its scope and is of national concern, so we might conceivably look to the federal government for assistance. In the past we in the U.S. have seen examples of massive federal funding; the National Science Foundation's grants for curriculum development and teacher training is one example. However, it has been years since any significant curriculum development has been funded, and teacher training programs are functioning at a minimal level. Over the next four years it seems unlikely that massive U.S. funding will be available to attack problems of computers in education, barring the definition of a "crisis" situation, such as happened after the launching of Sputnik.

Assistance on a state level is another possibility, and some state governments are helping. Minnesota, with its Minnesota Educational Computing Consortium, is the leading example. Yet, there are persistent rumors of tighter budgets and restricted services at MECC. And no other state matches Minnesota in its level of support for computer literacy in schools.

It is at the local level that there is reason for optimism. There are approximately a hundred thousand microcomputers currently installed or on order for use in elementary and secondary schools in the United States. Often such a microcomputer is purchased by a media center, an individual school, a student organization, a parent group or a teacher.

An individual teacher, perhaps you, can have a significant impact upon computer education in a school or district. Indeed, tens of thousands of teachers working individually and collectively can have a far greater impact than any program funded by a federal or state government. Here are four things that you can do:

1. Continue to learn about computers and their educational uses. Computers are an important part of education. As an educator you have a professional obligation to increase your knowledge and skills in this area. .
2. Help your students to learn about computers. This can be done in every academic discipline and is not dependent on having a large computer facility available. The language arts teacher can show examples and discuss computer-generated poetry or word-processed manuscripts. The social studies teacher can show examples and discuss computerized information retrieval, databanks, data-based decision making, and so on. The math or science teacher should have little trouble illustrating roles of computers in these disciplines.
3. Do some planning at the school and district level. What should students know about computers after leaving your course or grade level? Can you get others who teach this course or grade level to agree on your goals? What should students who graduate from your school know about computers? It costs very little to have a committee that discusses school district goals and works on the problem of articulation between school levels. If you felt the committee could make a significant contribution to education, perhaps you would be willing to volunteer your time to such a group.
4. Support and work through your professional organizations. Your support as a member and as a volunteer helper allows these organizations to have resources for high-level planning and leadership activities. Professional organizations such as the International Council for Computers in Education do make a significant difference.

To summarize, it would indeed by nice if large amounts of money would become available. But this is unlikely to happen. Meanwhile, you, and tens of thousands of other educators, represent a huge resource. This resource can change education.

Editorial # 20. North to Alaska. V9 N2

(Editor's Message)

David Moursund

Editorial # 20 (Vol. 9 No. 2) October 1981

The Computing Teacher

Last spring I was invited to Kenai and to Anchorage to do some consulting and give some talks: it was my first visit to Alaska. I was impressed by the beautiful scenery, the dedicated and enthusiastic teachers, and the high level of interest and involvement in the instructional use of computers.

On August 24-27 I returned to Alaska to give two talks to the Alaska Association for Supervision and Curriculum Development and to consult with the computer leaders in the Anchorage School District. I would like to share some of my observations with you.

The level of interest and involvement in computers in education is quite high. I expect that Alaska will soon be the leading state in terms of instructional use of computers on a per capita basis. Perhaps this is because of the venturesome spirit of the "pioneers" who are filling the teaching positions in Alaska. Perhaps it reflects the considerable isolation and long winter nights, with a limited number of things to do.

In any case, students as well as teachers are enthusiastic. Some students are moving from a culture with no written language into English and then into computers, all in the course of a few years. It may well turn out that the native people have a high aptitude for learning the computer field.

In addition to enthusiastic teachers, Alaska has money. Consider Anchorage, which has about 45% of the state's population. It now has well over 100 Apple microcomputers, and its own funds are sufficient to add perhaps 50 machines per year. In the recently completed session of the state legislature, a bill was introduced to provide Anchorage with a million dollars to buy microcomputers. The bill passed the legislature, but was vetoed by the governor. It will be reintroduced next year.

Meanwhile, there is a rumor that the State Department of Education is thinking about the possibility of providing matching funds to schools purchasing microcomputers. Already the Department of Education has, through various projects, helped in the rapid growth of computers and telecommunication equipment throughout the state.

Within all of this enthusiasm and progress, I ran into something that is rapidly becoming a "sore point" with me. I believe that three different teachers (a media specialist. an elementary teacher, and a social studies teacher) each introduced themselves to me by saying, "I know I'm a real dummy, but. . ." This is coming from people who are well-established leaders in their own fields, and who are venturesome enough to begin exploring the field of computers in education.

I believe that computer scientists are partially responsible for this attitude—one that I find so self-defeating. Can you imagine a book written by a media specialist entitled *Introduction to*

Media for the Complete Idiot? But computer scientists write books with somewhat similar titles for people trying to get started with computers.

It is absolutely essential to orderly progress in computers in education that media specialists, elementary teachers, social scientists, etc. get involved. When I meet people trying to get started with computers, I try to be very supportive. I hope that you will do the same!

Editorial # 21. The Good Life. V9 N3.

(Editor's Message)

David Moursund

Editorial # 21 (Vol. 9 No. 3) November 1981

The Computing Teacher

As many of you know, I currently receive an annual salary of $0.00 for working for the International Council for Computers in Education. Thus, I must do additional work for a living, and it is the University of Oregon's Computer and Information Science Department that provides me that opportunity. Today was Monday, the first day of fall term. I'd like to share my day with you so that you can gain some insight into the life of one college professor.

I arrived at work a little before 8:00 a.m. to face a desk cluttered with unfinished work. One pile was material from the ICCE Board of Directors meeting, an all day meeting held Saturday. Another pile was lecture notes and overhead projector materials for a class I am teaching. I was working on them Sunday afternoon. There were a number of miscellaneous things to do—before panic set in, I sat down and wrote up a list of "Things to Do and/or Worry About."

Reassured by the single page of things to do, I began to type a letter responding to a request to present a workshop in Alaska. I handled three interruptions as I typed this short letter. The first was Dick Ricketts, the Managing Editor of *The Computing Teacher.* We discussed the ICCE Board meeting and several problems facing ICCE. The next two were students who were unable to get into the Computer Science courses they wanted.

These two students were the first of a steady stream. Our department turned away more than 400 students this fall! Nearly 200 of them were denied admission to the first term of the freshman level sequence for students who may want to major in computer science and/or who feel the need for solid coursework in this field. The first term of this sequence is offered only during fall term. Our department does not have sufficient faculty and computer resources to meet the demand.

As the morning continued, our departmental secretary finished typing the letter I had composed late last Friday to our higher level administration. The letter indicates my unhappiness with our department having to turn away 400 students, and suggests that the university must take action to solve this problem. Our university, like many, is working with a decreasing budget, so there are no easy answers here.

I ended the morning by working on my graduate seminar on Computers in Education. We have a good collection of students at the master's and Ph.D. levels in this area, so the seminar will be fun this year.

Lunch was with Dick Ricketts, discussing press releases about ICCE and *The Computing Teacher.* The steady stream of students continued after lunch until my 2:00 p.m. meeting with a College of Education committee. The committee is planning a major conference for this next summer, and it is also working to bring the college into the computer era. Each appears to be a large task.

I left the meeting early, to face 270 students in the Concepts of Computing course I teach. Then, back to my office to handle the day's mail. Two requests for information about our master's program in computer science education and two requests for information about the doctoral program. Five letters that should have been sorted into *The Computing Teacher's* mailbox. Two letters requesting information about the Association for Computing Machinery's Elementary and Secondary Schools Subcommittee. One letter asking me to give a talk, and a couple of miscellaneous requests for information. A typical Monday's mail…

At 5: 10 I start to leave for home. At 5:20 I actually leave, after a brief TCT staff meeting. On the way home I try to think of a topic for this Editor's Message, and you are reading the results.

Now Monday evening is drawing to a close, as is this message. Reflecting about the people, the interactions, the excitement, one conclusion stands out: It's a Good Life!

P.S. I have a neat family, and they play an important role in my life. Today we managed to interact for a couple of hours, sort of around the edges of a busy day. Some days are better; some are worse.

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Editorial # 22. Editor's Message. V9 N4.

(Editor's Message)

David Moursund

Editorial # 22 (Vol. 9 No. 4) December 1981

The Computing Teacher

I don't usually read editorial messages, so I am always surprised to learn that some people do. My impression of a good editorial is that it contains a strong statement of a particular point of view and a call to action. For this month's TCT I have prepared three short editorial messages. Buried in one of them is an offer that I hope you will find difficult to refuse. Read on!

Thanks

ICCE, the publisher of The Computing Teacher, is a nonprofit, tax exempt corporation. It began in August of 1979 with zero funds, but high hopes. The corporation is now into its third year, and is still solvent. Paid circulation of The Computing Teacher is now about 6,000 and is growing in excess of one percent a week. That doesn't sound like much when compared to Byte Magazine, with its circulation in excess of 200,000. But it compares very favorably with other nonprofit professional journals in the field of computers in education.

Since ICCE has never been able to afford extensive advertising, it must be that you, our readers, are responsible for our continued growth. For this I say THANKS! The current year's ICCE budget will be in balance if this growth rate continues for another three months. If the growth rate continues on into the next academic year, then we will be able to continue to improve the quality and value of *The Computing Teacher.*

There is still plenty of room for growth. In the United States alone there are over 15,000 school districts. Thus, in more than half of all school districts there is no subscriber to TCT. HELP!

What Is Computer Literacy?

This is the editorial message containing the offer that I hope you cannot refuse. For many years now, leaders in the field of computers in education have agreed that all precollege students should become computer literate. People who are not in computers in education have generally been willing to accept this idea. But they have raised the embarrassing question, "What is computer literacy?"

A year ago I was asked to write an answer to that question for a computer literacy conference to be held in Reston, Virginia. I wrote the paper, but was fogged in at the Eugene, Oregon airport during the conference, so didn't get to present it in person. Since then I have continued to work on this paper, and it is now a thirty-two page, $1.50 ICCE booklet. *Precollege Computer Literacy: A Personal Computing Approach* examines how computers might be personally relevant to students at all grade levels. Computer literacy is defined in terms of how computers are relevant as:

1. An aid to learning.

2. An aid to problem solving.
3. A topic of instruction (computer and information science).
4. Entertainment.
5. A part of the future.

This is a total curriculum approach to defining and implementing computer literacy. It requires that teachers at all grade levels and in all academic disciplines become computer literate with respect to their own educational areas. This certainly provides a worthy goal for computer educators for the next decade or so.

Now, for the offer I hope you cannot refuse. If you will send to me the name of a person or the name of a school or organization that you have convinced to subscribe to *The Computing Teacher,* I will send you two free copies of *Precollege Computer Literacy: A Personal Computing Approach.* The intent is that you keep one and pass the other along to the new subscriber. This will be done strictly on an honor system. I don't expect you to send me the money to pay for the subscription. Your statement that they intend to subscribe is sufficient. Note also that ICCE will not contact the people you name. This offer begins on December 1,1981 and expires on April 15, 1982. Thus, the name(s) you send me must be new successes-activity on your part after December 1st. If you manage to get us two new subscriptions, I'll send you four copies of the booklet. Three new subscriptions gives you six copies, and so on.

North to Canada

My most recent travels have taken me to Calgary, Alberta, and to Winnipeg, Manitoba. The similarities of these two places are interesting.

In both cases I was invited by the president of the local Association for Educational Data Systems to speak to a group that was primarily precollege teachers and school administrators. In both cases the president of AEDS is a faculty member in the school or faculty of education in the provincial university. That is, in both provinces we find leadership in the field of computers in education coming out of the school of education in the university.

Both the University of Alberta and the University of Manitoba have a long history of their education faculty being involved in educational uses of computers. In both cases regional timeshared computer systems have been in place for years, with the facilities made available both to public schools and to faculty and students within the school of education. In both cases there has been substantial development of computer assisted instruction materials, with these materials being used in the local schools and/or for other purposes.

In both cases there has been a recent trend towards acquiring microcomputers. Thus, both schools of education have a room full of microcomputers and are teaching courses that require their use. Both schools of education offer a computers-in-education course, and both have had a substantial increase in enrollment this fall. Both schools offer versions of the course off campus, and the demand and enrollment in these off campus courses has also increased substantially.

In both provinces there is interest and provincial-wide planning for computer literacy, but in neither case has the planning yet led to an implementation phase. Thus, the public schools offer some computer programming courses, often of considerable depth and high quality; however, relatively few high school graduates are functionally computer literate.

Colleges of education throughout the United States are beginning to be aware that they should be involved in educational aspects of computers. Most are many years behind the Canadian schools described above.

Editorial # 23. Traditional Computer Assisted Learning. V9 N5

(Editor's Message)

David Moursund

Editorial # 23 (Vol. 9 No. 5) January 1982

The Computing Teacher

I have been actively involved in the precollege educational use of computers for about 15 years. During all of this time I have remained convinced that eventually computers would significantly affect the content of education. For example, eventually mathematics courses will change to reflect the capabilities and applications of computers.

During this same time I have been somewhat negative toward what I now call traditional computer assisted learning attempts to change the process of education. First, as a teacher I felt that I could do better than the routine drill and practice instructional materials that were being so highly touted. Second, the schools where I taught couldn't afford much use of these materials, and their computer facilities were not well suited to working with large numbers of students.

Every once in a while, however, I encountered computer assisted learning materials that sparked my belief that eventually computers would change the process of education. The Huntington II simulations and other high quality educational simulations produced in the late 1960s and early 19705 provide a good example. Such simulations add a new and exciting dimension to education.

Even more striking was the first time I saw the PLATO system, about six years ago. For me, PLATO was science fiction come alive. Things that I had read and daydreamed about [what would result if wide-scale use of PLATO] [Editor's note, 2005. The previous bracketed material was inserted to correct some missing text in the original January 1982 editorial] were actually implemented in the software and hardware of the PLATO system. It seemed obvious to me at the time that eventually PLATO would substantially change the process of our educational system.

Unfortunately, PLATO has remained too expensive for widespread use at the precollege level. Its direct impact has been minimal. But indirectly it has provided a standard against which microcomputer systems compete. What is needed is instructional computer systems with the capabilities and quality of the best PLATO materials, but with the cost of microcomputer-delivered materials.

In recent years another major factor has entered the scene. LOGO, with its color graphs and good interaction, has provided us with an excellent example of a child-directed system. In no sense is it "traditional" computer assisted learning, so I mention it here only as a transition to a still newer development.

I recently did some consulting with WICAT, a relatively young company located in Orem, Utah. The company was started by people who were leaders in computer assisted instruction, and who were dedicated to improving education through this technology. The original non-profit company has grown rapidly, and now consists of a for-profit company and a non-profit research institute. The research institute runs an experimental school (currently grades K-5, but eventually to be expanded to the upper grades), conducts research in computer-related educational areas and develops computer-based educational materials. The for-profit company markets hardware and educational computer-based software systems.

WICAT represents an interesting and exciting compromise between PLATO and LOGO. The hardware they are marketing is based upon the 68000 microprocessor chip, which is very competitively priced. (The 68000 is a 16-bit microprocessor and is very fast.) The software I saw demonstrated was superb—fully competitive with the best from PLATO. The WICAT computer system comes in various configurations. The one they most hope to get into schools is a thirty terminal timeshared system, which could well have a total price in the $50,000 to $60,000 range.

Imagine, for a moment, what such a system might do for an elementary school classroom. First, consider the conventional drill and practice and tutorial instructional materials. We now have good evidence that students learn quite a bit faster on the average when they use these materials. Add to this the word processing and electronic mail capabilities of the system. All students would learn to use both, both for doing traditional writing activities and for communicating with other students on the computer system. Of course, the system includes a spelling checker and access to stored information; that is, computerized information storage and retrieval. Finally, the system has good quality computer graphics and good quality voice output. Students having access to such a system for an hour per day could be expected to make superior educational progress, as compared to equivalent students in a non-computer environment.

Now we are at the heart of the matter. With this type of computerized addition to education, students will learn more and faster. Students educated in such an environment will have a distinct advantage over students educated in our traditional public school setting. Sure, there is an added cost (or classes will have to be larger). But many parents are willing and able to pay for it, because a good quality education is one of the most important things they can help provide for their children. If the public schools can't do it, private schools will.

My conclusion is that this next generation of microcomputer-based educational software and hardware systems will begin to change the face of precollege education. As parents come to realize the advantage obtained by children educated in such an environment, there will be an overwhelming demand to make the computer facilities available to all students—not just those in private schools and/or in "rich" school districts. It will be interesting to see if our public school system can adjust to the demand and to the resulting changes in education. I suspect that it can-but that many teachers and many school systems will find the change quite painful.

Editorial # 24. On Being a Change Agent. V8 N6

(Editor's Message)

David Moursund

Editorial # 24 (Vol. 9 No. 6) February 1982

The Computing Teacher

If our technologically-oriented society continues, then eventually computers will be commonplace. Children will grow up in homes, schools and neighborhoods in which everyone uses computers. Computerized information retrieval, word processing and problem solving will be as widely used as paper and pencil techniques are today.

But that "eventually" may be a long way off. Sure, hardware can be mass-produced, and hardware progress continues unabated. Sure, a piece of high quality software can be widely distributed, making the cost to each end-user quite reasonable.

Unfortunately, knowledgeable end-users cannot be mass produced. The computer is a powerful tool, but it is a complex tool. To use a general range of computer capabilities effectively takes considerable knowledge, training, experience and a measure of courage.

That is where you and other educators come in. You are a computer-knowledgeable educator, capable of helping others to learn about computers. Thus, you are a change agent.

Being a change agent can be fun. It is being a leader, rather than a follower. It is exploring new worlds, facing new problems. It is taking risks. The personal growth rewards can be high.

But being a change agent is stressful. This is especially true in the computer field. 'How do I know what I am doing is right?" "The computer field is changing so fast—how can I possibly keep up?" "Others seem to know so much more than I." "The field hasn't been researched very well. I fear that I will do more harm than good." "I don't have time to keep up in the field where I got my degree. What chance do I have in the computer field?"

Do you have any of these doubts? I have had all of them, and they continue to reoccur periodically. Be aware that these are common fears! Here are some ways to deal with them.

RELAX! PAUSE FOR A MOMENT. TAKE A COUPLE OF DEEP BREATHS. REALIZE THAT YOU ARE "DOING A NUMBER" ON YOURSELF.

If you are a regular reader of *The Computing Teacher,* then undoubtedly you are in the upper five percent of all educators in terms of your computer knowledge. You know a lot, both relative to other educators and relative to most students. You know enough to help others learn, and you know enough to do some things that will reduce the stress on you.

1. Admit freely and openly:
    a. That you don't know as much as you would like to know about computers, but you are still learning.
    b. That you feel it is very important to help others learn about computers, and that you are committed to doing so.

This type of open and honest attitude is beneficial to you and to your colleagues. It is intellectual honesty—an excellent role model for students.

2. Learn from your everyday environment. You are surrounded by easily accessible opportunities to learn. For example:

    a. Talk to your fellow educators about current and future applications of computers. As you try to express your insights you will receive valuable feedback as well as hearing the insights of others.

    b. If you are a teacher, think carefully about what you teach. Then discuss the problems of computers in education with your students. Learn from them as you help them to begin to understand the role of computers in your teaching area.

    c. Watch science-oriented television programs, especially those on PBS. You will see that computers are an everyday tool in modern science, and you will learn some of these computer applications.

    d. Pay attention to computer and other electronics-oriented ads. Browse in an electronics store. Visit an electronic arcade center.

3. Take a course. (Or, if you can't do that, buy a computer-oriented book and read it.) Check your nearby college or university. Perhaps you can get your school district to arrange an appropriate course. If you can't find what you need, encourage your school district or a nearby school to create an appropriate course.

4. Finally, continue to be a change agent. Eventually you, and thousands like you, will be successful. Then you will be surrounded by computer-knowledgeable people, and you will no longer need to be a change agent in this area.

Editorial # 25. 23. V9 N7

(Editor's Message)

David Moursund

Editorial # 25 (Vol. 9 No. 7) March 1982

The Computing Teacher

Many subscribers to The Computing Teacher do not realize that they are Individual Members of the International Council for Computers in Education. In this editorial, I'll tell you about ICCE—what it is, what it is doing, and what it hopes to do.

ICCE is an international, non-profit, professional organization of educators. It is especially concerned with instructional uses of computers at the precollege level and with computer-related aspects of teacher education. ICCE was officially established as a tax-exempt, non-profit corporation in August, 1979; however, its roots are intertwined with the Oregon Council for Computers in Education, established in 1971. Moreover, The Computing Teacher began life as the Oregon Computing Teacher back in 1974.

Each person subscribing to The Computing Teacher automatically becomes an Individual Member of the International Council for Computers in Education. About 11 % of the current membership is from outside the United States, with dozens of countries represented.

In addition to Individual Members, ICCE has Organization Members. Currently there are 23 of them (that's where the title of this editorial comes from). Eight of these Organization Members are from outside the United States.

ICCE is governed by a twelve person Board of Directors. Eight members of the Board are selected by eight Organization Members for two year terms. Each year four new Organization Members become eligible to appoint a Board member, and this privilege is rotated through the total list of Organization Members. Thus, eventually each Organization Member gets to appoint a Board member.

The remaining four Board members are selected by the eight members appointed by the Organization. The overall Board selects from its membership a president, vice-president, secretary and treasurer. To summarize, ICCE's Board of Directors is appointed by and is directly responsible to its Organization Members.

Currently, ICCE has two major publication thrusts. *The Computing Teacher* is published nine times per year, 10,000 copies per issue. The majority of these go to Individual Members of ICCE, but a number are given away for promotional purposes, often for use at regional meetings of Organization Members. ICCE also publishes various booklets and a book aimed at computer-using educators. This list of inexpensive publications is slowly growing and has been well received.

ICCE is one of the sponsoring organizations of the National Educational Computing Conference. This year that excellent conference will be held in Kansas City, Missouri, June 28-30. ICCE holds its annual meeting during and at that conference.

ICCE's goals and future sense of direction are as follows:

1. To help provide leadership in the field of computers in instruction at the precollege level and in teacher education.
2. To publish a high quality, useful journal (and eventually, more than one journal) specifically designed to support educators interested in the instructional uses of computers.
3. To publish books and booklets that help educators interested in instructional uses of computers. Some of these will be designed for precollege level students.
4. To support our Organization Members in their efforts to continue their "grass-roots" approach to promoting computers in education and in their other activities.

Goal number one is especially important because few national or state governments are providing adequate planning and leadership in educational uses of computers. Indeed, few such large political bodies (or their corresponding departments of education) have adopted and promote the goals for computers in education listed below.

1. All students should become functionally computer literate. The meaning/level of computer knowledge and skills included under this heading is spelled out in detail in my booklet Precollege Computer Literacy: A Personal Computing Approach, published by ICCE, 1981.
2. Computer assisted learning should occur when it is both educationally and economically sound.
3. The content of all courses should adequately reflect the capabilities of computers as an aid to problem solving and the ramifications of using computers as a tool within these courses.
4. Schools that have appropriate resources (faculty and computers) should provide appropriate learning opportunities beyond those needed for 1-3 above for two groups of students:
    a. Students seeking a job immediately upon leaving high school.
    b. Students planning a computer-related career requiring education beyond high school.

Editorial # 26. Pre-Service, In-Service, Self-Service. V9 N8

(Editor's Message)

David Moursund

Editorial # 26 (Vol. 9 No. 8) April 1982

The Computing Teacher

I suspect that most of us don't realize how big the computer industry really is. The other day I was reading *The Wall Street Journal.* An article on IBM's microcomputer caught my eye. The article indicated that this microcomputer was selling much better than IBM had expected, and it predicted that sales could well be 200,000 microcomputers in North America in 1982, a figure representing income of about 580 million dollars.

The same article lists IBM's *total sales* for 1981 at 29 billion dollars. This is 50 times the estimated dollar value of the personal computers IBM hopes to sell in 1982. That is, $580,000,000 is a mere 2% or so of IBM's probable 1982 sales.

While numbers have always been my friend, I do have trouble grasping the meaning of large numbers such as 200,000 microcomputers. The way I handle it is to remember that the population of my home state (Oregon) is about.1 % of North America, and that the population of my home town (Eugene) is about 5% of Oregon. Thus, 200,000 microcomputers in North America translates into 2,000 microcomputers in Oregon or 100 microcomputers in Eugene. I can understand these smaller numbers.

IBM, of course, is not the leading seller of microcomputers. Several articles I have read in the past few weeks suggest that both Apple and Radio Shack expect to sell approximately 350,000 microcomputers in 1982. Total sales of microcomputers by these and other companies in North America in 1982 could well be in the range of 1.25 million to 1.5 million machines. And many of these machines will be newer, faster, more powerful than the microcomputers of last year or the year before!

The capability of our mass production-oriented industry and aggressive marketing of its products is overwhelming. One and a half million microcomputers corresponds to 15,000 machines in Oregon, or 750 in Eugene. All forecasts call for progressively larger sales in 1983, 1984, 1985, etc.

Hardware can be mass-produced. While it is more difficult to produce good quality software, software can be mass marketed. Thus good ideas such as LOGO, PILOT or Pascal can be made available rather inexpensively on a per machine basis.

Teacher knowledge, however, cannot be mass-produced. Learning is an individual process. Indeed, for most of us, learning is a slow process, requiring considerable effort.

Traditional models for teacher education are preservice and inservice. A teacher grows up in our society, goes to our pre-college schools and experiences our pre-college educational system. The teacher goes on to college, receiving additional subject matter (content-oriented) education and training in teaching. Generally, preservice teachers learn to teach in a manner roughly equivalent to the type of teaching they have experienced in their own pre-college education.

Then on to the job, with massive learning occurring during the first few years. Most teachers learn more about teaching during their first year of teaching than they do during four years of college. But those early years on the job do not fit the traditional model of inservice education. Rather, it is self-service education, where teachers teach themselves, learning on the job from their students, from other teachers and through the school of hard knocks. The actual out-of-pocket cost to the school district or to the individual teacher for this self-service education is very small.

In examining the problem of computer education for teachers, we can observe traditional preservice and inservice models. Each is valuable, and each should be developed. But they are both expensive and slow, and taken together they are not doing the job.

The third model, self-service, needs to be utilized more fully. What happens when a teacher is allowed to take one of the school's computers home for a weekend? Perhaps the teacher "plays" with the machine for four hours. The teacher's spouse and children play with it for another four hours (perhaps the neighbors are also involved). The total cost to the school is almost zero. But what would a four-hour inservice for the teacher cost? If we count teacher time; that is, release time for a half-day plus the cost of organizing and presenting an in-service workshop, it costs about $100.

Okay! Now we have a good idea. What else can we do to get teachers involved in self-service education? How about a couple of books and a couple of computer-oriented magazines placed in the teacher's lounge? ICCE's booklet on computer literacy costs $1.50 for one, and as little as $ .50 each in quantity. Suppose a school district gave one of these booklets to every teacher in the district. The cost to the district might be $ .60 per teacher. Many teachers would spend an hour browsing through this 32-page booklet. But an hour of teacher's time is worth about $20!

If I were a school administrator, I would quickly move to utilize this self-service idea. I would even cut down slightly on hardware and software purchases in order to put computer-oriented magazines and a few select books into every teachers' lounge. I would offer to buy additional reading material for any teacher who demonstrated that s/he would read it. Meanwhile, I would make increased use of the machines in my schools. Teachers would be encouraged to borrow them to use evenings, weekends and during vacations. Indeed, I would consider purchasing some machines strictly as loaners. Suppose, for example, that a teacher agreed to enroll in a computer course at a nearby college or university. I would lend that teacher a computer to use full time at home during the course. I'd even buy that teacher a year's subscription to *The Computing Teacher.* The cost would be very small relative to the cost of the teacher's time. Self-service education is by far the cheapest method to attack the problem of helping all teachers become computer literate.

Editorial # 27. Artificial Mind. V9 N9

(Editor's Message)

David Moursund

Editorial # 27 (Vol. 9 No. 9) May 1982

The Computing Teacher

Many people think of a human being as having a mind, body and soul. From that point of view, this essay is concerned with mind and body.

One characteristic that distinguishes human beings from other life forms on the planet is the human ability to create and learn to use an extremely wide variety of aids to the mind and body. The body is aided by tools such as a spear, knife, hammer or saw. It is aided by clothing and houses. It is aided by paved roads, cars, trains and airplanes.

The human mind is aided by pencil and paper, books, and skills such as reading, writing and arithmetic. .

It is amusing to contemplate an academic field named "artificial body." This field is the study of aids to the physical body, their applications and their effects. Perhaps the study of artificial body began with cave people discussing clubs. Sure, a club is a useful tool. But one might become overly dependent on it—and a good club is not always available. Better to develop a strong fist and good kicking skills…

Is a microscope an example of artificial body? Perhaps it should be classified as "artificial mind," or perhaps an entirely new classification is needed. In any case, it should be viewed with suspicion. The human eye was not meant to behold wiggly creatures in a drop of water.

Now let's take the parallel a bit further… "Artificial mind" is an interesting idea which computer scientists have popularized, using the term artificial intelligence (AI) or machine intelligence to refer to a certain subfield of computer science.

While artificia1 body has never been a particularly interesting topic for philosophical discussion and argument, artificial intelligence has proven quite fruitful. Way back in 1950, Turing proposed a test for artificial intelligence. His test is an imitation game. If a computer can imitate human performance sufficiently well, we can say that artificial intelligence has been achieved. One can establish precise, measurable criteria for this imitation game, and then researchers can work towards producing artificially intelligent computers.

But most computer scientists are not particularly concerned with Turing's imitation game nor in philosophical discussions of the nature of human mind versus artificial mind. Rather, they are concerned with developing useful *aids* to the human mind—aids that can help in the solution of difficult problems.

The four function electronic calculator is such an aid. Whether it is an example of artificial intelligence really is not very important as compared with its applications and effects. Nearly every teacher owns and uses a calculator. Rarely does a teacher perform a pencil and paper long division of multi digit numbers except to instruct students. But the calculator has had almost no impact upon the mathematics curriculum in grades K-8. . .

The calculator pales in significance when compared with a number of newer products of computer scientists. Researchers in artificial intelligence have coined the phrase "expert" systems to refer to the problem-solving-oriented, knowledge-based systems they are now developing. One such program can diagnose lung diseases at a level competitive with well-trained physicians. Another reads electrocardiograms. Still another one can analyze oil well core samples and seismic data at the level of a college graduate in this field. Other expert systems play games such as chess, checkers or backgammon at very high levels.

There is nothing particularly magical about an expert system. Within a limited problem-solving area, human performance is very carefully studied and analyzed. Procedures are developed which allow a computer to solve problems within that limited area. These procedures make use of very large data banks, large amounts of computer power and the researchers' insights into how to solve the problems. Computer performance improves with continued research into the problem, the collection of more and better data, the development of better software and the development of more powerful computers.

Over the next decade we are likely to see the development of hundreds of expert systems. Each is likely to perform as well or better than a quite competent human being working on the same type of problem. The products of artificial intelligence researchers and developers will become everyday tools of adults who have need to solve those particular problems. They will use these computer tools for the same reasons that the typical teacher uses a calculator to do multi digit long division.

This presents an immense challenge to all levels of our educational system. What should people learn to do mentally? What should they learn to do aided by pencil, paper, books and other. traditional aids? What should they learn to do aided by calculators and computers? Educators at every level should be vitally concerned with these questions. They should do their best to answer the questions and they should work to implement their answers into the curriculum. .

But this means that educators must be computer literate. They must know the capabilities and uses of computers within their own disciplines and must have general knowledge of current and future computer capabilities. I view this as a great intellectual and educational challenge. I hope that you, TCT readers, will meet this challenge.

Editorial # 28. A “Grass Roots” Umbrella. V10 N 1

(Editor’s Message)

David Moursund

Editorial # 28 (Vol. 10 No. 1) September 1982

The Computing Teacher

As computers become increasingly available in precollege education, more and more teachers are saying:

> “We need help. We want to belong to an organization dedicated to promoting effective instructional use of computers. We want an organization that serves the needs of classroom teachers. We want an organization that helps coordinate the activities of other organizations that work in the field of instructional uses of computers.”

The International Council for Computers in Education is such an organization. This editorial message discusses the current status and plans of ICCE.

Officially, ICCE is only three years old. But the roots of ICCE are easily traced back to the summer and fall of 1971 when a group of classroom teachers met to form a statewide organization dedicated to the instructional use of computers. This was a grassroots organization, with representation from all educational levels and all geographical parts of the state.

That state organization was known as the Oregon Council for Computer Education. Besides spawning ICCE in 1979, it has grown into the Northwest Council for Computer Education. It remains a grassroots organization, run by classroom teachers and others dedicated to improved instructional use of computers.

ICCE has grown rapidly, so that it now has over 8,000 Individual Members and twenty-seven Organization Members. Recently its Board of Directors met to discuss ICCE's future. Sandy Wagner, Board Member from the California Computer-Using Educators, clearly expressed what needs to be done. ICCE must provide international leadership, but it must represent the classroom teacher. All of the Board Members present supported this position.

The ICCE Board Members discussed a number of ways to enhance ICCE's position as an umbrella organization and to better serve the needs of its members. During the coming year, you will begin to see the effects of this planning.

The Board's Decisions

First, ICCE will take a stronger role as a spokesperson for computer-using educators. For example, some software vendors follow a policy of a 30-day money-back guarantee. Excellent! We will encourage and support such vendors. Some vendors allow software purchasers to make an archival copy. Others provide an inexpensive and rapid replacement service if a piece of software is damaged beyond use. Such vendors deserve our whole-hearted support!

Another example of what ICCE can do is to represent clearly the needs of classroom teachers to their administrators. Teachers need help to learn to use computers. They need easy access to equipment for self-instruction; they need inservice instruction; they need books, magazines, and self-instruction software; they need time and encouragement.

An especially heavy burden is placed upon teachers who are already established as computer-using educators. They are expected to help other teachers, to organize and conduct workshops, to select and develop instructional materials, to make software and hardware purchase decisions, to develop new courses and new instructional uses of computers and so on. Such teachers need release time from other duties!

The ICCE Board Members discussed a number of changes to ICCE. One idea that was approved is the establishment of Technical Liaison Committees (TLC). A TLC is a small committee of perhaps four to eight people with a common academic area interest. We intend to establish TLCs in such areas as Library/Media, Math, Science, Social Science and so on. Each TLC will consist of people with a strong national or international involvement within their academic discipline, but who are devoted to effective instructional use of computers at the precollege level.

TLCs will be a liaison with existing professional organizations. Other TLC activities will include providing advice to the ICCE Board and developing position papers for publication by ICCE.

If ICCE is to help and represent classroom teachers adequately, it must help provide meetings that teachers can attend. National meetings are useful-but few classroom teachers can attend. It is the local and regional meetings that best meet the needs of classroom teachers.

ICCE has a major source of strength in its Organization Members. It is those Organization Members that can conduct local and regional meetings; they can effectively interact with classroom teachers.

The most important ICCE structural change that was discussed is how the Board of Directors should be selected and related governance issues. Currently, eight members of the Board are appointed by Organization Members. These Board Members then select a president, vice-president, secretary and treasurer. The Board will have between eight and twelve members, depending upon how many of the officers come from the eight Organization-appointed Members. The eight Organization Members eligible to appoint a Board Member rotate through all of the Organization Members, so that eventually every Organization Member will be represented on the Board.

Likely, however, this will be changed. Various proposals were discussed. The proposal receiving the most support calls for the creation of a Council of Representatives consisting of one member appointed by each Organization Member. The Council of Representatives will select from among its members a nine-person Board of Directors. Board Members will serve three-year terms, with three people appointed to be Board Members each year.

Currently ICCE does quite a few things for its Organization Members. ICCE provides continuing general publicity plus announcements of their meetings, reduced price subscriptions to *The Computing Teacher*, reduced prices on its books and booklets, and copies of TCT or other literature to distribute at meetings. ICCE will continue to do these things and more.

But in turn, ICCE needs much stronger support from its Organization Members. The following ideas have been discussed by part of ICCE's Board and can serve as a basis for discussion. It is proposed that Organization Members be required to do the following:

1. Provide two copies of each of the newsletters and other publications for the ICCE Organization Members. (ICCE staff would organize this exchange of materials.)
2. Prominently display their ICCE Organization Membership in their conference announcements. The registration form for an Organization Member's conference would include provisions for people to join ICCE.
3. ICCE Individual Members would pay “local member, best price” registration fees at Organization Member conferences. Thus, if an Organization Member has a special conference registration fee for its own members, this same registration fee would be available to all ICCE members.
4. There would be an ICCE booth at each Organization Member conference to sell ICCE materials. It would be organized and run by the Organization Member putting on the conference.

Remember, all of the ideas 1-4 above are being discussed. Your immediate input is being sought. Contact ICCE through its Board or through the officers of its Organization Members.

Finally, I want to publicize more broadly an offer that ICCE has made several times in the past. If you do not have a statewide computer-using educators group that clearly represents the needs of precollege teachers, ICCE would like to help you get started. We can provide you with seed money, planning help, help in organizing a conference, help in securing speakers and so on. If we advance money to you, it will be at no risk to you and/or the organization you hope to form. If your conference takes in enough money to cover all expenses plus the money we advance, we would expect to get our money back. Your organization would keep all profits.

Remember, ICCE is your organization. It can only represent your needs if you make these needs known and if you, in turn, support ICCE. Send us your ideas!

Editorial # 29. The Free enterprise System. V10 N2\

(Editor's Message)

David Moursund

Editorial # 29 (Vol. 10 No. 2) October 1982

The Computing Teacher

I was tempted to title this editorial message ENTREPRENEURSHIP but I feared such a title might attract even fewer readers than usual. An entrepreneur is "one who undertakes to start and conduct an enterprise, assuming full control and risk." I want to discuss some roles of entrepreneurs in the field of computers-in-education.

Our traditional idea of an entrepreneur is one who develops a new product and starts a company to sell it. Certainly, the microcomputer field provides an almost endless list of successes and failures of this sort, both in hardware and in software. The Apple Corporation provides a splendid example of a success story.

But I want to talk about a different sort of entrepreneur, the individual teacher or school administrator. To get started, it seems to me that it was about three years ago when the French national government announced a ten-year plan to place 10,000 microcomputers into French schools. That would be equivalent to the United States government announcing plans to place about 40,000 computers into U.S. schools, since France has about a fourth the population of the U.S.

France has an educational system that is highly centralized and one with considerable uniformity throughout the country. The national government controls the educational system. The ten-year proposal to acquire 10,000 microcomputers also included plans for teacher training.

I wondered at the time whether the United States would be able to match this rate of computers-in-education progress. It seemed unlikely that our government would be willing to purchase and give away 40,000 microcomputers. And federally funded teacher education of this magnitude seemed out of the question.

Three years have now passed. There are approximately 100,000 microcomputers in United States schools. This figure seems likely to increase to 200,000 in the next year or two and is likely to continue its rapid growth for years to come.

Teacher education has also been rapid, but it is more difficult to quantify. For example, I estimate that the number of universities offering a master's degree in computer science education has tripled in the last three years. In-district inservice workshops and short courses have likely increased a similar amount.

How can such rapid progress be occurring without effective national education policy or leadership? One might guess that it is because of educational leadership at the state level. But that is not correct. Minnesota, with its Minnesota Educational Computing Consortium, is a rare exception. Few state legislatures have provided significant amounts of money earmarked for educational use of computers.

The answer is the individual educator. Individual teachers and individual school administrators have undertaken to “start and conduct” computers-in-education enterprises, “assuming full risk and control.” Their risk is usually not measured in dollars, but rather it is the risk of exploring new territory and venturing into the unknown. Their rewards are not measured in dollars, but rather in growth in self-esteem, growth in knowledge, and the awareness of making a significant contribution to education.

The growth of educational computing in the United States has not been even. I suspect that to a large extent this is due to variations in the degree of educational entrepreneurship that is allowed in different parts of the country. Even in neighboring towns one can find a repressive, “controlled” educational system and a progressive, entrepreneurial educational system.

The educator-as-entrepreneur idea need not be limited to computers in education. In every professional aspect of an educator's life there is opportunity for starting and conducting new enterprises, for risk-taking and control-taking. Some school systems and school administrators are very good at harnessing this huge source of energy. They help to create an exciting, progressive atmosphere for teachers and students.

Others have lost their entrepreneurial spirit, or never had much to begin with. They cannot readily respond to change or make effective use of the untapped potential of their building level administrators and teachers.

Computers provide an interesting and challenging test for a school system. Some are succeeding quite well, while others are failing. It is here that the analogy with business breaks down. When a business entrepreneur fails, the business goes bankrupt and the entrepreneur loses money. But when a school system fails to provide progressive, high quality education it is the students who suffer. Ultimately, the whole country and the world suffer, as the untapped potential of these developing minds becomes a lost resource.

Editorial # 30. The Unchanging Conventional Curriculum. V10 N 4

(Editor's Message)

David Moursund

Editorial #30 (Vol. 10 No. 4) December 1982

The Computing Teacher

I divide computers in instruction into three major parts. Learning using computers (often called Computer-Assisted Learning) and learning about computers receive the most attention. There the goals seem clear. We want CAL to be used if students will learn more, better, faster, at little increase (or decreased) cost. [Note added January 2005. The tail end of the previous sentence doesn't say what I intended to say. The sentence should say: We want CAL to be used if students will learn more, better, faster, at little increased (better yet, a decreased) cost. We want all students to become computer literate (that is, to obtain a useful-tool level of knowledge about computers and their effects).

A third major aspect of computers in instruction receives little attention and seems not to be understood by most educators. It is the potential impact of computers upon the content of the conventional curriculum.

When I try to explain this third area, I invariably use calculators as an example. In 1965 the first desk-top electronic digit calculator was produced. It was the same size and same price (about $1,500) as the electro-mechanical calculators of those days. It performed the same four functions with the same accuracy, but was faster and quieter.

Up to that time there was no reason that calculators should have a significant impact on the curriculum in grades 1-8. If a person was going to use mathematics to solve problems, then the person needed to add, subtract, multiply and divide. The fact that $1,500 machines could do the same thing was of little consequence. That amount of money would buy a new car—certainly such an expensive tool as a calculator could not be made available to young students. Indeed, four function calculators were too expensive to be readily available in business, government and higher education at that time.

We all know what has happened to the price of calculators. Now one can purchase a solar cell-powered, handheld, four-function calculator with four key memory for as little as $10. Such a calculator doesn't even have an on-off switch, since its batteries provide sufficient energy under any light conditions that allow one to read a calculator display.

At one time I expected that inexpensive calculators would drastically change the elementary and middle school mathematics curriculum. After all, a major goal in math is problem solving. Calculation is a necessary evil in problem solving, but rarely an appropriate end goal in its own right. If all students were provided with calculators, perhaps half of the time spent in math instruction in grades 1-8 could be devoted to higher level thinking, problem solving, geometry, statistics and logic. The golden age of mathematics education would be upon us.

That has not happened, despite the encouragement of the National Council of Teachers of Mathematics and many of the country's leading mathematics educators. Certainly the reason for this has not been the cost of calculators. Nor has it been that teachers cannot learn to use calculators. Almost all teachers have calculators for their own personal use. It isn't an absence of materials. Many books have been written for teachers and for students. (I am the author of one and co-author of another. Neither has sold well.) The *Arithmetic Teacher* has carried numerous examples of calculator activities for the elementary school student.

Now we have computers, and they also are getting increasingly inexpensive. Eventually they will be commonplace in homes, as they are rapidly becoming in all work environments where they are used. The parallel with calculators is frightening. Right now we have the arguments that computers are still too expensive, too fragile, too easy to steal, not available. Added to this we have the argument that computers are difficult to use, difficult to learn to use, and that most teachers don't know how to use them. These are almost the same arguments advanced against calculators a few years ago.

But all of these "barriers" will be overcome. It is now clear that CAL will gradually play an increasing role in instruction, and that eventually it will playa major role. It is now clear that computer literacy will become a standard educational goal, and that all students will learn about computers.

But will the conventional curriculum content be changed? If so, how? Two of my students completed their doctorates in computer science education this summer. Each produced a thesis that relates to the curriculum content question.

Gerard Rambally did a conceptual design of a computer graphics package for secondary school students and their teachers. The package would provide a wide range of capabilities and could be learned in a few weeks by a typical student. Gerard went on to look at a variety of topics in a conventional high school mathematics curriculum to show potential uses of such a package. For example, graphing is useful in equation solving. But if one graphs by hand, the process is quite slow, and arithmetic errors may seriously distort the results. If all students had everyday access to a good computer graphics system, the conventional mathematics curriculum would change.

Mike Haney looked at the secondary school science lab. He did a conceptual design of a very sophisticated package of programs to help the student and teacher in science labs. These packages include provisions for the collection, manipulation, storage and display of data, as well as the control of experiments. Mike implemented several of the packages and explored their impact upon the curriculum content and process. If all students had everyday access to a good laboratory science computer system, the conventional laboratory science curriculum would change.

The work of Rambally and Haney illustrates the potential. In both cases it is shown that it is possible to make a very useful tool available to students and teachers. The tool can be mastered by both audiences in a few weeks of use as part of a course at the ninth grade level. Once mastered, the tool is useful in subsequent courses and provides a foundation for change in the conventional curriculum.

In my opinion, this third area of computers in instruction is the most important at the current time. The other two areas will continue to make progress and will contribute significantly to our educational system. We will get better and better computer-assisted learning systems, designed to help students master paper and pencil arithmetic. We will get better and better CAL systems to help students learn historical science laboratory techniques. We will get better and better CAL materials that help students learn paper and pencil graphing techniques and equation-solving techniques.

I believe that the way to approach this third area of computer application is through teacher education and experimental projects. The projects might be funded at the school, district, state or national level. Certainly, this is a good place to put some federal funds. But even an individual school can tryout and implement such changes if they have sufficiently knowledgeable teachers.

We are beginning to see what "sufficiently knowledgeable" might mean. The typical elementary school teacher who has a calculator for personal use is not sufficiently knowledgeable about calculators unless that teacher understands mathematical problem solving and higher level goals in math education. Similarly, the typical computer-using secondary school teacher may not be sufficiently knowledgeable about computers. It is not sufficient to merely be a computer user, one who can master the use of programs such as those discussed by Rambally and Haney. Rather, we need teachers with deep insight into their disciplines and the roles their disciplines play in business, government, industry and research. The teachers need a deep level of knowledge of the computer tool and specific knowledge of the role computers could be playing in curriculum.

The Computing Teacher would like to carry articles describing situations where substantial change in the current curriculum content is occurring. If you are involved in such a project or know of such a project, try to get it written up for submission to TCT.

Gerard Rambally's thesis is $5.00 and Mike Haney's thesis is $7.00. Both are available from the Department of Computer and Information Science, University of Oregon, Eugene, Oregon 97403. These are not ICCE publications, so make sure that you order them from the address listed above.

Editorial # 31. I Don’t Know. V10 N5.

(Editor’s Message)

David Moursund

Editorial #31 (Vol. 10 No. 5) January 1983

The Computing Teacher

A few weeks ago I was walking down the display aisle at a large computers-in-education conference. Within a period of a few minutes I was "accosted" by three different individuals.

Individual #1: “What do you think of—(a particular piece of courseware)? Don't you think it's really neat?”

My response: “I'm sorry, I haven't tried it yet.”

Individual #2: “What do you think of—(a particular new piece of hardware)? Do you feel it will really take hold?”

My response: “I'm sorry, I haven't seen it yet.”

Individual #3: “My school wants to use computers for—(briefly describes a particular problem). What do you recommend?”

My response: “I'm sorry, I don't know very much about specific hardware and software in that particular area.”

Do you see the pattern? It is one in which I am continually apologizing for my lack of expertise; I am continually made to feel inadequate.

It isn't as though I don't know quite a bit about the field of computers in education. I taught my first course to high school students in this field in 1963, and I began to teach teachers in this field in the summer of 1965. Since then I have worked very hard to learn more about computers, computers in education, and teacher education. I am a good student and I have made substantial progress.

Part of the problem is psychological, and it is here that my past comes back to haunt me. My bachelor's, master's, and doctor's degrees are all in mathematics, as were my initial teaching experiences. I was taught (that is, strongly indoctrinated) that a bachelor's degree in mathematics qualifies a person to teach precollege mathematics. If one is an especially strong student, the bachelor's degree earns one a graduate teaching assistantship and minimally qualifies one to teach freshman college algebra courses.

With a master's degree and more teaching experience, the graduate teaching assistant is allowed to teach an introductory calculus course. The “really advanced” graduate student in mathematics might even be allowed to teach sophomore level courses!

The general model that I learned for math teaching was that one should be totally competent. A good math teacher must be able to explain every topic and solve every problem arising in a course. Indeed, the goal was to be able to do this in real time, off the top of one's head. It was not appropriate to respond to a question with, "I don't know."

I don't know-let's learn together! It seems like a simple idea, and it is a healthy attitude for all educators. Roughly speaking, I find that elementary teachers most easily implement the “I don't know-let's learn together” idea, followed by junior high school teachers, high school teachers and college teachers, with university teachers at the bottom of the list. I can see why I have trouble—especially when my math background is factored in!

"New" math notwithstanding, the content of the K-16 math curriculum is quite old. It is difficult to find a major topic in this curriculum that is less than 50 years old, and most of the content is hundreds of years old.

Computers in education is just the opposite. Almost everything is less than 50 years old and much of it is less than a couple of years old. Hundreds of companies are developing new hardware and software. Literally thousands of people are trying out new ideas, developing new curricula and carrying on research. Computers are both a relevant aid to problem solving and a source of problems in every academic discipline at every academic level. This relevance is growing rapidly.

So, what is a middle-aged, retreaded mathematician to do? Certainly I can continue to learn. That is essential.

But it is equally essential to overcome the psychological barrier. I need to learn to say, "I don't know—let's learn together," **without following it with an apology.** There is nothing wrong with not knowing about the latest piece of hardware or software. There is nothing wrong with not carrying around in one's head all of the fine details of a particular machine that some bright 14-year-olds seem to memorize so easily. I am still a competent person even if a 14-year-old knows many things about computers that I don't know.

For me, what is especially important is learning to take advantage of my strengths, such as wisdom and experience gained through the past 46 years. I have a greater breadth and depth of knowledge than most of my students. I have had a greater range of experiences,

and I have had more practice in learning to learn. If I keep these facts firmly in mind, I can more easily say, "I don't know—let's learn together." For me, that is an important goal.

Note added for January 2005 reprinting. The following item appeared on the same page as the January 1983 editorial and was included in the 1985 book

EPIE—Consumers Union

Most people are familiar with Consumers Union, publishers of Consumer Reports. For many years, Educational Products Information Exchange (EPIE) has been a "consumers union" for educational products. Now EPIE and CU have formed a partnership to review computers-in-education software and hardware.

To learn more about EPIE-CU, turn to the centerfold of this issue of *The Computing Teacher.* There you will find a copy of MICROGRAM, the EPIE-CU newsletter. MICROGRAM is published nine times per year and will appear exclusively in The Computing Teacher. The ICCE editorial staff and the EPIE-CU staff would appreciate feedback on MICROGRAM.

Editorial # 32. Aren’t We All Handicapped? V10 N 6

(Editor’s Message)

David Moursund

Editorial # 32 (Vol. 10 No. 6) February 1982

The Computing Teacher

3Aren't We All Handicapped?

A few years ago I worked on a "talking calculator" project. At that time a battery powered talking calculator was about the size of a small tape recorder and cost about $350. Each key would "say" its value or operation when depressed, and the calculator could say the digits of an answer. The goal was to develop talking calculator materials for blind students. (Incidentally, one can now purchase a talking calculator for under $50.)

Blind students have considerable difficulty in learning to do mathematics. The computational algorithms we standardly teach in our schools are designed for sighted students. Can you imagine trying to do a long division on a brailler? (This is somewhat like a typewriter, and long division requires rolling the paper up and down repeatedly.)

To me, the talking calculator seemed like a wonderful invention. The blind student could learn to use it for all of the operations. Since there would be no need to learn to use a brailler to do computations, the blind student would save substantial learning time. Indeed, as compared to a sighted student, the blind student might even have a major advantage, since sighted students were still being forced to learn paper-and-pencil assisted calculation methods.

The materials I designed stressed mental arithmetic and estimation, as well as use of the talking calculator. In my enthusiasm I also built in a healthy dose of problem solving. After all, I reasoned, a major goal in math is problem solving.

Alas, that was my undoing. The organization that funded the project didn't like the resulting product, mainly because of its emphasis upon higher level problem-solving skills. Drill and practice on computation was what was wanted, and developing a high level of computational skill was the only goal.

Such shortsightedness continues to amaze me. How can responsible, well-educated, well meaning people be so dumb? Perhaps they are handicapped by tradition?

More recently I was discussing with a student the possibility of providing certain physically handicapped students with some math-oriented computer aids. A student with limited arm and hand mobility has trouble learning to draw graphs or to do the symbol manipulation and calculation needed to solve equations.

A computer can graph a set of data or a function. A computer can solve an equation. How much time is spent in the "traditional" mathematics curriculum teaching students to graph and to solve equations? In essence these are merely computational skills, sort of a higher level form of the four basic operations in arithmetic.

The student I was working with is handicapped by cerebral palsy and has considerable trouble in using a pencil. He agreed that this was indeed a project well worth exploring, Like many of my good ideas, this one also failed to bear fruit. The student reported back that he was not able to find a single student in Oregon with this type of handicap who was so advanced in mathematics as to need to draw a graph or solve an equation.

That certainly makes me wonder about the success of our mathematics instruction program in dealing with such students. It also suggests that we question other aspects of this mathematics program. For a great many students, our current mathematics curriculum is not very successful.

The trouble that many "non-handicapped" students have in learning mathematics raises some interesting questions. Many (but certainly not all) physical and mental handicaps are relatively easy to detect. We see an obvious difference from some sort of norm. But what should we use as a norm? Perhaps it is a handicap to require more than a week of instruction to master paper-and-pencil long division. Perhaps it is a handicap to require more than a week of instruction to become competent at plotting data or sketching curves.

Clearly, we are not now talking about the usual handicapping conditions. Rather, we are talking about average human abilities relative to the task of learning mathematics. Our mathematics education curriculum seems to consist of a sequence of barriers or hurdles, with a student not being allowed to proceed upward until each barrier is passed. Thus, addition and subtraction must be mastered before one can study division. (But this need not be the case if one is doing mental arithmetic or using a calculator.) All four basic arithmetic paper and pencil calculational procedures must be mastered before one begins algebra. (But computer programming and algebra are closely related, and many students learn to program before they study algebra.)

Just for the fun of it, suppose that some federal agency decided that a student was indeed educationally handicapped if s/he could not master certain types of mathematical manipulation tasks (including arithmetic calculation, simplification of algebraic expressions, graphing, and so on) quite quickly. It would then become legal and desirable to provide these students with appropriate extra help and with aids. Since calculators and computers are useful aids, these students would be given easy access to calculators and computers.

If our educational system provided appropriate instructional materials and support (especially, if problem solving were taught and emphasized for these students), then these students might even gain a considerable advantage over "normal" students.

While the whole idea is somewhat far-fetched, in actuality something akin to it is happening. Certain students are being given ready access to computers and are being provided with appropriate software and instruction. Most often these are students who come from rich socio-economic backgrounds and who already might be considered to be advantaged. Relative to these students, all other students are disadvantaged and are operating under a handicap.

I am quite sure that over the next few years we will come to accept the computer as an everyday tool for adults. After all, almost all adults now own and use calculators. (Adults can decide for themselves whether to use a calculator to overcome their paper-and-pencil calculative skills handicaps.)

Indeed, I feel that eventually we will come to accept computers as an everyday tool for precollege students. But that “eventually” sometimes seems a long way off! Meanwhile, our precollege curriculum remains virtually unchanged. Perhaps a more liberal definition of “handicapping condition” in a new Pl 92-142 might benefit us all.

Editorial # 33. District Inservice Planning. V10 N 7

(Editor's Message)

David Moursund

Editorial # 33 (Vol. 10 No. 7) March 1983

The Computing Teacher

District Inservice

Most major school districts have begun to offer inservice workshops and courses in computers in education. I am surprised and disappointed at the lack of careful, long range planning that characterizes most of these inservice programs.

I feel that the logical starting point for planning is with a district's overall goals for computers in instruction such as the revised Cupertino, California goals in this issue. If a district doesn't have a set of goals, I recommend the "standard" ones mentioned in previous editorial messages.

1. A functional, working-tool level of computer literacy for all students.
2. Computer assisted learning to be used when it is educationally and economically sound.
3. The entire K-12 curriculum to adequately reflect computers as an aid to problem solving and as a source of problems.
4. Special computer and information science courses to be made available for vocationally-oriented students and for college-oriented students.

As a school district works to define and adopt such goals, it should keep in mind that the first grader of today will spend his/her adult life in a society in which almost all people will have easy, everyday access to computers. (The analogy with current calculator access is useful.) Ten years from now computers will be readily available in schools, homes and places of work.

After deciding upon student and curriculum-oriented goals, a district should plan on how to meet the goals. The Albany School District Computer Education plan in the January, 1983 TCT is an example of a planning document. The necessary resources in such a plan might be divided into three categories:

1. Computer hardware, software and courseware.
2. Resource materials such as books, course outlines, films, video tapes, and so on.
3. Computer-knowledgeable teachers and administrators.

It is evident that there are tradeoffs among these needed resources. But there is no adequate substitute for teacher and administrator knowledge. A good plan to increase this knowledge might take into consideration four general groups:

1. All teachers.

2. Teachers who are, or who will become, building level and district level resource people or specialists.
3. School administrators.
4. Lay people, especially school board members and parents.

The typical approach to reaching all teachers is via a half day or full day workshop during a scheduled inservice day. (See footnote 1.) In this workshop, every teacher might get a few minutes of hands-on experience, see some computers and their applications, and be exposed to general ideas of computers in education. If this initial workshop is to be effective, there must be some follow-up activities. These might include visits to the teachers' schools by a computers in education resource person, placing computers in teachers' classrooms, and classroom visits by school administrators.

However, an introductory workshop barely scratches the surface of the computers in education literacy teachers need. Unfortunately, relatively few school districts have a coherent plan for higher level inservice work. Indeed, many teachers fail to see this need. At a recent one-day introductory workshop, a teacher complained to me that the workshop was not meeting her needs. It turned out that this was the sixteenth introductory workshop she had attended!

My feeling is that every inservice teacher should have an opportunity to take two full courses.

1. **Introduction to Computers in Education.** While this course has substantial hands-on experience, the amount of actual computer programming in the course would likely be in the range of 15 to 25 percent.
2. **Introduction to Computer and Information Science for Educators.** The majority of this course would be an introduction to problem solving and programming.

Each of these would be a four-credit quarter-length course or a three-credit semester-length course. While the courses could be independent of each other, the first would be the preferred course for a person taking only one.

In my opinion, courses 1 and 2 are only a beginning for a teacher who wants to be a building level specialist or a teacher of computer and information science. I feel that all inservice teachers should have easily available opportunities to take higher level courses. Building upon courses 1 and 2 as a prerequisite, a district might work with nearby colleges and/or use its own resources to offer courses in areas such as:

1. Design of computer-assisted learning materials.
2. Programming languages (BASIC, Logo, Pascal).
3. Applications of computers to the ___________ (fill in the blank with any secondary school subject) curriculum.
4. Computer graphics.
5. Artificial Intelligence.
6. Modeling and simulation.
7. Information retrieval.

8. Etc.

The list is easily extended. The point is, there are literally dozens of appropriate courses above the introductory level. Many teachers would take these courses if they were readily available. This issue of *The Computing Teacher* lists colleges where such summer courses are offered. Teachers who take these courses will become the building level resource people and the teachers of computer and information science. Such courses are essential if computers are to have a positive effect upon our educational system.

Footnote # 1. Some students in my graduate seminars have recently completed two documents of value to inservice and preservice program directors. Each is about 100 typed pages in length and costs $5 from the Department of Computer and Information Science, University of Oregon, Eugene, Oregon 97403. The titles are *Introductory In-Service Workshop: Computers in Education* and *Computers in Education: A Course for Precollege Teachers*. Please be aware that these are student projects and are not ICCE publications.

Editorial # 34. Computer Literacy: Talking and Doing. V10 N 8

(Editor's Message)

David Moursund

Editorial # 34 (Vol. 10 No. 8) April 1983

The Computing Teacher

The US. Office of Education has funded a national project to define computer literacy and to develop an instrument that could be used to measure the computer literacy of students, teachers, principals and superintendents. The Educational Testing Service of Princeton, New Jersey is the prime contractor on this project and the Human Resources Research Organization of Alexandria, Virginia is a subcontractor for a major piece of the work.

In January 1983 a distinguished group of "national experts" met in Washington, D.C. to express their opinions on ideas going into the development of the definition and measurement instruments. I found the meeting both enjoyable and frustrating.

The essence of the problem is defining computer literacy. The group of nine national experts seemed to divide into two camps. One camp essentially thinks of computer literacy as a talking-level of knowledge. This includes knowing some computer history; knowing definitions of computer-related words; knowing some applications of computers in business, government and industry; knowing about social and ethical issues; and so on. Many of these objectives are stated, "The student is aware of …" Of course this talking-level-of-knowledge camp wants students to have some hands-on computer experience and hence a modest level of skill in actually using a computer.

The second group admits that the ideas of the first group are important, but insists that the most important aspect of computer literacy is being able to make a computer do things. This group then is further divided as to what this might mean. Does it mean being able to program in Logo, BASIC or Pascal, or does it mean knowing how to use a word processor, an information retrieval system and an electronic spreadsheet?

Those of you who know me personally or who have followed my writings are aware that I support both groups, but most strongly support the "doing" parts of a definition of computer literacy. Within that group I am moderately supportive of the "traditional language computer programming" subgroup and very strongly supportive of students learning to use applications packages.

I believe that we are at a critical junction. If the "talking-knowledge" definition wins out, it will be a substantial setback to the progress of computers in education. Imagine if a talking-knowledge group won out in reading and writing literacy or in mathematics literacy. Students would not have to be able to read, write or do mathematics. Rather, we would assess their literacy (presumably via oral testing) by determining if they knew some applications of reading, writing and arithmetic. We would determine if they had some historical knowledge of these areas, had seen and touched a book, had been read to from a book, and so on. I suppose that the ethics of book stealing would be discussed, as would be the threat to privacy of actually using books to store information about people. Numerology would perhaps be a required course and students could make oral presentations relating numerology to astrology.

All of this is silliness, of course, as is limiting computer literacy to a talking level of knowledge. I believe the major issue will be the question of programming versus using applications packages within the "doing" group. I am quite experienced in arguing that all students should receive instruction in computer programming. Such instruction is an excellent vehicle for learning and practicing important ideas such as problem solving, top-down problem analysis, representation of algorithms, algorithmic thinking, repetition, modularity, bugs and debugging, and documentation. My fear is that the typical teacher of computer programming may treat these topics as incidentals and produce "hackers" instead of computer literates.

At the current time I support the teaching of computer programming at any grade level, provided the teacher is competent in the computer field—that is, has a good knowledge of all of the ideas listed in the previous paragraph and integrates them into the instruction; that the instructional materials have these same characteristics; and that the totality of hardware and software available are adequate to support this type of instruction.

Unfortunately, this seldom occurs. The basis for my strong support of students learning to use applications packages is that less teacher knowledge and less high-quality instructional materials are needed. Moreover, this is clearly the sense of direction of the computer field. The computer-using public of the year 1990 or 2000 will not know a programming language such as Logo, BASIC or Pascal. Their ability to use computers will not depend upon knowing how to program in these or other high-level programming languages.

What will be important is knowing how to utilize the capabilities of a computer and integrating this knowledge into one's overall knowledge and performance. The student who knows how to write will know how to use a word processor as an aid to writing. The student who knows how to read will know how to use a computerized information retrieval system to obtain materials to be read. The student who knows the meaning and use of equations or graphs will know how to use a computer to solve equations and draw graphs. The student interested in composing music will know how to use a computer-assisted music composition and performance system. All students will learn to use electronic spreadsheets and other general-purpose aids to problem solving.

I believe that this is the key to computer literacy. It is a "doing" level of knowledge, with this knowledge integrated into the totality of a student's knowledge and performance. This type of computer literacy can be taught now and can be measured. I believe that it is essential that those who would define and measure computer literacy see that this is where we are headed and that this must be a significant part of any modern definition of computer literacy.

Editorial # 35. Micro-Torials. V10 N9

(Editor's Message)

David Moursund

Editorial # 35 (Vol. 10 No. 9) May 1983

The Computing Teacher

What's a Micro-Torial?

A micro-torial is merely a short editorial. One of my pleasures in life is being able to write what I think and then see my thoughts in print. The editorials I write for TCT give me particular pleasure.

But my usual editorial format is a full page or more—perhaps a thousand words. Such a format restricts the number of topics I can cover and forces me to write at greater length on some topics than I otherwise would.

Hence, the micro-torial, the short TCT editorial. Some of these micro-torials may be expanded in future issues of TCT.

Thanks!

Recently I read some of my editorials from previous years. One written for the Vol. 6 #4 (May 1979) issue of *The Oregon Computing Teacher* caught my attention. The cover of that issue has the "Oregon" crossed out—May 1979 was the first issue of *The Computing Teacher!*

The editorial commented on the history of *The Oregon Computing* Teacher which had begun publication in May 1974 and had grown to a paid circulation of nearly 350.

During those first five years I did almost all the work of putting together and distributing the publication. Indeed, that continued for the first year of *The Computing Teacher,* the official publication of the newly-formed International Council for Computers in Education.

Perhaps because of this some, people think that I still do most of the work in publishing and distributing *The Computing Teacher*. That is absolutely wrong. ICCE now has a paid and volunteer staff of well over 20 people, with a total full-time equivalent in excess of 14. This staff makes possible *The Computing Teacher,* with its steadily increasing quality, its paid circulation of about 12,000 and its press runs of 17,000 copies. It makes possible the 11 ICCE booklets whose total sales now exceed 1,200 copies per week. ICCE now has 35 Organization Members and four Technical Liaison Committees. In addition, a very special thanks to the column editors who, on a volunteer basis, have contributed so much to the overall quality of TCT:

Richard Adams	Bob Hilgenfeld	Tim Riordon
Linda Ettinger	Bev Jones	Bob Shostak
Les Golub	Pat Konopatzke	Bob Skapura
Mike Haney	Kathleen Martin	

It is not possible to give appropriate recognition and THANKS to each of the individuals who make ICCE what it is today. But without them, ICCE just would not exist. From the bottom of my heart I say THANKS to all of them.

It's Been a Very Good Year

This issue of TCT is the last one for this academic year and for ICCE's 1982-1983 fiscal year. It has been a year of substantial progress, fraught with fears, foul-ups and forthright attempts to “get our act in gear.” ICCE is now well established as the largest computers-in-precollege-education professional society. We now have over 12,000 Individual Members and 35 Organization Members, and both of these numbers continue to grow. This growth is providing the financial strength and “clout” for ICCE to be a significant factor in the world of precollege education.

Welcome to New South Wales

The Computer Education Group of New South Wales (Australia) is the 34th Organization Member of ICCE. This well-established group has well over 500 members, puts out a substantial publication and holds conferences.

My feeling is that people in the United States are rather “smug” in the great progress their country is making in computers-in-precollege-education. There seems relatively little realization that other countries are also deeply involved and may be making even more substantial progress.

Australia has a population of about 15 million and is divided into six states. While no individual state rivals Minnesota in its computers-in-education progress, the “average” for all six states likely exceeds that of the United States.

Of course, this is subject both to definition and to debate. I continually look at my own state of Oregon as a model. I am sure that Oregon is well above average, both in the percentage of functionally computer literate teachers and in computer facilities per student. But we lack leadership from the Oregon State Department of Education. We lack leadership from the Teachers Standards and Practices Commission (they set the rules for teacher certification). We lack a coherent plan for use of computers in precollege education and for teacher education. In short, progress in Oregon is fragmented.

What some states in the United States and what some countries are doing is to address the problems of computers-in-education on a statewide or nationwide basis. I strongly support such endeavors!

Welcome to New York State AEDS

The New York State Association for Educational Data Systems is the 35th Organization Member of ICCE.

NYSAEDS was established more than 17 years ago. This last fall I had the pleasure of making several presentations at their annual conference. I was impressed by the overall quality of the conference and the NYSAEDS leadership. It represents teachers, school administrators and educational data systems people actively working together to improve education. I am very pleased to announce their ICCE membership.

Thoughts on Software

It has become fashionable to be critical of software. Even the rank amateur seems to take pleasure in quoting an anonymous source which states that about 95 percent of software is trash. I suspect that this makes the speaker feel knowledgeable and perhaps somewhat superior, being able to be critical of “95 percent of what's out there.”

It is healthy to be critical of software (and of books, films, teachers and the whole educational system). But it is more healthy to base this criticism upon a strong knowledge foundation and to support it with realistic suggestions for improvement.

My personal feeling is that instructionally-oriented software is making superior progress and in many ways could serve as a model for other aspects of our instructional delivery system. There are perhaps a thousand companies in North America that produce educationally-oriented software and sell it on a wide scale basis. There is intense competition. The competitors are aware of each other's products and continually work to improve their own products. Software developers are adjusting to problems of a steady stream of new and more capable machines, computer graphics, voice output and input, a relatively small and immature market and so on.

I find that it is very easy to be critical of each and every piece of software I encounter. After all, the software wasn't designed exactly to fit my personal needs. It does not exactly reflect my personal style of instruction or learning. It is not an exact embodiment of my philosophy of education.

But I say the same things for every textbook I read, for every teacher I observe, and for every educational philosophy that I study. From these observations I am becoming less critical of software developers and more appreciative of their efforts. They have a long way to go, but they are trying hard and making rapid progress. To them I say, “Congratulations, and keep up the good work!”

Editorial # 36. Error in numbering. There is no # 36.

There was an error in numbering in the 1985 book. The numbering sequence in the book skipped from #35 to #37. The #35 was the last of the nine editorials in Volume 10, and the #37 is the first of the editorials in Volume 11.

Editorial # 37. In Search of Controversy. V11 N1

(Editor's Message)

David Moursund

Editorial # 37 (Vol. 11 No. 1) August 1983

The Computing Teacher

A few days ago I received a phone call from a television reporter for a leading morning television news show. The reporter indicated that she had found a person who was strongly against computers in education and was now looking for a strong proponent for computers in education. She was looking for controversy—the spice of reporting.

This was not my first brush with a search for controversy. A few weeks earlier I was interviewed by a newspaper reporter who insisted that controversy was essential to the article he wanted to write. Controversy attracts readers and sells newspapers.

My response to the television reporter was to give a five-minute overview of computers in education, pointing out how each of the major themes can lead to controversy. I then proceeded to give sample arguments for each side of each issue. Actually, I was rather impressed with my skills as a university professor. But evidently the reporter wasn't, as she rapidly brought the conversation to a close. I think she decided that I was not an adequate proponent for instructional use of computers.

I enjoy a good argument and I do have some skills as a debater. But something about the media's search for controversy in computers-in-education rubs me the wrong way. There are important problems and the problems deserve to be fully aired. But the goal is to improve education, not to sell newspapers or to increase television viewing.

The list of controversial issues which follows is not intended to be exhaustive. Rather, it is intended to demonstrate that there are indeed many hard issues that have not been resolved. I have not made any attempt to order these issues by importance. All are important, as are many others not listed here. I would like to receive letters from TCT readers, listing the issues of most concern to them.

1. **Women in computing.** The parallel is often drawn with the area of women and mathematics education. Women are under-represented in computer class enrollments beginning in junior high school and continuing through the doctorate. Why, and what can or should we try to do about this?
2. **Haves versus have-nots.** Computers are evenly distributed. Children with wealthy parents are more apt to have home computers. Wealthy

school districts and high-tuition private schools tend to have more computers than other districts or schools. What role should state and federal government play in helping to equalize computer access?

3. **Drill and practice versus "deeper" levels of computer usage.** Some schools use their computers mainly for drill and practice on conventional subject matter, while others have students involved with word processing, electronic spreadsheets, information retrieval systems, Logo and other programming languages. What are the best uses of computer in an educational environment?

4. **Computer literacy.** While most educators agree that this is a good thing, there is little agreement as to the meaning of computer literacy. Is it a course? Does it include programming in a language such as BASIC, Logo or Pascal? Can it be taught by teachers who have only a very low level of computer knowledge and experience?

5. **Teacher education.** Should all current teachers be required to become computers-in-education literate? Should preservice teachers be required to take computers-in-education courses? In conjunction with 4. above, should teachers be required to integrate computer-related ideas into the courses they currently offer?

6. **Software for networks or multiple users**. Many schools now have a number of microcomputers, a network or a timeshared system. Should a school have to buy multiple copies of each piece of software it uses? How can the needs of students and their schools be balanced against the needs of software developers and distributors?

7. **Quality of software.** Good quality educational software is very difficult and expensive to develop. How should we deal with less-than-good educational software and what can be done to facilitate the rapid development and dissemination of better quality educational software?

8. **Content of the conventional curriculum.** More and more we will find that computers are a significant aid to solving the problems being studied throughout the curriculum. If a computer can help solve a certain type of problem, what should a student learn to do mentally, aided by pencil and paper, or aided by computer?

9. **State and national leadership.** What role should state and federal government play in computers-in-education? Should they provide planning, leadership and money? How can government activity be coordinated with that of state and national computers-in-education organizations and with the work of local school districts?

10. **Publisher control of curriculum.** For years we have known that books and other print materials are the dominant source of curriculum content. In essence, a small number of publishers determine the curriculum. Is it appropriate that this continue to happen as computers become the dominant instructional delivery system?

11. **Computer languages.** The current argument seems to be BASIC versus Logo versus Pascal. Others favor Ada, C or COMAL. Some very knowledgeable people argue that BASIC is perhaps the worst thing that has ever happened in the computer field, while other equally qualified people are working to have BASIC taught to all precollege students.
12. **High technology.** Computers are only part of what is now called "high technology," and high technology is only part of what might be taught in schools. Is the current educational balance among science, social science and humanities appropriate? How can we foster the uniquely human talents and skills in a world that seems to place more and more emphasis upon technology?

Editorial # 38. Greener Grass. V11 N2

(Editor's Message)

David Moursund

Editorial # 38 (Vol. 11 No. 2) September 1983

The Computing Teacher

I do a lot of traveling, giving talks at computers-in-education conferences, consulting, and doing workshops. In the past few months I have been in New Jersey, Alberta (Canada), Texas, New Mexico, Victoria (Canada), New South Wales (Australia), and Idaho. I have talked with people from dozens of other states and provinces.

Surprisingly, I hear the same message again and again. It goes something like this. "I know we are not doing too well here. We only have [what follows is a long list of hardware]. We are only making use of [what follows is a long list of software]. We are only using computers for [what follows is a long list of computer applications at various grade levels]. Our teacher inservice program is only [what follows is a list of courses and teachers that are receiving training]."

I interpret these revelations in two ways. Sometimes they are a search for approval, a search for confirmation that this represents good progress. More frequently, however, the speaker is representing a deeply held feeling that others are doing better. "We are making some progress, but I am quite sure that others are doing better. Help us to catch up."

Nowhere have I seen this more strongly than in my recent trip to Australia. I was left with the impression that one of Australia's national pastimes is feeling somewhat inadequate. Thus, much of my time in Australia was spent reassuring people that they are doing just as well as others; that they are slightly ahead in some areas and slightly behind in others. Australian grass is the same color as the grass in other places I have visited.

Actually, the Australian grass seemed quite green and its color is improving rapidly. Each state in Australia has a computers-in-education group. These groups recently joined to form a national computers-in-education organization. I gave several talks at their national conference. Representatives from the state of Tasmania spoke about their inservice program that reached two-fifths of all of their teachers last year, and of the computer curriculum they are integrating at the K-12 level.

I met with the director for a state department of education group in New South Wales which has resources and authority to function on a statewide basis. I met with a number of computers-in-education leaders who were as qualified as the leaders I have met in other places. Women seem well represented among the leaders—perhaps at a higher percentage level than I have seen elsewhere.

To be honest, I was impressed!

And to be doubly honest, I am impressed by the progress of every place I visit. This progress represents education at its best—enthusiastic, energetic, intelligent, dedicated educators working to learn a new field and to translate their knowledge into improvements in education for students. It is these people who are at the very heart of progress in education.

Lest Australians become complacent, however, I did detect one major potential difficulty. The Australian education pay scale does not include steps for earning additional credit hours or higher degrees. One of the major incentives for continuing to learn more about one's own field and other areas is missing.

Many things can motivate a teacher to continue to learn, to try new ideas, to work hard. Money is one of these for some teachers. For others it may be professional pride, a feeling of responsibility to their students or personal satisfaction in their own intellectual growth. Whatever it takes for a particular teacher, we must try to find it. The essence of the current movement for computers in education is not the hardware and software. It is the people, with their knowledge, skills and involvement.

One of the strongest motivators is peer recognition and the positive strokes provided by one's fellow educators. Educators like to be told that they are doing a good job and that what they are doing is important. They need, and deserve, recognition for their extra efforts, for the personal sacrifices they are making to do their jobs better.

Right now the general public is not particularly supportive of education. Rather than providing educators with positive strokes, the general public has become increasingly unsupportive and critical of education. This is leading many educators to believe that the grass must be greener somewhere outside of education. Indeed, it is evident that some educators who are working very hard to learn about computers hope to use this knowledge to leave education. Why should one stay in education when the field is so poorly supported or appreciated by the general public?

My personal feeling is that this situation is bottoming out and that public support of education is beginning to grow. But while we wait for this to happen, we can help ourselves. The next time you see an educator do something you like, offer a compliment. It's as simple as that. Be generous with your positive strokes. By doing so you will make a significant contribution to the improvement of our educational system.

Oh yes, about that green grass. There is no doubt that the grass often looks greener on the other side of the fence. On closer inspection, though, it seldom is. In western Oregon, however, the grass is especially green. Of course, some people might attribute this to rain…

Editorial # 39. Twenty Years Ago. V11 N3

(Editor's Message)

David Moursund

Editorial # 39 (Vol. 11 No. 3) October 1983

The Computing Teacher

I have begun two of my recent talks by discussing what computers-in-education was like about twenty years ago. This was easy to do because my first serious involvement with computers-in-education occurred in the summer of 1963. I had finished my doctorate six months earlier and was spending part of the summer in helping to teach some bright high school students a little about computer-related mathematics.

By 1963 the computer industry was well into the second generation of hardware. Transistorized computers with core memory were widely available in universities and large colleges. ALGOL, COBOL and FORTRAN had made their debuts, as had fairly sophisticated batch processing systems and the initial time-shared systems. BASIC was under development at Dartmouth.

The university I was attending graduated its first Ph.D. in computer science in 1963, although they didn't call it by that name. Quite a few computer science departments existed by then, but some universities resisted their establishment more than others.

The profession of computer science was well established. Indeed, the Association for Computing Machinery (ACM) had been in existence since 1947 and was growing rapidly. In the 1960s the ACM took a substantial interest in college-level computers-in-education. The "Curriculum '68" report contributed substantially to defining an appropriate undergraduate computer science curriculum.

Computer assisted instruction was well established by 1963. While there were many small projects, perhaps most interesting historically is the PLATO project that began at the University of Illinois in 1959. By 1963 this project was well underway and beginning to receive national attention.

Computers were already in some precollege education systems and the teacher education problem was already being attacked. Richard Andree of the University of Oklahoma was active in teacher education and writing about computers in precollege education in 1958. (I'm sure there were other pioneers in the late '50s or even earlier. I happen to know Richard Andree and have seen some of his early papers.)

This type of historical perspective is fun, and it can also be useful. Suppose that you were magically transported back in time to the year 1963 with your current knowledge of computers and education. What type of advice and leadership might you have provided to the emerging field of computers-in-precollege-education? That is, what should we have started doing in 1963 to help computers-in-education today?

One can examine various aspects of computers-in-education to come up with ideas. For example, consider hardware. It was already evident in 1963 that hardware would continue to improve rapidly, with substantial decreases in price-to-performance ratio and continued improvements in reliability. Your 1983 knowledge probably would have made little difference.

Or, consider software. Perhaps you could have hastened the development of Pascal or Logo. You could have helped broaden people's perspective about programming languages. You might have caused the expression “user-friendly software” to come into earlier usage. But to a large extent the software field was moving as fast as it could.

However, the mention of Logo is an important idea. Few people in 1963 imagined that eventually we would have a language especially designed for young students and that computers would become a useful tool in the elementary school. Consequently, few people did appropriate underlying research and development.

A government agency could have funded several K-12 experimental computers-in-education schools. Work in understanding what computer-related ideas were most appropriately taught at the different grade levels and how to integrate computer-related ideas throughout the curriculum could have been studied. Development of an entire K-12 curriculum that assumed easy computer access for all students could have begun.

Certainly the results from such experimental work would be valuable today. And this suggests another important idea. Who are the leaders of computers-in-precollege-education today? Many are people who were beginning their careers twenty or more years ago. Could we have done something to help develop more of these leaders? Certainly!

But what does all this have to do with today? I think the answer is obvious. Over the next twenty years we will continue to make very rapid hardware and software progress. Computers will become available to all students on an easy access, everyday basis. But, where are we headed? Who is doing the needed research? Where are the experimental schools? Where are the curriculum development projects? Are we producing enough potential leaders?

The United States government and governments in a number of other countries are concerned with the current quality of education. They are especially concerned with technology and with computers.

What should they be doing? I feel that the previous paragraph provides one answer. Look to the future and make some long-term investments. Fund the research, the curriculum development, the leadership development. This type of funding is essential to orderly and high quality progress in the field of computers-in-precollege education.

Editorial # 40. ICLEP (Individual Computer Literacy Education Plan): A Powerful Idea. V11 N4

(Editor's Message)

David Moursund

Editorial # 40 (Vol. 11 No. 4) November 1983

The Computing Teacher

I thoroughly enjoyed reading Seymour Papert's book *Mindstorms: Logo, Computers and Powerful Ideas,* describing the general ideas of Logo and its potential impact upon education. Perhaps the most intriguing concept in the book was that of a "powerful idea." Of course, we have all seen powerful ideas before. Democracy is a powerful idea, as is universal literacy. A powerful idea can be understood, accepted and supported by large numbers of people. A really powerful idea, such as a particular form of religion, may change the world. Papert's ideas and Logo may help to change education.

But education is very resistant to change. Thus, it may take quite a few powerful ideas to produce a significant change. I believe that an Individual Computer Literacy Education Plan for educators (and for students as they become educationally more self-sufficient) is a powerful idea that can help change education. The concept is simple enough. Every educator should assume responsibility for his/her own computers-in-education literacy and should consciously develop a plan to acquire a professional level of computer literacy.

Every educator is aware of computers. It is impossible to live in our society without being exposed to computers via movies and television, advertising, actual computers at school and in people's homes, articles in professional journals and magazines, etc. All educators have made conscious or unconscious decisions about how they will deal with computers about how computers will be involved with their professional and non-professional lives.

Often an educator's "computer decision" is based upon relatively little factual knowledge and upon facts that change rapidly with time. An educator may have had exposure to a computer while in college many years ago. That first impression lingers and perhaps dominates, even though it is only vaguely related to today's inexpensive, interactive, graphics-oriented microcomputer system. An educator may have had a computer course, poorly taught and not particularly appropriate to the educator's needs. This may have left a lasting impression that computers are a difficult topic, certainly beyond the capabilities of most young students.

Alternatively, an educator may have been exposed to a "dream world" such as an elementary classroom full of microcomputers and Logo disks, with students taught by an exceptionally capable teacher with a deep knowledge of Logo and discovery-based learning. The educator may be aware of word processing and equate this with all students learning to write both well and often. The educator may be aware that computers can solve equations and graph functions—this may be equated with a complete revision of the mathematics curriculum. The educator may be aware of electronic spreadsheet programs and equate this with a complete revision of the accounting curriculum.

In either case, educators need a modern, realistic awareness of the current and potential capabilities of computers as well as their limitations. Such an awareness can be gained through a modest amount of reading, hands-on experience, talking to people and thinking about computers. It might come from attendance at a computer conference or participation in a computer workshop.

What comes next? An ICLEP—an Individual Computer Literacy Education Plan. Each educator has a substantial professional level of knowledge and skills in education. But the nature of the knowledge and skills varies tremendously among educators. The elementary school teacher has little need for the subject matter specialty knowledge of the secondary school physics teacher or the administrative skills of the district superintendent. Clearly, each educator has need for computer literacy knowledge and skills suited to his or her own role in education.

Who is best suited to determine the individual computer literacy levels of knowledge and skills needed by various educators? To a very large extent it is the educators themselves! Certainly outside help is desirable, especially in gaining initial computer awareness. But who am I to try to tell elementary school music or art specialists what they need to know about computers to do their job in a professional manner? Who am I to try to tell a school principal, a health teacher, a social studies teacher and an industrial arts teacher what they need to know to continue to be professionals in their respective areas of education?

The key to this is professionalism. Most educators look upon themselves as professionals—highly trained and skilled in performing their jobs. They have confidence in their knowledge and skills, as well as in their ability to gain additional knowledge and skills.

Each educator needs to be encouraged to consciously develop an ICLEP. An educator's ICLEP consists of two main parts. The first part is a plan for gaining general computer literacy such as one might expect of all educators. Such a plan should take into consideration that educators are college educated and serve as role models to their students.

The second part of an ICLEP should be specific to the educator's particular professional responsibilities. This may need to change quite rapidly as computers become readily available to students and they develop skill in their use.

An ICLEP includes both short- and long-term goals. It includes specific objectives and ways to measure progress toward these objectives. It includes timelines and check points, specific times or points where progress is reviewed, goals and objectives are considered and new goals and objectives are set.

An ICLEP is well suited to educators, since educators are well educated, professional level adults. But what about students? Certainly it is not reasonable to expect a first grade student to accept prime responsibility for developing an ICLEP. But how much responsibility might a ninth grader take? As a student progresses through our educational system, it is reasonable that the student assume more and more individual responsibility for his/her education. One major goal of the educational system should be to help students acquire the maturity and wisdom to accept and deal with this responsibility.

Computer literacy is an excellent area in which to give students an opportunity to assume and practice this individual responsibility. This is especially true because the opportunities for acquiring a high and functional level of computer literacy are by no means fully institutionalized. Students can and do learn a great deal about computers at home, at friends' homes, at science museums and libraries, etc.

Your role as an educator should be clear. Not only should you have your own ICLEP, but you should help students develop their own ICLEPs. Even in the first grade, students can begin to accept responsibility for their own education. Our formal, in-school educational system is only part of a student's opportunity to learn. Early and frequent encouragement should be given to all students to make education an all-day, everyday, lifetime experience.

Editorial # 41. Logo Frightens Me. V11 N5

(Editor's Message)

David Moursund

Editorial # 41 (Vol. 11 No. 5) December-January 1983-84

The Computing Teacher

I first encountered Logo about ten years ago, and even then I was quite impressed. Since then I have frequently supported Logo in my writing, teaching and public speaking engagements. ICCE has supported Logo through a column in *The Computing Teacher*, and this is the second Logo issue of TCT. ICCE is publishing a book on Logo (See "Logo in the Classroom—Session 1," p. 67).

I have learned quite a bit about Logo and its uses, and I encourage all of my computers in education students to do the same. Recently, I co-directed a doctorate thesis that centered on teaching teachers to teach students to use Logo.

On the surface I am a strong supporter of Logo. But deep down in me there is some fear associated with Logo's role in education.

My fear ruts two parts. First, I fear that Logo is being oversold. Some people are developing unreasonable and unrealizable expectations about what Logo can do for education.

Second, I fear that Logo will not reach its potential. Understanding the Logo phenomenon is difficult. It is accompanied by an almost-religious enthusiasm. In talking with many Logo-oriented educators, I am led to believe that Logo not only will make their students computer literate and substantially improve their problem-solving skills, but will make a major contribution to rectifying many of the current ills of education. These claims may prove to be true, but it is important to acknowledge that, to date, such deeply-held beliefs in Logo go largely unsubstantiated. A number of my graduate students have done careful surveys of the Logo literature, searching for solid research to back up the widely-voiced claims. The literature is sparse. It consists mainly of descriptions of teachers using Logo with students, most concluding that students enjoyed using Logo to draw pictures. One could say the same thing about students provided with a set of paints and a brush.

That is not to say there is no research on Logo. The Brookline project, for example, gave us a strong hint of Logo's potential. But one must view with suspicion an experiment in which the elementary school teacher has a doctorate in engineering. Indeed, few of the so-called experiments have been done making use of "ordinary" teachers-those with a very modest level of training, experience and interest in the computer field.

The very heart of much Logo-based instruction is what is often called discovery-based learning. Discovery-based learning has been extensively researched and has substantial merit. But its effective implementation requires well-trained, skilled, committed teachers. Logo by itself cannot create the teacher-related parts of a sound educational environment.

Teachers often equate a minimal level of success in using Logo with students becoming computer literate and becoming much better problem solvers. This reflects very little depth of insight into the various components of computer literacy. It reflects almost no insight into problem solving or into potential roles of computers (or Logo) as an aid to problem solving.

It feels to me like Logo has been oversold. Marketing experts have done their job, but that isn't what has oversold Logo. Educators have done it to themselves. In looking for "the answer" in computing, these educators have latched onto Logo. It obviously is part of an answer, but transforming a partial solution into a panacea is damaging, both to education and to the potential of Logo.

Logo can be a powerful aid to learning. Perhaps your definition of computer literacy includes learning to write and debug programs to solve problems. Perhaps you want your students to develop insight into top-down analysis, stepwise refinement and problem or program segmentation. Perhaps you would like your students to study aspects of a specific content area through a discovery approach.

Logo is an excellent vehicle to achieve these goals. But not without the help of a knowledgeable teacher and suitable curriculum materials. Logo by itself will do little for most students. Certainly there will be rare exceptions—students who learn Logo and explore concepts on their own to create interesting and challenging projects. But most students require knowledgeable and experienced teachers, as well as good curriculum materials.

Now we are at the very heart of my fear. Logo is a wonderful language, but a Logo-equipped computer system is not a teacher-proof educational tool. Most teachers require a substantial amount of computer education and experience to even begin to help their students to realize the potentials of a Logo computer system. And that is only a beginning. What happens to such students in the months and years that follow, as they have continued access to computers? Where will they receive guidance and help in their endeavors to learn more of the potentials of Logo and computers?

For me, a pattern of answers is beginning to appear. Computers will have a profound impact upon education. Eventually more of the needed research will be done, so we will have increased knowledge of ways to use computers effectively.

If we are willing to settle overall for a mediocre education, decreased reliance upon teachers and increased reliance upon computers can help us achieve the goal. But if we have higher aspirations, such as students achieving their full potential, then highly qualified teachers will be more important than ever. Attracting and holding good teachers, providing them with high quality preservice and inservice education, supporting them with appropriate resources-these are keys to improving our educational system. I believe in the potential of Logo, but I believe much more strongly in the part educators will play in its effective use. This Logo-oriented issue of The Computing Teacher gives good evidence of the progress being made.

Editorial #42. 38 Billion Curriculum Units: Thoughts on Fully Integrating Individualized instruction. V11 N6

(Editor's Message)

David Moursund

Editorial # 42 (Vol. 11 No. 6) February 1984

The Computing Teacher

A frequent theme in these editorials is that computers should be fully integrated into the curriculum at all grade levels. This means that computers as an aid to problem solving and computers as a source of problems should be integrated into every discipline—in art and music as well as in math and science. Full integration also means that instruction in any one discipline takes into consideration and builds upon previous instruction in every other discipline to the extent that this is appropriate.

Along with full integration of computers, I generally support the idea of individualization of instruction. I don't recall having read definitive research on the merits of individualized instruction, but it has intuitive appeal.

For simplicity, let us assume that the entire K-12 curriculum could be divided into twelve major strands (themes, subjects). A particular student might be at grade level in some strands and above or below grade level in other strands.

It is evident that instruction in one strand needs to consider instruction and a student's level in other strands. For example, suppose that a fifth grade student is at grade level in math but is two years below grade level in reading. The student is beginning a unit on word problems. If these word problems assume a fifth grade reading level, the student is apt to do poorly.

But what about the content of the word problems? These draw upon the student's knowledge of the world. A problem might have to do with buying or selling, with the speed of cars or airplanes, with the population of cities and countries, with ideas from science or medicine. This type of integration of ideas from other disciplines might make the math more interesting and relevant.

Now, let's analyze this situation more carefully. Suppose that almost all students are within two years of their designated grade levels in all strands. This would mean, for example, that a typical student designated as a fifth grader might range, from third grade level in one or two strands up to seventh grade level in other strands. Of course, some students will vary beyond this range, but this model will assume that does not occur.

In a fully integrated individualized program of study, a student would use instructional materials suited to his/her levels in the various strands. Our hypothetical designated fifth grader might need sixth grade level math content based upon fourth grade reading ability, seventh grade knowledge of history and world affairs, and third grade art skills.

Now for a little arithmetic. In this simple model for individualized instruction, suppose a designated fifth grader wants to do an individualized math lesson. Let us assume that we want the math lesson to be at the student's current math level and to appropriately reflect the student's levels in all other strands. For simplicity, assume just five possible levels in each strand. This means we are not breaking things down more finely, such as to tenths of grade levels. This will need to be 5 raised to the 12^{th} power (which is close to a quarter of a billion) different versions of this math lesson! If we now multiply by the 13 grade levels and the 12 strands we find a need for about 38 billion different year-long curriculum units.

These numbers suggest why we will never have a fully integrated and individualized collection of curriculum materials. They also point to the difficulty of even beginning to integrate computers into the content of the existing K-12 curriculum.

I can think of three ways to attack this problem. First, there is the traditional approach of introducing a new, non-integrated strand into the curriculum. We could develop a K-12 computer and information science curriculum strand, making every effort to keep it as independent of other knowledge as possible.

But such complete independence is obviously impossible, so we are led to the second traditional approach. Each strand builds upon other strands when absolutely necessary, but usually at a minimal level. Authors of eleventh grade math or computer materials often (perhaps as a selling point) claim the materials are at an eighth or ninth grade reading level. Some college level computer materials claim that they require no math beyond the eighth grade level.

Such a lack of full integration cuts down on the number of different curriculum units needed for individualization. But still, the number of curriculum units required would remain very large. Thus, a third idea. Rather than placing the burden of individualization upon developers of curriculum materials, why not place the burden upon the learner?

What a novel idea! A student should assume responsibility for his/her education. Obviously this idea must be adjusted to a student's developmental level. A sixth grade student is able to take much more responsibility for learning than is a first grader. The overall instructional system would need to be designed to give increasing responsibility to students as they grow in ability to handle this responsibility. The ultimate goal would be to become fully responsible for one's own learning.

While some students make considerable progress toward this ultimate goal, on the average our current school system does a rather poor job in this area. It is interesting to contemplate why, and to think about the role that computer-assisted learning might play. My personal feeling is that CAL could play a major role and that it will lead to substantially increased student responsibility for learning. But this responsibility can come without computers. All educators should be trying to help their students to become independent, self-responsible learners.

Editorial # 43. The Two-Percent Solution. V11 N7

(Editor's Message)

David Moursund

Editorial # 43 (Vol. 11 No. 7) March 1984

The Computing Teacher

I am frequently asked how much money schools should be spending for instructional use of computers. My answer is that it depends upon the goals set by the school or district.

But that answer is less than satisfying to administrators in a school district just beginning to make a serious commitment to the instructional use of computers. Administrators need help in determining the level of expenses and nature of the commitment that may be necessary over the long run.

With these people I discuss The Two-Percent Solution. The idea is simple enough. Let's see what could happen if a school district budgeted two percent of its funds, year after year, for instructional computing. Some districts might obtain this level of funding by a reallocation of current funds. But since budgets have been so tight for so long, this is unlikely in most districts. As an alternative, one could imagine the taxpayers in a district passing a special perpetual tax that adds two percent to the district's budget. Or, one might imagine a one-percent tax and a reallocation of current funds to generate the other one percent. An analysis of how two percent of a district's current budget might be used for instructional computing helps one to understand how much money is actually needed.

Two percent is an arbitrary figure, but one can find many colleges and universities that have that level of expenditure for instructional computing purposes. Also, the use of a percentage figure relates expenditures to a district's overall funding level. This is important because funding levels vary widely. A recent issue of *The Wall Street Journal* discussed a school in Alaska that had a budget of $16,000 per student per year. The same article noted that the average for the United States is about $2,500 per student per year, with some states having an average per-pupil yearly expenditure of under $2,000.

Where will the two percent go? I suggest four major categories of expenditures, with a reasonable level of funding for each. A fifth category, a contingency fund, is suggested to take care of unforeseen expenses. Keep in mind that these are merely suggestions; they can lead to insight into what a particular school district might do.

1. **Hardware:** Approximately one-half of the total funds.

2. Software, print materials and other support materials: Approximately one-sixth of the total funds.
3. **Inservice education:** Approximately one-twelfth of the total funds. This provides initial and continuing training for administrators, teachers, support personnel and aides.
4. **Computer coordinators:** Approximately one-sixth of the total funds. This might be used at both a district and a building level.
5. **Contingency:** Approximately one-twelfth of the total funds. In the first year, all of this might be used to supplement inservice education. In subsequent years it might be used in the other categories, or for some new purpose such as remodeling a room for a computer lab.

This sort of allocation assumes that office space, janitorial services, ongoing administrative and staff support, and other miscellaneous expenses will N part of the general school district budget and will not be specifically deducted from instructional computing funds.

To make this concrete, suppose we look at a school district with 5,000 students and a budget of $2,500 per student per year. The Two-Percent Solution allocates $50 per student per year for instructional computing.

	Category	Per Pupil	Total
1.	Hardware	$25.00	$125,000
2.	Software & Materials	$ 8.33	$41,667
3.	Inservice Education	$4.17	$20,833
4.	Coordinator	$ 8.33	$41,667
5.	Contingency	$4.17	$20,833

The figure that tends to be most interesting to school district administrators is the money for hardware. What can one buy with $25 per student per year? The answer obviously depends upon the particular equipment being purchased. A recent ad in my town's local newspaper indicated one could purchase a 64K machine with one disk drive, printer and monochrome monitor for about $900. The ad was for a very widely sold computer system from a reputable local dealer.

The same newspaper contained an ad for a Timex-Sinclair Model 1000 system, 16K expansion module and three software tapes at a special discount price of $29.97. A tape recorder and television set are needed to make this into a usable system.

The $900 figure might be considered adequate for a low to middle-priced microcomputer. You can expect that the quality of machine that this amount of money can buy will continue to improve rapidly in the future. Many school districts are purchasing more expensive microcomputers, but they usually obtain a substantial discount from the list price.

Now a couple of assumptions are needed. A typical school doesn't want a printer on every microcomputer, and it's likely the school will want some dual disk systems. As a school obtains a quantity of machines, it is likely some will be networked using a floppy or hard disk system. This may cut the average cost of a user station. Let us assume that the average cost of a user station will be about $900. Let's also assure that such systems will have a four-year life span, with maintenance costs averaging $100 per machine over the four years. An equivalent way of expressing this is to assume that $1,000 provides a user station that functions for four years and is then completely worn out.

A particular school district may decide to purchase computers costing much more than is assumed above. Such machines might have a longer life span, different maintenance costs and so on. The point is, the explicit example given here serves as a model a district can use to analyze its own situation.

Continuing the example, the first year's funds would purchase approximately one machine per 40 students. (The current average in the United States is approximately one machine per 120 students, or a third of what would be achieved in. the first year.) The second year's funds would bring the average to one machine per 20 students; the steady state situation in the fourth and subsequent years would be one machine per ten students. This analysis ignores whatever computers a district might already own.

An average of one machine per ten students is equivalent to about a half-hour of machine time per student per day. If computers are going to have a significant impact upon our overall educational system, we should be able to see the beginning of the impact with this average level of computer usage.

This hardware analysis suggests that an average school district, by spending one percent of its budget every year for hardware, will eventually have about one microcomputer per ten students. That is about 12 times the current average in the United States. If computer prices continue to decline, or if machines have a longer life span, then an even higher ratio will be achieved. Alternately, if a district selects more expensive hardware, it will achieve a lower ratio of machines per student.

The money allocated for software, manuals, books, films and related support material is substantial but may prove inadequate, as classroom sets of textbooks and expendable workbooks may be quite expensive. One way to analyze this is to look at various categories of instructional computing. The categories I use are learning/teaching about computers, learning/teaching using computers and learning/teaching incorporating computers. Each category requires differing amounts and types of software, support materials and teacher knowledge. Learning/teaching about computers requires relatively little software beyond the language translators and operating system. It does require books, films and other media, and it requires quite knowledgeable teachers.

Learning/teaching using computers (usually called computer-assisted learning) can require a substantial software library. Currently the costs of such software are high and the total quantity of good software is still quite limited. We can expect a continued rapid growth in the availability of good computer-assisted learning software. We will probably find that vendors will make available multiple copies of software, or software for local networks, at quite good prices.

Learning/teaching incorporating computers requires changes in the content of the conventional curriculum. A typing course might become a word processing course, requiring word processing software and perhaps a typing tutor program. A bookkeeping course might be substantially changed by providing electronic spreadsheet and accounting software. A science lab might be changed by a package of programs for the on-line control of experiments and the collection and processing of data. A math course might require a substantial library of graphic, equation-solving and symbol-manipulation software.

A different way to view this expenditure category is that the $1,000 machine will have $333 of software, print materials and other support materials. This is quite a bit if all of these materials have a long lifespan and can be used by a variety of students. For example, a single rental film might be viewed by many hundreds of students and a reference book may be useful for several years. A growing library of commercial software might be supplemented by carefully screened public domain software.

The money for inservice education of administrators, teachers, support personnel and aides will allow for initial and continued growth in their knowledge and skills. If a district has not yet put much money into computer-related inservice education, the first year's expenditures probably need to be above one-twelfth of the total funds. This can be done by drawing upon the contingency fund.

It is important to realize that inservice education must continue beyond the initial effort. The level of knowledge needed when there is only one microcomputer per 120 students is quite different from what is needed when there is one microcomputer for every ten students. At this level we could begin to see substantial changes in the content of current non-computer courses. This will require extensive inservice education as well as funds to support curriculum development and revision.

The funds and training effort need not be evenly spread among all educators. Likely it will prove desirable for each school to have a building-level coordinator with some release time from regular teaching duties. While all educators need an elementary working-tool level of computer knowledge, these building-level coordinators will need substantially more knowledge as part of their jobs. They will pass on some of their knowledge and skill. Some of the inservice education funds could be used to facilitate this much higher level of training.

Finally, we come to the computer coordinator funds. In four years a 5,000-student school district will have about 500 microcomputer systems valued at approximately a half-million dollars. The district may have several hundred thousand dollars invested in software and other support materials. This is a substantial investment. A district computer coordinator will have a wide range of duties including supervising hardware and software acquisition, assisting in a large inservice education program, and working with curriculum committees to integrate computers into the curriculum.

Some of the district computer coordinator funds might be used at the building level-especially in large districts. The idea of building-level computer coordinators is very important. Consider an elementary school with 400-500 students. Under the model being discussed, this school might eventually have 40 or more microcomputers.

The fifth category, the contingency fund, can be used for a wide variety of purposes. As stated earlier, it might be used to supplement teacher inservice monies, especially in the beginning, or for remodeling.

Funds could also be provided for:

- Accessing large-scale data banks;

- Special-purpose peripherals such as videodisc equipment;
- Hardware and software for students to borrow for home use;
- Establishing a community (neighborhood) school to provide community access to instructional computing equipment.

Possible uses of the contingency fund seem endless.

The Two-Percent Solution provides an interesting model to explore certain aspects of the future of computers in instruction. Most important is the idea of a permanent commitment to a reasonable level of funding. Most school districts have not yet made this sort of commitment. They are purchasing equipment using entitlement funds, block grants, grants from foundations, money from parent/teacher organizations, and so on. They are giving "one shot" teacher training workshops with little or no follow-up or opportunity for deeper training. They have not yet done the necessary planning for computers to have a significant and continuing long term impact upon the overall content and process of education.

Two percent is a good initial goal. It is enough money to establish a solid program of instructional use of computers. Two percent will probably prove quite inadequate over the long run. Perhaps a few years from now I will be writing an editorial on The Five-Percent Solution.

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Note added to the 2005 reprint. This particular editorial included a "permission to reprint" at the end of the article, as indicated above the dashed line.

Editorial # 44. Equity. V11 N8

(Editor's Message)

David Moursund

Editorial # 44 (Vol. 11 No. 8) April 1984

The Computing Teacher

The term "equity" is emotion-laden and means different things to different people. But for most people equity conjures up serious problems which they feel need to be addressed. These problems can be addressed by federal, state and local governmental agencies. They can be addressed by churches, professional societies and political parties. They can be addressed by school systems, parent groups and other local organizations. And they can be addressed by each individual.

This editorial focuses on the individual. What can you do? Obviously, it is impossible for me to tailor an answer specifically for each reader. Instead, I will outline an approach that may help you answer the question for yourself.

Every educator has a personal philosophy of education. This philosophy covers general goals and how these goals might be achieved. Often one's educational philosophy is closely tied in with one's overall views on religion, life and humanity. For example, many educators are very people-oriented. They want to help students to grow-to achieve their full potentials. Others see education as an instrument to help support and develop a particular religious or ethnic viewpoint. Whatever your philosophy, you use it consciously and unconsciously to make day-to-day and long-term decisions. It profoundly affects your interactions with students and other people.

An educator's personal philosophy of education is apt to be quite complex. In essence it is a reflection of one's total knowledge, skills and life experiences. Thus, it is a difficult task to define explicitly one's educational philosophy. But that is where I ask you to begin. Spend a few minutes summarizing your educational philosophy mentally or on paper before reading on.

My personal educational philosophy is based on what I consider to be some of the most important goals of education. I support many goals of education, but two general categories tend to stand out.

1. Individual Student Goals: Education should help each student to achieve his/her full potential.
2. Collective Goals: Education should help support community, regional, national and worldwide interests.

Individual Student Goals focus on one student at a time. Each student has potential. With the proper help, through education and other means, this potential can be realized. Each student is vitally important.

The focus of Collective Goals is on the whole world, entire nations and large political subdivisions. To a large extent, governments support education to further their political ideals and power bases. In free world countries, for example, it is essential to have informed citizens, people who understand the general political and economic ideas of their country and who are willing to help decide what actions their governments should take.

I support goals of both types, and I see considerable overlap between the two categories. But there are substantial differences.

To a large extent, Collective Goals are something that the ubiquitous "they" should be concerned with and should "do something" about. "They" might be the national government, a state or provincial government, big business or some other large organization. "They" are often far removed from me. The responsibility for taking appropriate actions, the responsibility for change, lies almost entirely outside my domain of activity. Here I am deliberately painting a narrow picture to make a point. Each of us has some influence beyond our immediate acquaintances. Actually, I am somewhat involved in the national and international scene, and I feel that I sometimes make a small contribution. But to a large extent I do feel powerless at such levels.

Individual Student Goals are different. I interact daily with individual students. I talk with individual teachers, individual parents and individual school administrators. It is here, in my one-on-one interactions with people, that my personal philosophy of education is most evident. And it is here that I feel I can actually do something to address problems of equity. Let me give an example.

One part of my educational philosophy is that I should treat all students equally. But I invariably and deliberately violate that philosophy when it comes to certain equity issues. To be specific, for many years I have not treated women equally. Rather, I have tried to treat them a little better than I treat men. This is a very personal thing. It is deep-rooted, perhaps based upon the fact that my mother struggled to be a college mathematics teacher when that was a man's domain. Or, perhaps it is based on the fact that my wife is a college professor and professional therapist, and I have high hopes for all my children (two girls, two boys).

I want to make this example as clear as possible. My personal philosophy of education is strongly rooted in helping *each* individual student achieve his/her full potential. But I feel that the nature of our society puts extra barriers in the path of a woman who seeks a professional career in science and math-related areas. While some of these barriers constitute outright discrimination, most are more subtle and difficult to combat.

I cannot solve this problem for all women. Indeed, I probably cannot solve this problem for even one woman. But I can certainly help, and I can help at a level that may make a significant difference for an individual woman. For me this has been very important. I can point to specific examples where what I have done has made a difference.

It is at the level of single individuals, in your one-on-one interactions, that you get the best chance to implement your ideas of equity. Examine your own educational philosophy. Decide what is most important to you. Then think about how questions of equity are related to your philosophy. Now you are at the very heart of the equity issue. You can make a difference!

Editorial # 45. You are ICCE. V11 N

(Editor's Message)

David Moursund

Editorial # 45 (Vol. 11 No. 9) May 1984

The Computing Teacher

ICCE is a non-profit professional society of educators involved in instructional uses of computers. ICCE is 15,000 Individual Members and 43 Organization Members. ICCE is *you* and thousands of other educators who believe that computers can play a significant role in improving education. And ICCE needs your help!

As a professional society, ICCE publishes *The Computing Teacher,* the *SIG Bulletin* and a number of booklets. It has developed and disseminated a software policy statement concerning copyright and piracy. It interacts with other professional societies—for example, through its Technical Liaison Committees. It is establishing Special Interest Groups for computer coordinators, teacher educators, educational administrators and other special groups. It has a committee working on teacher certification. It co-sponsors the National Educational Computing Conference and has co-sponsored other major conferences. ICCE's Organization Members sponsor a number of high-quality regional conferences.

Since its formation in 1979, ICCE has grown steadily and rapidly, approximately doubling in size each year. But this past four months has seen a marked slowing in the growth rate. A budget that has always been tight has become tighter. Some projects have been curtailed and other desirable projects have not been started.

This slowdown in growth has occurred while the growth of computers in schools has continued at a rapid pace. We suspect that the slowdown is due to the rapidly increasing competition ICCE is facing.

Most educators do not think of their professional societies as businesses. But ICCE, as well as other professional societies, has a business/financial existence. It has income and expenses, employees and products. Considered as a business, ICCE has two general types of potential competitors:

- Non-profit professional societies in the computer field and in other fields.
- For-profit commercial publishing companies that publish magazines, books and journals.

ICCE is now by far the largest professional society for precollege instructional use of computers. It actively cooperates with other professional societies, both in the computer field and in other fields. Such cooperation is mutually beneficial and is good for education. Thus, ICCE's "competition" with professional societies is quite friendly in nature; we have no indication that such competition is financially damaging to ICCE.

But the competition from commercial publishing companies is something else. Consider just the magazine publishers. They fall into three major categories:

- **Brand specific:** These magazines generally have the name of a specific brand or model of computer in their title. Most brand-specific magazines are not particularly educationally oriented. But the brand specificity makes the contents easy for owners of the brand to use; the title alone is a major selling point.
- **General purpose:** *Byte* and *Creative Computing* are two well-known examples. Often such publications carry some education articles in each issue and may devote one issue per year almost entirely to education.
- **Computer education:** *Classroom Computer Learning* and the publications from Scholastic Inc. such as *Electronic Learning* are well-known examples. These publications are specifically designed for educators and/or their students.

An individual educator or a school has a limited amount of money to spend on computer-related periodicals. Often this forces decisions to be made between publications of professional societies and magazines of the three types listed above.

So what does this mean to ICCE? From a business point of view, ICCE has two distinct advantages over commercial publishers. First, ICCE is a professional society of educators committed to improving education. These Individual Members are educational leaders in their schools and districts. Their loyalty to ICCE and support of its professional activities is strong.

Second, ICCE has Organization Members that run conferences and publish newsletters. These conferences and newsletters reach and involve educators at the grassroots level. No commercial publisher has such a grassroots support system.

The essence of the situation is one of non-profit professional societies versus for-profit publishing companies. Each has a distinct and important role to play in each academic field. In the computer field these distinctions are blurred, perhaps partly due to the newness of the field and its high dependence upon hardware.

Over the long run I feel the distinction between non-profit professional societies and for-profit publishing companies in the computer field will become clearer. A professional society is grassroots driven. Its members select its officers and board of directors. Its members decide what projects are to be undertaken and how resources are to be allocated. And, critically important, professional societies make extensive use of volunteers.

Of course ICCE has a paid staff, and this staff is quite dedicated. But who do you think writes the articles appearing in *The Computing Teacher* and the *SIG Bulletin*? Who referees these articles? Where do you think the software, book and film reviews come from? In all cases the answer is volunteers! Who served on the committee that developed the software policy statement? Who serves on the ICCE Board of Directors or the teacher certification committee? Again, the answer is unpaid volunteers. These people are using ICCE as a channel through which they can contribute some of their time and energy to computer education.

I hope my message is clear. The future of ICCE lies with you and thousands of other educators. There are many ways you can help. Write a letter to the ICCE editors expressing an opinion on an article that has been published or a topic you would like to see covered. Volunteer to referee articles or be a reviewer of software, books or films. Write an article for *The Computing Teacher* or the *SIG Bulletin*. Work to start a local chapter of a SIG in your community. Support ICCE's Organization Members by attending and participating in their conferences. Work to promote the field of instructional uses of computers at all levels. Continue to improve your own computer-related educational skills.

Remember, you are ICCE. You are a member of a healthy and leading professional society. This society represents you as you represent it. Your continued support is appreciated—and it makes a difference.

Editorial # 46. Back to Basics. V12 N1

(Editor's Message)

David Moursund

Editorial # 46 (Vol. 12 No. 1) August/September 1984

The Computing Teacher

Reading, writing and arithmetic—the 3 R's. Some computer educators become so enamored with computer potentials that they forget why the "basics" are so named.

Reading provides access to information. A book is an inexpensive, easily portable vehicle for transmitting large quantities of information over time and distance. Reading provides access to quite a bit of the accumulated knowledge of the human race. Reading is also a form of entertainment.

Writing provides the materials to be read. Equally important, writing is an aid to the human mind as it works to solve a variety of problems. For example, writing provides temporary storage of ideas as I work out the order and details of a workshop or lecture I intend to present.

Arithmetic also serves two major purposes. Numbers can represent quantities or location, distance, time, area, volume and other measurements. Arithmetic (more generally, mathematics) provides a language to represent, store and access these types of information. As with reading and writing, quantifiable information can be transmitted over time and distance. The geometric theorems of Euclid are as valid today as they were two thousand years ago.

Arithmetic is also an aid to problem solving. If a problem can be represented using the notation and ideas of arithmetic, then one may be able to solve the problem using the accumulated knowledge and the tools of this field. The tools include operations such as addition, subtraction, multiplication and division; other tools include drawing diagrams and graphs.

As an educator, it is important that you understand the 3 R's. As a computer educator, it is important that you understand how computers interface with and possibly affect the 3 R's.

The role of reading and writing as aids in transmitting information over time and distance has been indicated. A number of other aids have been invented. The telegraph and telephone certainly revolutionized communication over long distances. Photographs and movies, radio and television, phonographs and tape recorders, computers and laser discs-all aid communication over time and/or distance. The telephone is particularly interesting. It takes some training to use a telephone. But what is mostly required is a level of speaking and listening skills that people can usually acquire without benefit of formal education. Thus, while formal training in use of telephones is required for some jobs, telephone literacy is not part of the school curriculum.

Right now computerized telecommunication systems, databanks, bulletin boards and teleconferencing seem rather esoteric to many. The suggestion is that learning to use such aids to communication is difficult and requires extensive formal training, even though using them is mostly a matter of reading and writing (typing). That is mainly true because such facilities are still relatively expensive and not readily available, and because the people-machine interfaces need additional work. Children who grow up with ready access to such facilities will find that they are easy and convenient to use. Reading and writing will remain basics, but they will be supplemented and extended by computerized aids to communication.

I want to make two additional points about [Insert added January 2005. Insert the two words: communications-oriented.] inventions. First, each new invention such as radio or television broadens the scope of communication. It takes substantial training and experience to be a skilled radio broadcaster or television producer. But generally it takes little formal training to be a user of these new inventions. The knowledge and skill needed to use the inventions is decreased by the development of appropriate people-machine interfaces. One sees this in modern cameras and in television sets.

Second, some inventions actually decrease or substantially change the type. of training and experience important to the basics of education. The typewriter has decreased the relative importance of being able to write very neatly and rapidly. It does take training to learn touch typing. But elementary school children can learn to type, rapidly acquiring useful skills. As a second example, consider learning to use a card catalog and to search library stacks versus learning to use a computerized information retrieval system. The latter will eventually be an easier and a far more reliable means of securing desired information. Notice in both examples that reading and writing are necessary skills and that the usefulness of the skills is expanded by inventions.

Increasing the Power of Basics

We have also indicated that reading and writing are aids to organizing ideas. Consider what you do as you prepare to write a paper or prepare to give a lecture. Consider the nature of the notes you take during a lecture or a staff meeting. To me it seems clear that an easily portable word processor may satisfy some of the same needs. But for me, such a tool will never replace pencil and paper for doodling during an incomprehensible talk or a dull staff meeting. Moreover, pencil and paper remain an excellent tool for prewriting and other organizing processes.

And that brings us to arithmetic. A calculator can aid in addition, subtraction, multiplication and division. A computer can draw graphs, solve equations and carry out complicated symbol manipulations. But these things are meaningful and useful only if one has mastered the vocabulary, notation and methods of representing problems in mathematical form. Electronic technology is a wonderful aid to parts of arithmetic, and its ready availability suggests changes in the nature of mathematics education. There can be less emphasis upon routine manipulation and more emphasis upon higher-level cognitive processes. But the need to learn vocabulary, notation, what types of problems can be solved and the representation of problems as mathematics remains. And so far, no computerized system approaches pencil and paper as an aid to organizing one's thoughts and trying to figure out how to represent or to solve a math problem.

Long Live Basics!

The point to be made with each of the 3 R's is the same. Computers do not decrease the value of reading, writing and arithmetic. But computers are an aid to accomplishing the underlying purpose of each of the basics. Thus, the ready availability of computers actually tends to broaden the scope/nature of each of the basics and thus places an additional burden on our educational system unless we change the system somewhat. I think that gradually computers will be assimilated into the definition of each of the three basics. Eventually the term "writing" will include keyboarding and use of a word processor. The term "reading" will include accessing information from computerized databanks. The term "arithmetic" will include making use of calculators and computers as aids to problem solving. And the basics will stay basic.

Editorial #47. NEA and Educational Software. V12 N2

(Editor's Message)

David Moursund

Editorial # 47 (Vol. 12 No. 2) October 1984

The Computing Teacher

The National Educational Association is a very large union, with about 1.7 million members. Its membership includes over half of all teachers in the United States. The NEA represents its members as they bargain for pay and working conditions. It represents its members on issues coming before state and federal legislative bodies. The NEA has a long and successful history.

In 1983 the NEA became interested in the area of computers in education. The special issue that attracted the NEA's attention was the quality of available educational software. A sequence of decisions was made, with an announcement of the general ideas appearing in the June, 1983 *NEA Today.*

The first decision the NEA made was to establish the NEA Educational Computer Service and to become involved in software evaluation. This was a major decision, made at a time when MicroSIFT from the public sector and EPIE from the private sector were both well established. Many local, regional, state and/or provincial educational organizations were (and still are) quite involved in software evaluation. Many companies publish software reviews, with their publications competing in the commercial marketplace. And many periodicals, both non-profit and for profit, publish software reviews.

The second decision the NEA made was to charge software companies to have their software evaluated. This was a particularly interesting decision, since no one else was doing so. Perhaps the ideal model for product comparison and evaluation is provided by Consumer's Union. Consumer's Union goes so far as to purchase all products it will test, making the purchases through retail stores at various sites throughout the country.

Most software evaluation organizations don't go that far. Even EPIE, which has close ties with Consumer's Union, expects software companies to provide it with the software to be evaluated.

The third decision the NEA made was to work with a for-profit company on this project. NEA and Cordatum, an engineering company, created the NEA Educational Computing Service.

NEA ECS publishes a series of catalogs listing NEA "Teacher Certified" software. A subscription is $20 per year.

The fourth, and most interesting, decision made by the. NEA was to become involved in the sale of software. NEA "Teacher Certified" software may be purchased through the catalog. It was arranged that all profits would be split equally between NEA's not-for-profit National Foundation for the Improvement of Education and the for-profit engineering firm Cordatum. Evidently, this arrangement has been changed recently. The Spring 1984 issue of the catalog indicates that checks and money orders should be made payable to the NEA Educational Computer Service. The Summer Supplement 1984 indicates that payments should be made to Cordatum, Inc., and gives Cordatum's address for the placement of orders.

In this editorial I will comment on all four decisions.

First is NEA's decision to get involved in software evaluation. Essentially this was a statement that those who were currently involved were not doing the job in a manner acceptable to the NEA-that the NEA felt it could do better.

The evaluation of software is a difficult business. It is easy enough to look at one piece of software and to write a personal "evaluation" (more technically, this should be called a review). It is quite another thing to handle large quantities of software in a timely and professional manner. There are perhaps 7,000 or more pieces of educational software currently on the market. It is essential that the evaluative work be credible—that is, so well done that it is widely accepted by others. It does no good to publish software evaluations if the potential end users don't trust the results and decide they would rather do it themselves.

MicroSIFT, for example, is part of the Northwest Regional Educational Laboratory, a prestigious federally supported research and development center. MicroSIFT assembled an advisory group that read like a "Who's Who" in computer science education. It made a substantial effort to get school districts involved from throughout the country and to produce very high-quality evaluations.

EPIE has a long history of educational products review. It secured grant funds from private foundations and support through Consumer's Union to enter the software evaluation fray.

The NEA has none of these characteristics. Its involvement in education for the past several years has been as a labor union, as an advocate of its members. The NEA has no record of academic involvement or expertise that lends credibility to this operation. What does NEA "Teacher Certified" mean when compared against a solid, positive evaluation from EPIE, MicroSIFT or a local educational authority?

The decision to charge software companies to have the NEA take a look at their products is questionable. It is evident that software evaluation is a costly process. The amount being charged (between $100 and $1,000 per package) is not enough to pay the expenses involved in a careful evaluation. Both EPIE and MicroSIFT make extensive use of unpaid volunteers. EPIE is dependent upon grants from foundations and is making a determined effort to vend its evaluations in a manner to keep the whole operation financially solvent. MicroSIFT has depended mainly on continued federal funding.

I view the decision to charge an evaluation fee to software companies to be politically poor. But perhaps worse was the decision to use the terminology NEA "Teacher Approved." The terminology suggests that all software has been divided into two categories—those packages that meet NEA's criteria and those that fail to meet the criteria. A person might be led to conclude that if software is not NEA “Teacher Approved” it is somehow inferior. But that is quite misleading. First, some sort of preliminary selection process occurs. The great majority of the 7,000 or more available software packages are not even selected for possible evaluation. Then two additional criteria must be met. The software company must agree to pay the evaluation fee of $100 to $1,000. The software company must agree to allow NEA (through its Educational Computer Service or Cordatum) to sell the software. Since some software companies are not willing to allow their products to be sold by outside vendors, their software is automatically excluded. Other companies, as a matter of principle, are unwilling to pay the required fees. The overall result is that many fine pieces of software are excluded from the evaluation process.

The third NEA decision, to contract with a for-profit company, is also questionable. The fact that Lawrence Fedewa is director of the NEA Educational Computer Service and is also both a major stockholder and vice president of Cordatum complicates the issue. Remember, the value of a software evaluation depends on the wide acceptance of the results, so that others who might do the evaluation decide not to. The credibility of the evaluators and their commitment to producing accurate and unbiased evaluations is essential.

But it is the fourth decision, the NEA deciding to become a software vendor, that is hardest to accept. The problem is one of vested interests. There appear to be two major categories of vested interests here. First, we have the NEA involved both as the evaluator of the software and the vendor of the software. If all of the software were deemed inadequate, there would be no software to vend. If all of it were deemed adequate, there would be no value to NEA “Teacher Certified,” This is also tied in closely with the second decision—charging the software companies. Here we seem to have pressure being put on companies to pay the NEA to evaluate their software in the hopes that it will become NEA "Teacher Certified" and then widely sold by the NEA.

An analogy might help make this first type of vested interest clearer. How would you feel if Consumer's Union were in the retail business, and it only sold products that received high ratings in its evaluation process? This would certainly decrease my faith in the value of their ratings.

The second aspect of this vested interest is that many NEA members are in a position where they are purchasing software for use in schools. Will some allow their membership in NEA to enter into their purchasing decisions? Might not other software be better or might not the software be available from a better vendor? “Better” in this case might include cheaper prices, better service, local support, a better guarantee and so on. Certainly this situation opens NEA members to a charge of conflict of interest.

Here we have the very essence of the issue. A union, such as the NEA, is created and exists for certain purposes. Once in existence it has the potential to become involved in activities that only vaguely relate to these initial purposes. I have no confidence whatsoever that the NEA involvement in software evaluation and software sales will help the quality of education in this country. I fail to see how this involvement is important to the mission of the NEA as a labor union. Moreover, this is a step in a direction that really scares me. If we can have NEA “Teacher Certified” software, then we can have NEA “Teacher Certified” books, films and other instructional media. I can imagine a battle between various teacher education unions on the appropriateness of different curricula or teaching methods. In all of this I see the student as the real loser.

The very essence of this issue is its potential impact on the quality of education students obtain. There is nothing that leads me to believe that having the NEA involved in software evaluation and sales will improve our educational system. On the contrary, I see this venture as setting a very bad precedent. Extensions of this precedent have a strong likelihood of decreasing the quality of our educational system.

Perhaps these conclusions are based on insufficient information. Cordatum, NEA or NEA ECS may have additional facts or counterarguments that will shed fresh light on their efforts. An article by staff members of NEA ECS is scheduled for the November *TCT*.

Editorial # 48. Preparation to Be a Computer Coordinator. V12 N3

(Editor's Message)

David Moursund

Editorial # 48 (Vol. 12 No. 3) November 1984

The Computing Teacher

As part of the University of Oregon summer program in computer science education, I run a twice-weekly colloquium series. Generally I present a number of these colloquia, but visitors and other faculty make the bulk of the presentations. Students who attend the colloquium series receive one graduate hour of credit for attending regularly and writing brief reports, consisting of four paragraphs: a summary; the most important point; the least important point; and how the presentation relates to the student's previous knowledge or experience. Via these reports I receive substantial feedback on students' reactions to the presentations.

One of my presentations this past summer was on computer coordinators. I will summarize the presentation and focus on its most controversial aspect herein. Approximately 100 computer educators have provided feedback that has contributed to the main ideas given here,

There are two general categories of computer coordinators—those at the school building level and those at a school district level. Often the school building computer coordinator has both teaching and coordinating duties, which is a considerable responsibility. A computer coordinator in a small district may find the breadth of responsibilities and the skills demanded exceed those needed to hold a similar position in a larger district.

At any level, a computer coordinator is apt to have a wide variety of duties. These can be analyzed by looking at a standard model of computers in instruction. A school or district is involved in teaching about computers (computer literacy and computer science), teaching using computers (often called computer-assisted learning) and teaching incorporating computers (use of the computer as a tool). A computer coordinator may be involved in hardware and software selection and acquisition; teacher and administrator education; curriculum planning and development; and long-term planning and budgeting. A coordinator is a resource person. A coordinator works with teachers, administrators, school board members and parents. A coordinator is a leader, doing or helping to facilitate what needs to be done.

Out of such an analysis comes a list of suggested competency areas. My list covers four major areas.

C1. Technical knowledge in the fields of computer science and computer education.

C2. Interpersonal relations skills; written and oral communication skills; administrative skills.

C3. Overall intelligence and perseverance; good ability to learn; a broad general education and dedication to lifelong learning.

C4. Knowledge and support of our educational system; good skills in teaching school children and educators.

My presentation stressed the importance of all of these areas, although more time was spent on the first than any one of the others.

I have received substantial feedback on this presentation. I carefully read the student reports, and many students approached me individually to offer suggestions. Prior to making the colloquium presentation, I wrote up the materials as a chapter in a book I am working on. Based upon the feedback, I rewrote the chapter a couple of times, then had it read by several computer coordinators and revised it again. The chapter is being reprinted in ICCE's SIG Bulletin, Vol. I Number 4. It can be obtained by subscribing to the SIG Bulletin.

The feedback I have received consists of three types.

Fl. Why did you stress technical competence (Cl) so much? It is not nearly as important as the other three areas.

F2. Why did you stress the non-technical areas (C2-C4) so much? They are not nearly as important as technical competence.

F3. If I had all of those qualifications, I'd leave teaching and get rich!

I had expected quite a few people to provide the third type of feedback. The demands being placed on computer coordinators tend to be overwhelming and unreasonable. A computer coordinator position is a high-stress job, with burnout a distinct possibility. Quite often the pay scale is the same used for teachers, but the required work and responsibilities are substantially larger.

I was surprised at the nearly equal numbers of people who offered either the first or the second feedback. In retrospect, however, it seems clear what is going on. Many people are in the computer field because they have a talent for acquiring technical skills in computer and information science. They enjoy the process of attacking and solving hard computer programming problems and studying the underlying theory. On the average, such people tend to be somewhat less interested and skilled in the non-technical areas C2-C4. Thus, they feel that C2-C4 are less important.

And of course, the opposite situation also occurs. Many educators are quite talented in the areas C2-C4, and at the same time have developed a considerable interest in the computer field. This interest carries them through learning various computer applications such as word processing, and through introductory programming. However, many such people find the “solid” computer science courses (such as the freshman/ sophomore sequence for undergraduate computer science majors) quite difficult and not particularly interesting. Their natural tendency is to conclude that technical competence is of less importance.

In my opinion a computer coordinator should be reasonably well qualified in all of CI-C4. However, I know a number of competent and successful computer coordinators, and they vary widely in their range of competencies. The really successful ones tend to share several characteristics: they are dedicated to education and have a strong work ethic; they are quite smart and good learners; they are good listeners and open to learning on the job; and they are all exceptionally strong in one or more of C1-C4.

If you have these characteristics and are reasonably qualified in all of Cl-C4, it is likely that you will succeed as a computer coordinator. If you find that your qualifications are unbalanced, put some effort into improving your weaker areas. The position of computer coordinator is terribly challenging, but it can be a tremendous amount of fun.

Several other suggestions can be based on the above type of analysis. If you are thinking about becoming a computer coordinator, look at your strengths and weaknesses. You may decide you would be much happier staying in your current position. If you find you have certain weaknesses and still want to be a computer coordinator, make this a factor in bargaining for a position. Indicate clearly what job responsibilities you are interested in having and which responsibilities you would prefer be assigned to others. After all, the overall job is apt to be bigger than one person can handle.

An essential aspect of being a computer coordinator is developing or finding others who can help you. If you are a computer coordinator with weaknesses in certain areas, try to find help in these areas. Also, consider keeping a careful log of how you spend your time and how much time you spend on the job. Use this log to bargain for increased pay or staff, as well as for deciding how to optimally use your skills and time.

Editorial # 49. More Harm Than Good. V12 N4

(Editor's Message)

David Moursund

Editorial # 49 (Vol. 12 No. 4) December/January 1984-85

The Computing Teacher

I received a phone call a few days ago from a friend deeply involved in teacher education aspects of computer education. He was quite upset about a recent happening in his state. Evidently a change in school requirements had caused a major decrease in the number of needed physical education teachers. Consequently, a number of physical education teachers were given a two-week computer literacy course and reassigned to the job of junior high school computer literacy teacher. He was upset that such a thing could occur in 1984. Would you like your children's first serious computer course to be provided by "14-day wonders" from a random academic field? How can computer educators allow such a thing to happen? It's a crime! Something should be done.

This example illustrates some of the difficulties of being a school district superintendent. The state or district requires that all students become computer literate via a junior high school course. There is a severe shortage of teachers in this area. Meanwhile, the superintendent is faced by the possibility of having to layoff or reassign a number of teachers who are quite experienced in working with students. The decision to retrain these teachers and make them into computer literacy instructors helps solve two different problems. Of course, it also opens the superintendent to criticism from leaders in computer education.

The example illustrates some difficult questions that most computer education leaders seem unwilling to face. On the one hand we have a strong push being led by parents, computer educators and many educational leaders to have all students become involved with computers.

On the other hand we have the fact that the overall field of computer and information science, as well as the specifics of computers in education, are quite complex. It seems relatively easy to state high-level goals such as, "All students should become computer literate;" and "Computer assisted learning should be used in all aspects of the curriculum when it is educationally and economically sound." But translating these goals into measurable behavioral objectives and specific lesson plans, and implementing the lesson plans, is a considerable challenge.

Moreover, there is little national agreement about the specific meaning of computer literacy or about when and how computer assisted learning should be used. There is little agreement about possible scope and sequence or even on the content of specific computer courses. Consequently, each school district or individual school is moving ahead on its own. The schools are trying to respond to the demands being placed by parents, students and educators. Are they doing more harm than good?

The more-harm-than-good question is worth asking even if we cannot provide a full answer. It may help us make some decisions that will improve the overall quality of our children's education.

Probably the easiest area in which to respond to the more-harm-than-good question is in computer-assisted learning. A substantial body of research literature on CAL has been accumulated over the past 30 years, and CAL has been extensively used for many years in a wide variety of educational settings. A number of researchers have surveyed the literature and given CAL favorable reports. It seems obvious to me that if CAL did more harm than good we would have accumulated substantial evidence supporting that assertion. Instead, the major issues seem to be cost effectiveness and availability of adequate hardware and software.

The more-harm-than-good question becomes more difficult as we investigate teaching computer literacy, teaching computer science or integrating the computer as a tool in the overall curriculum. School districts seriously addressing the issue of computers in education often develop a scope and sequence for instructional computing. Such a plan may cover K-12 and be designed to provide substantial computer opportunities to all students.

At the grade school levels the computer plan may have three major components. One is hands-on experience, perhaps using a variety of CAL materials. A second is instruction in using a computer as a tool, perhaps for word processing. The third is specific computer literacy instruction, perhaps including some programming. This plan is often implemented by the regular classroom teacher, who may have had several days of computer workshops—perhaps some more, some less. I doubt that most of these teachers have had the equivalent of two weeks of instruction in computer education, Of course, some elementary schools have hired computer specialists with a substantial amount of computer knowledge and experience,

Now we see why the more-harm-than good question is so difficult. I can visit a classroom and observe teachers working with kids and computers, and form a personal opinion as to whether I would want my own or others' children to be involved in this setting. Indeed, I have done this. With some (generally quite computer-knowledgeable) teachers, it seems clear that children are receiving a good educational experience. With other teachers it seems evident that the overall result is of questionable or even negative educational value. But where is the published literature on this? Who has done a definitive study that supports or rejects the idea of using regular elementary school classroom teachers to introduce computers into the curriculum?

Teachers need different amounts of training for different types of computer applications. Having students use drill and practice materials to reinforce traditional curriculum materials requires relatively little computer education knowledge on the part of teachers. It is easily justified by the existing research. And what about having students learn keyboarding, word processing or use of an applications package from a teacher who is at best a novice in these areas? My guess is that we will eventually develop solid evidence to support such instruction. User-friendly software backed up by computer assisted instruction to teach use of the software will certainly reduce necessary teacher knowledge. But finally, what about having children learn BASIC or Logo in such an environment? Show me the evidence that this is appropriate.

Remember, your evidence must consider alternative uses of student and teacher time, and of the money spent for computer facilities.

Many students now receive their first formal computer course at the middle school or junior high school level. It may be nine weeks or half a year in length. Typically more than half of the course content is an introduction to computer programming, generally in BASIC. Often the course is taught by a computer teacher—a person who teaches such a course several or many times per year. Frequently such computer literacy teachers are self taught; preparation via a two-week workshop may well be about the average, Of course, many such computer teachers have more extensive preparation.

Such courses have been taught for many years and standard textbooks now are readily available. We all have heard of students who learned to program while in middle school or junior high school and then went on to make a lot of money as programmers. But have you heard of students who were completely turned off by computers because of a poor-quality course or because they were not developmentally ready to handle the course? Such negative examples receive little publicity, but may far outnumber the well-publicized, positive cases. There is surprisingly little research literature on this topic.

At the high school level the district computer scope and sequence plan generally calls for offering a number of computer literacy, computer application, and computer programming courses, perhaps culminating in an advanced placement (Pascal) course. Once again, teacher preparation varies widely. A few teachers have the equivalent of a bachelor's degree in computer science, but most have had little modern, formal preparation.

A significant fraction of students entering college computer science courses have had high school computer courses. Some colleges keep careful track of the performances of these students versus the performance of students who enter with no formal computer background, Once again the published literature is sparse. However, my personal communications with many computer scientists suggest that having had a high school computer course may be a distinct disadvantage to doing well in a college computer science course. Some suggest that such courses teach spaghetti programming and don't emphasize problem solving. Others suggest that BASIC is the problem. Certainly the more-harm-than-good question is open to lively debate for such students.

In this editorial I want to express particular concern about a child's first serious computer course. Suggestions that all students should become computer literate can be traced back at least to the early 1970s. An April 1972 publication of the Conference Board of the Mathematical Sciences recommends a junior high school computer literacy course for all students. A junior high school or middle school computer literacy course of nine to 18 weeks fits my definition of a “serious” computer course. For most students now, this would not be their first exposure to computers, but it would be their first substantial course in this field.

I read many research papers, and I do a fairly good job of keeping up with the computer education literature. I am personally aware of many individual cases in which students learned about computers while they were quite young and then went on to make very good use of this knowledge. I know that many handicapped children can benefit greatly from access to a computer with appropriate peripherals. I have also heard that girls may benefit from relatively early exposure to computers. Surprisingly, however, I have never read a paper presenting strong research evidence that it is important to a student's development to receive computer literacy instruction before completing junior high school. The lack of such evidence makes me wonder why we push so hard for such a course. The initial example of the "14-day wonders" suggests that we are willing to risk poorly taught courses in order to make this introductory course widely available before students reach high school.

Personally, I would rather this first serious introduction to computers be postponed until high school rather than be poorly taught! A delay can have benefits. It allows for increased developmental maturity on the part of students, and it may increase the likelihood that the teacher will have a deeper and broader computer background and more computer experience. High schools have had computers longer than junior high schools, and high schools are frequently larger than junior high or middle schools. Because high schools want to offer a variety of computer courses, they are more apt to be able to hire a full-time computer teacher who has good credentials in this field.

Of course, one can argue about the meaning of "poorly taught." A well-taught computer literacy course is apt to require adequate computer facilities, a well-qualified teacher, a good course outline and appropriate supportive materials for the students and teacher. A well-qualified teacher can make do with inadequate computer access, books and other supportive materials. But a poorly qualified teacher may not be much helped by a room full of expensive new microcomputers.

The issue, then, is what constitutes a well-qualified teacher. In every standardly taught subject except computer literacy we have an answer. Teacher training institutions have developed courses of study designed to meet state or provincial teacher certification standards. The teacher of seventh-grade mathematics is required to take several years of college mathematics and a math methods course. The music teacher may well have majored in music while in college. The physical education teacher may well have been a college athlete with a major in physical education.

The key question is whether we should tolerate substantially lower qualifications for a computer literacy teacher than we require for teachers of other subjects.

As argued earlier in this editorial, in many cases delaying a student's first serious computer course will help improve the quality and/or effectiveness of that course. Prior to a student's first serious computer course, we can stress learning to use various application packages and having the opportunity to make substantial use of good computer assisted learning materials. Each of these has long-term benefits to the student. Each requires only modest amounts of teacher training. And each helps prepare a student to gain more from the first serious computer course, whenever it comes.

The more-harm-than-good question has no simple answer. Most of the necessary research remains to be done, I suspect that a major part of the answer will be the teacher. There is no substitute for a well-qualified, experienced teacher supported by appropriate technology.

Editorial # 50. Problem Solving: A Computer Educator's Perspective. V12 N5

(Editor's Message)

David Moursund

Editorial # 50 (Vol. 12 No. 25) February 1985

The Computing Teacher

I have been thinking about and working on problem solving for many years. I have read a number of books about problem solving and listened to others expound on this topic. I have included units on problem solving in many of my books, and problem solving is often emphasized in the courses I teach. Gradually I have convinced myself that I know quite a bit about this topic. I see problem solving as part of every academic discipline and lying at the very heart of education. I see problem solving as an ordinary, everyday activity of every person who has conscious awareness and some ability to act upon the world.

At a workshop I presented recently, I devoted an hour to problem solving. During the hour I summarized and illustrated ideas that are finally becoming clear to me—ideas that I feel every computer educator should come to understand. As the hour progressed I felt less and less rapport with the workshop participants. By the end it seemed clear to me that "it didn't go over worth a darn."

Afterward I vacillated between feeling that my presentation was totally inadequate and that the workshop participants were totally inattentive. But there has got to be a better explanation. I believe the explanation is that most people have been brainwashed into believing that problem solving is a difficult topic that is beyond-most people's comprehension—and certainly not something to be covered in a one-hour presentation. To them I say, "Hogwash!"

Since I am not one to be easily thwarted, I intend to keep trying to clarify and to present my basic ideas. They are simple enough to be understood by all educators and all students. All computer educators, and eventually all educators, should have a good understanding of the roles of computers in problem solving. This editorial summarizes what I feel are the key ideas.

To begin, we need simple definitions of "problem" and "problem solving." Remember, here we are giving short and non-technical definitions.

A problem has three parts:

1. How something actually is (initial state).

2. How you would like the thing to be (goal state).
3. What you can do about the situation (allowable types of actions to move from the initial state to the goal state).

For me, problem solving encompasses two interrelated ideas. First, problem solving is a philosophy which includes the above definition. It is a personal philosophy, stressing that I can understand a situation and then contemplate and carry out actions to change the situation, moving from the initial state to the goal state. Second, problem solving is an activity. It is an activity utilizing the knowledge, skills and energy needed to understand initial and goal states, and to formulate and carry out actions to move from initial to goal states.

Notice that there is no mention of computers or mathematics in these two ideas. If my shoe feels loose on my foot and I tie my shoe, I am solving a problem. If I make use of a dictionary to check the spelling or definition of a word when writing, I am problem solving. If I have a fever and take aspirin, I am problem solving. Computers and mathematics can play an important role in solving certain types of problems, but may play no role at all in solving many other problems.

A more detailed example emphasizes the point. I notice that I am shivering and that I feel cold. I identify "I feel cold" as a given initial situation. I have knowledge of what it feels like to be warm (or less cold). I set as a goal to feel warm. Based upon previously-gained knowledge and experience, I am aware of a number of possible actions that can move me from a cold state to a warm state. I can put on a sweater, turn up the heat, close a window, fly to southern Florida, exercise, or use auto-hypnosis to control my body's thermostat. I can mentally contemplate each of these along with other possible actions. I can determine likely outcomes and ramifications before actually taking action. For example, I may reject going to southern Florida, because I lack the necessary money and I have to teach a class one hour from now.

After a careful analysis of the situation (which may take only a few seconds, especially if I have frequently experienced the problem in the past), I decide upon an action and then take that action. Perhaps I put on a sweater. I then observe the results. Most likely I begin to feel warmer and I dismiss the problem from my mind—it has been solved. But perhaps I continue to shiver. I might reexamine the initial situation and conclude that the problem was not correctly defined. Perhaps I am shivering because of an illness-induced chill, and may need the help of a medical doctor.

The example illustrates the key ideas of problem solving. To begin, one must have ownership of the problem—a desire to understand and solve the problem. In school, most problems come from books and/or the teacher. We try to train students to simulate ownership, but with many students we don't succeed very well. Artificial classroom problems may be far removed from a student's world outside the classroom. Computers have helped some students, because the students can more easily simulate ownership of computer-related problems; some students are able to create their own computer-related problems.

One must have the knowledge and experience to recognize and adequately define both the given initial situation and the desired goal situation. That is where a broad general education enters the picture. With a broad general education one can understand and more carefully define initial and goal states for a broad range of problems.

Next, one must have a feeling of power—a repertoire of possible actions that might move one from the initial to the goal state. One must have the training and experience to contemplate various approaches and the ramifications of using a particular approach. Here again we see the value of a broad general education. Often it is necessary to use one's general information-acquiring skills to seek out approaches that might be useful in moving from the initial to the goal state. This might require library research or other types of research.

Finally, one must be able to take action and to assess the results of the action to see if the problem has been solved or to determine what has gone wrong. The actual action one takes may involve use of low or high technology. Often it draws upon one's overall education and experience.

In my original example, several of the proposed courses of action involved using high technology. Turning up the heat might mean adjusting a thermostat which controls a furnace which in turn is tied into a large-scale electrical or gas distribution system. A decision to fly to southern Florida involves purchasing a ticket and making use of an airplane owned by a large company, piloted by a professional pilot, and assisted by an air traffic control system.

It is also important to recognize the extent to which problem solving builds upon and makes use of the work of others. I can turn up a thermostat, but I cannot build and maintain a large-scale gas or electrical distribution system. I can earn money to purchase an airline ticket, but it is not likely that I will maintain or pilot a large airplane. I can learn auto-hypnosis, but a teacher and biofeedback mechanism would be helpful.

Now, let's return to computers and their role in problem solving. Computers have spawned a new academic discipline—computer and information science. What does a person need to know about computer and information science in order to understand initial states and desired goal states that involve computer technology? How can one come to understand the types of computerized or computer-assisted actions that do exist or might exist in moving from initial to goal states? How much formal education and experience is required in this area? What part of these actions should be under one's direct control (I could learn to use auto-hypnosis to adjust my own body thermostat) and what part should one merely know how to use (I could learn how to purchase an airplane ticket and go to the airport)? An introductory study of answers to these types of questions is a component of a definition of computer literacy. A more comprehensive study of the answers helps define a college or graduate degree in computer and information science.

Let's look at three examples from computer education. Consider first a Logo programming environment, perhaps in an elementary or middle school. Logo is a very rich environment for improving one's understanding of a philosophy of problem solving. After some initial instruction and practice, I am seated at a Logo system with a blank screen (initial state). I imagine a particular picture on the screen (desired goal state). Now I must contemplate the possible actions I might take. Paper, pencil and reference books may be a big help. It may be critical that I know how to “play turtle,” so my body and mind can visualize the results of instructions to the turtle. Will the actions I am contemplating produce the desired picture? What are the ramifications of my approach? For example, I could imagine a picture and sketch it on paper. I could then ask a friend to draw it using the Logo system. Some results of this approach may be that I fail to learn some details of using Logo and would not develop experience in using the system. I might later fail a Logo programming test.

Suppose I go ahead and draw a picture using Logo. At various stages I might look at what I am producing and decide to redefine the problem. I might change my mind on the picture I want to create. I might decide that the picture can be done better using a non-computer medium such as watercolors. In all of this I am gaining experience in various steps of problem solving. I have the added advantage that I am also learning something about computer and information science—sort of a "two for the price of one" deal.

I do not feel that it is enough to merely provide the Logo environment and initial bits of instruction to the student. A philosophy and some general steps of problem solving should be made explicit. The philosophy is one of power, of being in control, of being able to contemplate and take actions to change a given situation, and of taking responsibility for one's actions. Logo can provide an excellent environment to practice this philosophy.

If I want to use Logo in defining and solving problems, however, I must learn the Logo system and develop skill in its use. As I learn more about the Logo system, my capability to use Logo to solve a broader range of problems will increase. Again, this should be made explicit. Not all students understand that their problem-solving skills are increased by study and practice. In addition, not all students understand that the problem solving they learn in one environment can apply in another, seemingly unrelated, environment. For many students, a Logo environment can provide a vivid demonstration of the value of study and practice. With a teacher's help, students can also learn that they are gaining problem-solving skills applicable in non-Logo environments.

Specifically, the Logo environment gives me the opportunity to learn some computer and information science. And here again I feel that the instruction should be explicit. It is not enough to expect students to learn these ideas by osmosis—key ideas should be carefully pointed out and illustrated. This requires a computer science-knowledgeable teacher and appropriate instructional materials.

For a second example, consider a tool such as a graphics package. It can draw bar, circle and line graphs, and perhaps does lettering and includes a collection of drawings done by professional artists. The development of the package may have required many hundreds of hours of work by a skilled programmer who is quite knowledgeable about computer graphics.

A student can learn to use some aspects of a graphics package in a few minutes. Learning to read and interpret graphs is a more difficult task, and learning when and how to make use of graphs and graphics is more complex still. Thus, computer educators must consider the full range of training and experience needed to include computer graphics as part of a student's repertoire in problem solving. Putting a student in front of a graphics system and providing instruction in its use is just a tiny part of computer graphics in education. It does little to increase the problem-solving capability of most students. The same type of analysis applies to other “tool” applications of computers such as data base systems, filers, spreadsheets and word processors.

As a third example, consider artificial intelligence and its recent progress. Consider also the analogy of taking an airplane trip to southern Florida. An airplane helps solve certain types of transportation problems. It requires modest training and experience for most people to learn to use a commercial airline. Similarly, an artificially intelligent computer system helps solve certain types of problems. But the problems may be much more complex, requiring substantial training and experience. Typical examples are diagnoses of medical problems, determination of where to drill for oil or prospect for minerals, and design of very large-scale integrated circuits. Quite a bit of the expertise needed to solve such problems can be incorporated in so-called “expert” computer systems.

It takes only modest training and experience to learn to use such expert systems. But the number of such systems, as well as their capability, is growing rapidly. This rapid proliferation of computers ensures that more and more people will have good access to the efforts of artificial intelligence researchers and developers. More and more problems will be solved by interaction with artificially intelligent computer systems.

The second and third examples are closely related, since a graphics package can be considered as an intelligent-like tool. In both cases we can expect rapid progress during the next decade, which will change what constitutes a high-quality education. There will need to be increased emphasis upon higher-level cognitive processes. Computer-assisted problem solving broadens the scope of problems that a person can consider solving, as well as the tools available to solve problems. However, it is not clear whether our educational system will be able to cope with such change.

Computer tools are changing certain areas of problem solving more rapidly than others, partly because some problems are more amenable to computer-assisted solution than others. Indeed, one can classify problems or problem areas on the basis of the current or potential role computers play in their solution. Such a classification might place poetry writing and psychotherapy near one end of the scale, while accounting and electrical engineering are placed near the other end. Such an analysis can help put computers into a proper perspective. Any particular problem area can be examined to see the relative importance of computer and non-computer approaches. Even in areas where computers are extensively used, it is evident that other factors are equally or more important. Computer-assisted problem solving is very important, but it is still a very small part of problem solving.

That's it! Those were the key ideas that I presented in the workshop. Try them with your students and colleagues. Let me know how they work.

Editorial # 51. The Thrill of Victory—the Agony of Defeat. V12 N6

(Editor's Message)

David Moursund

Editorial # 51 (Vol. 12 No. 26) March 1985

The Computing Teacher

I learned to play chess when I was in junior high school. I guess I was slightly better than average at the game, but certainly not strongly gifted.

A few years later I purchased a book on chess. I learned three things from the book: some general ideas on center control and mobility; some rules of thumb such as "When ahead in material, exchange pieces but not pawns;" and some specific chess openings.

I didn't play any competitive chess in high school. However, I have a distinct memory of playing several games with a person I considered to be quite a bit smarter than me. It seemed that we had about equal chess experience and interest. But he had not studied a chess book. Using the openings I had studied, I quickly achieved an initial advantage in each game. Using general ideas of center control and mobility, I was able to increase the advantage. And, from time to time, the rules of thumb helped me to determine moves that seemed to maintain my advantage.

In retrospect, this was the first time that I had a clear illustration of the intellectual or problem-solving advantages to be gained by building upon the work of others. Just a few hours of studying a chess book significantly improved my game.

I continued to play a little recreational chess in college and graduate school, eventually learning that many people were considerably more talented than me! Still, I enjoyed the game and certainly was an above average player.

During the 1970s, the Association for Computing Machinery's fall conference became the site for the annual United States National Computer Chess Tournament. Typically a dozen entrants would pit their chess-playing programs against each other in a four-round tournament. It was fun to watch the games proceed and to experience the enthusiasm and camaraderie of the humans who had developed the software. .

Occasionally a match would be arranged pitting computer against human. I remember one such match in the late 197Os between the current United States (human) speed chess champion and one of the best computer chess systems. In speed chess each player must average a move every five seconds.

As they sat down to play, the human player appeared nervous. Well he might, because he was pitted against a program that had been many years in development and that was being run on a very fast mainframe computer. Sure enough, in the first game the computer took advantage of its extensive book of openings to gain a slight advantage. The human blundered under the pressure, and the computer increased its advantage. Soon it was clear that the computer would win the first game.

But even as he went down to defeat, the human began to relax, and a hint of a grin appeared on his face. He had overcome his first fear, his confidence had returned, and he had seen some weaknesses in the way the computer played after its initial strong opening. Sure enough, in the second and subsequent games, the human handily defeated the computer!

When chess software became available for a microcomputer, I acquired a program and played with it for a while. Then I lost interest for several years, finding that working with graduate students and ICCE allowed little time for recreational chess.

Recently I became interested in chess again, and I dug out a copy of a 1979 microcomputer chess program from Hayden Software named *Sargon I*. I played a number of games, winning some and losing some. The program has a number of flaws. Indeed, under certain circumstances it cheats by making an illegal move!

For Christmas I received a copy of the 1983 *Sargon III.* I was very impressed by the four years of software progress it represents. The newer program is more user friendly, has all the features I could imagine wanting, and plays better quality chess. We sometimes forget that such rapid software progress is occurring. The newer Sargon program is far superior to the old, even though they both run on the same hardware.

One feature of Sargon III is that after it makes a move, the computer continues to "think" about possible next moves while its opponent is deciding upon a move. I found this particularly intimidating. All the time I was trying to analyze the board, I could imagine the computer analyzing it more quickly and more deeply, preparing to counter whatever move I might make.

Another feature of Sargon III is its book of openings. Its memorized collection of openings is far superior to what I can recall from my childhood.

Thus, the computer invariably gains an advantage over me in the first part of any game. Often this advantage is preserved as I go down to defeat.

I find the most interesting aspect of the Moursund versus Sargon conflict to be the human element. Several of my children often come to watch—they offer suggestions and cheer me on. Perhaps they sense my inner turmoil as my brain struggles to compete with a machine. Time after time I find myself blundering and having to resort to the feature that allows one to take back moves. Sometimes I win, and the feeling of elation is real. More often, however, I lose.

I suppose that during my lifetime I have spent about a thousand hours studying and playing chess. I have some pride in my skills. This pride has been carefully preserved over the years by avoiding competition with better quality chess players. But now I find that I cannot even play as well as a computer program that runs on an inexpensive microcomputer. That does considerable damage to my ego!

This chess example is a good illustration of what the future will bring to many of us. The field of artificial intelligence is now beginning to produce commercially viable products. These knowledge-based expert systems perform at a high level in a number of problem areas. Indeed, they are competitive with human experts within certain narrow problem domains. Eventually we will have knowledge-based expert systems that solve or help solve many of the problems that our schools currently teach students to solve without use of computers. Eventually we will have computer systems that can outperform teachers in a number of tasks that they currently consider to lie within their domain of expertise.

Many of us educators pride ourselves on our knowledge, teaching skills and problem-solving skills. How will we deal with a challenge from computers? It is interesting to think about how teachers can meet the challenge of artificial intelligence.

Editorial # 52. The Fifth Generation: It's for Real. V12 N7

(Editor's Message)

David Moursund

Editorial # 52 (Vol. 12 No. 7) April 1985

The Computing Teacher

Recently I attended a talk given by Pamela McCorduck. She and Edward Feigenbaum are co-authors of *The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World.* The revised and updated second edition was published in paperback in 1984 by Signet. I found the book interesting because I have taught artificial intelligence courses and have had a long-term interest in this field.

The Fifth Generation is about a ten-year Japanese project (now into its fourth year) that proposes great progress in both hardware and software, with the ultimate result to be a computer system that exhibits a high level of artificial intelligence. The book describes the project as well as competing work going on in a number of other countries. A major theme of the book is that the United States is losing its computer lead and may well fall behind the Japanese.

Both in reading the book and in listening to Pamela McCorduck talk I was struck by the "hype." There appears to be a concerted effort to awe us by the potentials of faster machines, better software and artificial intelligence. The message seems to be, "Watch out! The Japanese are coming! We must do something!" The book contains a flavor of global warfare.

What is this "fifth generation," and what difference might it make to education? Is it mainly hype, or is it for real?

My feeling is that the fifth generation is quite important and wi1l eventually help change the basic nature of education. Beneath the hype is a culmination of computer progress that is important to all of us. The following discussion of computer "generations" supports my thesis.

Many years ago it seemed easy to keep track of the generations of computer hardware. The first generation was characterized by vacuum tubes, the second by transistors, the third by integrated circuits. That hardware classification approach carried us through the 1960s, but then it began to run into trouble. There is an easy distinction between a vacuum tube and a transistor; there is an easy distinction between an individual transistor and an integrated circuit containing a number of transistors and other components. But where does one go from there?

Progress in integrated circuitry continued smoothly, with no gigantic breakthrough. But some hype was needed to publicize the progress and to help sell new hardware. So eventually we had fourth generation computers, employing large scale integrated (LSI) circuitry or very large scale integrated (VLSI) circuitry.

Now people talk about the fifth generation of computer hardware. It is characterized by the use of sti1l larger and faster VLSI circuitry, very large primary and secondary storage, and parallel processing (employing a large number of processing units). But such fifth generation hardware is not spectacularly different from fourth generation hardware. It is only when we also look at software progress that we begin to understand the significance of fifth generation computer systems.

The progress in systems software and computer languages has been steady, if not as spectacular as hardware progress. Early computers had essentially no operating systems. One user would have complete control of the machine, doing a "cold" start. The bootstrap process of first keying in or in some other way loading a program that would load one's main program was representative of first generation systems software. The early programs were written in machine or assembly language.

Soon we got more sophisticated assemblers, higher level languages with their compilers, and an operating system able to process a stream (batch) of jobs. Input and output were handled by card-to-tape and tape-to-printer systems that operated simultaneously with the central batch processing system. That represented the second generation of systems software.

Progress continued, and we got quite sophisticated disk operating systems that handled batch processing, multi-tasking, and the early efforts at timeshared computing. Application libraries grew rapidly and user interfaces became more friendly. These ideas characterize a third generation of software.

The fourth generation of software is represented by where we are now, with better user interfaces, easier access to data bases, networking, and more powerful programming languages. As with the hardware generations, there is no clear line of demarcation between third and fourth generations.

But the next generation of software does represent a significant jump. In simple terms, it has two major parts. First is an operating system and programming languages that can take advantage of parallel processing. It is difficult to appreciate how hard it is to take advantage of having thousands or perhaps hundreds of thousands of processing units all working on a single problem. But significant progress in this endeavor could well produce computers that are many thousands of times as fast as current machines.

The second major part is artificial intelligence (AI). AI researchers work to computerize some of the knowledge of an expert or a group of experts in a particular problem-solving domain. Progress in AI has been steady, but is not characterized by distinct generations or spectacular breakthroughs. Perhaps the most obvious sign of this progress is found on the front covers of many leading magazines in the past two years. Artificial intelligence has become commercially viable. Many companies believe that it is now profitable to solve or help solve a number of problems using AI techniques.

The problems that AI is attacking are very difficult. It is only now, about 40 years after the first electronic digital computers, that the necessary hardware, software and computer science progress are combining to produce significant results. The term “fifth generation” is a shorthand way of representing this progress and the goals for the next decade. A reasonable level of success is guaranteed, in that rapid evolutionary progress will continue in hardware, software and computer science. No spectacular breakthrough is necessary to produce computer systems that are increasingly capable of solving more and more problems that once were only in the province of very highly qualified human experts.

Judging from computer history, progress represented by the fifth generation will gradually filter down into the computer systems that educators, students and others can access on a daily basis. Eventually fifth generation hardware, software and ideas will become commonplace.

The educational implementations are profound. A very simple example is provided by the potentials for voice input. If voice input becomes readily available, should we teach typing, cursive handwriting, or printing? Or consider problem solving in the sciences and mathematics. If a computer can solve a particular category of problem, should students be required to learn to solve the same type of problem by hand?

These questions suggest that education must change to reflect people having easy, everyday access to very powerful machines. Moreover, they point to the equity-of-access problem. The analogy with access to books is instructive. In some sense public libraries and the fact that books are relatively inexpensive have kept the equity of book access under control. But computers are much more expensive than books, and we don't have anything like a public library system for free access to computers. It seems evident that some people will have the financial resources to take advantage of newer computer systems, and others won't.

Even these questions seem easy when compared to questions that arise as one begins to consider the creation of very large-scale data banks of knowledge that can be accessed and processed by artificially intelligent computer systems. The creation and maintenance of such systems may initially be quite dependent upon federal funding.

Who will have access to the information in the data banks? Who will have the training to retrieve such information? Who will control what “facts” go into the data banks? Who will control the type or nature of the “reasoning” that will be programmed into the computer systems? Consider, for example, questions related to a social system. There are considerable differences of opinion in the U.S. between Democrats and Republicans as to the correct answer or lines of action for many questions. The military-industrial complex may have still another view that it feels is correct.

Such questions place still additional burdens on educated people and their educational systems. The issue of fifth generation computers is not “Watch out! The Japanese are coming!” The issue is really “Watch out! Fifth generation computers are coming!”

Editorial # 53. Modem. V12 N8

(Editor's Message)

David Moursund

Editorial # 53 (Vol. 12 No. 8) May 1985

The Computing Teacher

Recently I purchased a modem for one of my home computers. I am not sure why I resisted so long, but I suspect that there is a deep psychological reason. I also discovered several other reasons as soon as the modem was installed. The modem precipitated a family crisis. A shouting match between two of my children (one wanted to talk via voice to friends; one wanted to talk via computer to bulletin boards) led to both losing phone privileges. Also, my wife threatened bodily harm to the computer when she saw us tying up the phone for an hour or two a day.

The obvious solution was a second phone line, and that has now been installed. I feel fortunate to be able to afford such a luxury: $15 a month to purchase family harmony. Sti1l, that isn't the end of the story. I am finding that spending an extra hour a day on a computer has changed my social interaction with my family. Moreover, it adds to the contention for access to one of our three home computers. It seems clear that I have not yet worked my way through these issues,

But these personal issues seem small as I think about larger issues of communication via and/or with a computer.

Twenty years ago I was teaching at Michigan State University in East Lansing. A computer terminal, telephone and modem were installed in a room in the computing center, and I was told that the system could be used to call a timeshared computer system in Chicago. That was my first exposure to BASIC and to use of a modem.

I recall the psychological barrier. The terminal, timeshared computing and telecommunications were all new to me. The documentation was poor. I knew that long distance phone calls were expensive. Computing via commercial long distance phone lines was sti1l relatively' new.

However, after much trial and error I learned to use the system, gaining an initial appreciation for timeshared BASIC use of a modem, and difficulties associated with using a remotely located computer via the commercial telephone system. During the past 20 years I have learned quite a bit about using remotely located computers.

In this message I want to comment on three general types of usage of a computer system via a modem. First, such a system can be used to access a computer in order to write computer programs. Twenty years ago that was really something—being able to do interactive computing on a timeshared system. Our university's large computer system could process FORTRAN, COBOL and assembly language in a batch mode with punched card input. Now, of course, we are all familiar with interactive computing. If the quality of the system is high, it tends to make little difference whether the CPU is located just a few inches from the keyboard or is located many miles away. What difference does it make how long the interconnecting wires are? The key idea is interactive computing, and that can be done using a variety of equipment.

A second major use of a computer with modem is to access data bases. Many of the data bases one would like to access are quite large and require considerable expense to keep updated. Thus, the most common way to access these data bases is via a modem-equipped computer system.

But such access is now commonplace and in many business settings is a necessary cost of doing business. Imagine running an airline ticket agency without access to the computerized reservation system.

Nowadays the issue is not the hardware. Rather, the issue is the software and the training needed to adequately use the software. Consider problems associated with accessing the type of information found in a (print material) library. All of us have been trained to use a card catalog, to physically locate materials in a library, and to browse. Access via computer changes the situation.

I don't think the main difference is learning to use the computerized equivalent of a card catalog. The amount of training needed to use a card catalog could just as well teach a person to search a computerized data bank. The task of physical location of materials is changed, but the change may make it easier. What could be easier than having the material immediately displayed on one's computer screen? (Of course, retrieving books and journals via interlibrary loan can be a pain, but that difficulty exists independently of computerized data banks.)

The main change is browsing. How often have you gone to a library to find a particular book, and then ended up checking out several books located on nearby shelves? One can browse a data bank, but two things are different. First, the concept of "nearby shelves" is missing. Thus, it takes specific training to learn to use a computer system to browse related materials. But perhaps much more difficult is the psychological barrier of cost. When I am in a library, the cost of browsing is the cost of my time; moreover, browsing is fun. When I am on a computer system there are computer charges, communications costs, and charges to access particular data banks. All in all I find these to be quite intimidating.

A third area of modem use—and the main motivation for this message—is for electronic bulletin boards and electronic mail. A computerized bulletin board is somewhat like a “hard copy” bulletin board on which one can post messages and comments. The messages and comments may be arranged by topic and/or who is allowed to access them. Electronic mail is roughly like regular mail, but the actual transmission of a letter is done electronically.

One can argue that bulletin boards and electronic mail are merely slight variations on traditional written communication. Certainly it makes little difference whether a carefully composed business letter is transmitted electronically or by the postal service. And jotting a quick memo to an acquaintance is similar to keying in a short message to an electronic mail system.

But those examples are not representative of what happens in an electronic bulletin board environment. A number of people may get involved in concurrent discussions of several topics. Many of the people may never have met face to face. The pace of the communication may be rapid, with messages being entered and read once a day or even more often.

For me, electronic bulletin boards represent a unique new mode of communication. The closest thing in my personal experience to the bulletin board was when I was a ham radio operator. A bunch of people who didn't know each other would chat about miscellaneous topics. Frequently the topic was their radio equipment; the fun was in establishing and maintaining the communication link.

Bulletin board communications tend to focus on issues rather than on the computer systems being used. They can involve a number of people who have no knowledge of each other's backgrounds and viewpoints. Under such conditions effective communication is challenging, if not downright difficult.

One example will help illustrate what I mean. In one bulletin board that I use regularly, the topic of testing in schools arose. Various people expressed opinions on this topic. One person absolutely blasted the idea of testing of any sort, supporting his position with strong, emotion-laden arguments. I responded to this person with some "logical" arguments to suggest that he was wrong. He responded with more arguments along the line of his original approach.

It seemed clear that even though we were exchanging written messages, we were not communicating. Eventually it became clear why. I come from a traditional educational background, and I was quite successful in our traditional educational system. But the person I was trying to communicate with has dyslexia. He did very poorly on tests while in grade school. As a consequence he was labeled as mentally retarded and did not receive an early education appropriate to his needs. It is no wonder that his arguments about testing are emotion-laden and that we were not able to communicate effectively.

But that is a key point. When humans communicate face to face, a significant percentage of the communication is nonverbal. (I have heard estimates that range up to two-thirds or more.) Much of the communication is in the affective domain. Electronic bulletin board communication is quite restricted in the affective domain. This is especially true when one is composing "live" at the keyboard, realizing that costs are mounting.

Communication is difficult enough when one is allowed to use all of one's senses and abilities. The restrictions imposed by an electronic bulletin board severely impede communication. As with any new technology, electronic bulletin boards have both good and bad features—both good and bad potential. Likely we will once again look to our educational system for help. I can imagine that “Bulletin Board Communication” will eventually enter the scope and sequence of our school curriculum.

Editorial # 54. Next Year. V12 N9

(Editor's Message)

David Moursund

Editorial # 54 (Vol. 12 No. 9) June 1985

The Computing Teacher

Around this time of year the ICCE staff begins planning next year's issues of *The Computing Teacher* and other ICCE publications. We start by gazing into a crystal ball, looking for what the future holds for computer education.

My usual approach to this type of crystal ball gazing is to divide the field of computer education into three main parts: learning/teaching about computers; learning/teaching using computers; and learning/teaching integrating computers. I also look at hardware and software trends and how they relate to these three general areas of computer use.

Hardware and software trends are easy to forecast. One can predict with considerable confidence that hardware will get better and become more readily available. For example, right now public schools in Alaska have approximately one microcomputer per 20 students. Alaska leads the nation in such computer availability. But one computer per 20 students is still very modest compared to the one computer per student (plus equal facilities at home) that will eventually become commonplace. Along with continued rapid growth in computer availability, it seems likely that increased networking and increased computer power will also come. Disk storage capabilities continue to increase, and personal hard-disk systems are growing in popularity.

The quality of educational software is also growing quite rapidly, and the value of the basic application packages is now well understood. If a school must choose between providing students with a word processor or a couple of high-quality simulations, it will choose the word processor. The trend toward integrated software application packages is clear. School systems will likely decide to place increased emphasis upon such integrated packages, since the cost is relatively small, given the broad range of individual pieces of software for instructional use that such packages provide.

The crystal ball seems quite clear in the area of learning/teaching about computers. Computer science (which includes computer programming) is well entrenched at the secondary school level. The Advanced Placement course and exam help define the upper end to which a secondary school might aspire. Eventually almost every secondary school will offer one or more computer programming or computer science courses. This means that eventually in the United States perhaps 50,000 teachers will have as a teaching assignment the teaching of computer programming and/or computer science. For those in larger schools, this will become their primary teaching assignment.

Teaching/learning using computers (CAL) now constitutes a very minor force in precollege education. If all computers in precollege education were used exclusively for this purpose, the average student would experience less than five minutes a day of CAL. Thus, it is safe to say that the current average CAL use is well under that figure. Of course it is not evenly distributed, and many teachers have yet to incorporate its use.

It seems reasonable to guess that CAL will grow about as fast as the availability of hardware. Over the years we can expect all students to experience substantial use of CAL and almost all teachers to incorporate it into their repertoire. Once a teacher has made the initial plunge, increased use of CAL may only require learning about a few new pieces of software a year.

The teaching/learning integrating computers includes use of word processors, data base systems, graphics packages, communications software and other applications software. Here the crystal ball is cloudy. Sometimes when the mist clears one can see a scenario in which an integrated package (incorporating all of the above applications, and more) is used beginning in the very early grades. All students learn to keyboard and to write in a word processing environment. All students learn process-oriented writing in an environment that includes a spelling and a grammar checker. All students learn to use and to create data bases. All students learn mathematics from the first grade on in an environment that includes calculators and computers.

Sometimes the crystal ball becomes even clearer as one looks at increased computer availability and computer-integrated instruction. Then one sees every student having an individual education plan (IEP) and a strong trend toward interdisciplinary studies. Integrated software is a tool that runs across all disciplines, blurring the lines between them. One can foresee great change in the curriculum as students master the computer-as-tool, and as the curriculum adjusts to such computer usage.

More and more schools and school districts will have a computer coordinator. This will be a person skilled in working with teachers, broadly knowledgeable in computer applications to the curriculum, and devoted to learning more about computer education. The profession of the computer coordinator will gradually become distinct from that of the computer science teacher, The number of computer coordinators wi1l probably exceed the number of computer science teachers, and they will exercise a major role in curriculum changes.

Next year's issues of *The Computing Teacher* will reflect the crystal ball gazing just described. More specifically, here are some things to expect:

1. Articles appearing in *The Computing Teacher* will tend to be shorter and will emphasize classroom applications.
2. *The Computing Teacher* will give special attention to the interdisciplinary aspects of computer-as-tool and how this is modifying traditional discipline-oriented barriers. The editors will solicit articles that describe interdisciplinary applications. We will also seek out articles describing major potential curriculum changes based on appropriate use of computer technology. For example, the National Council of Teachers of Mathematics

has recently supported integration of calculators and computers into the full K-12 mathematics curriculum. Such changes will affect almost all teachers.

3. There will be an increased emphasis on computer-assisted learning and applications software. This means more software reviews and more information about new educational software.
4. One section of *The Computing Teacher* will be devoted to teachers of computer programming and computer science. It will contain articles about teaching computer science, including the Advanced Placement course.

These are by no means all of the changes you can expect for next year, but some things will be a surprise. Remember, much of the content of *The Computing Teacher* depends on articles that are submitted for publication. We need your help. What would you like to see, and what do you think other readers would like to see? Write to us, sending your ideas and/or an article. Remember, the field of computer education is in its infancy. The best is yet to come!