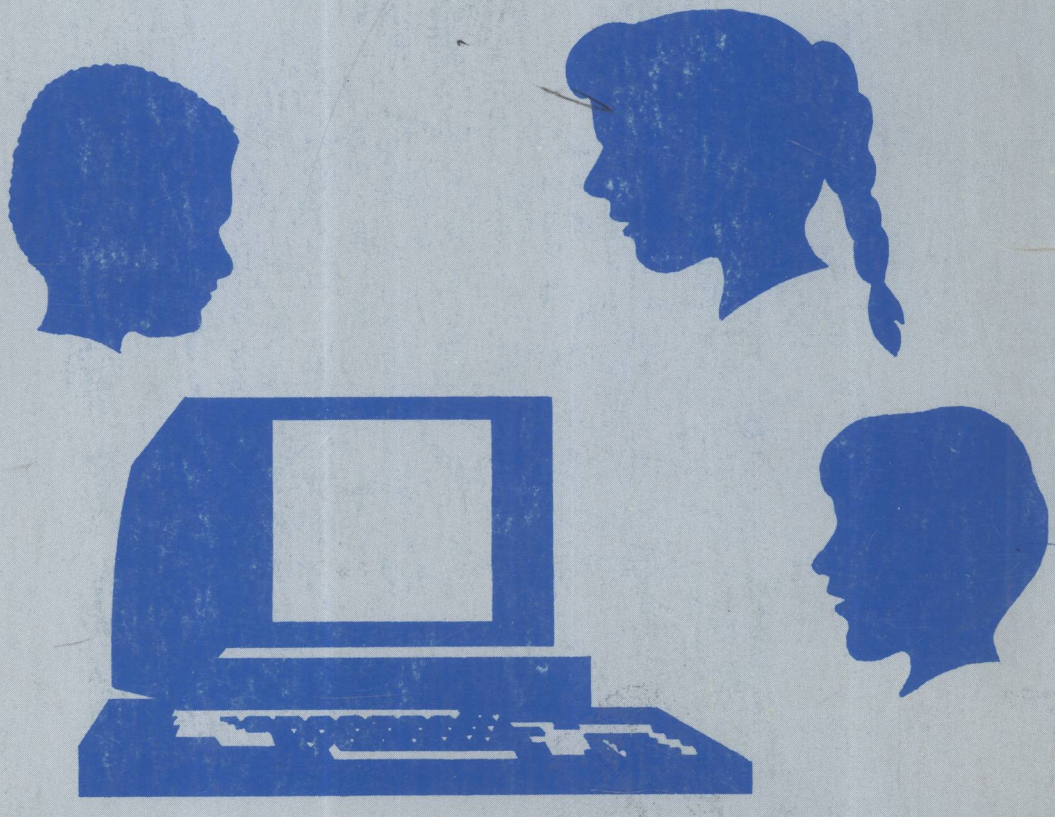
Second Annual

Conference Proceedings

Microcomputers in K-12 Education

Pierre Barrette, Editor



Computer Science Press

Second Annual
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Microcomputers in K-12 Education

Pierre Barrette, Editor
Southern Illinois University

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This book contains the conference proceedings for the Second Annual Conference of Microcomputers in K-12 Education which was held at Southern Illinois University on March 18-19, 1982.

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Conference Proceedings

Microcomputers in K-12 Education

OTHER BOOKS OF INTEREST

S.I. Ahmad and K.T. Fung
Introduction to Computer Design and Implementation

Wayne Amsbury
Structured Basic and Beyond

Pierre Barrette, Editor
Microcomputers in K–12 Education

M. Carberry, H. Khalil, J. Leathrum, and L. Levy
Foundations of Computer Science

Erik L. Dagless and David Aspinall
Introduction to Microcomputers

William Findlay and David Watt
Pascal: An Introduction to Methodical Programming, Second Edition

Rachelle Heller and C. Dianne Martin
Bits 'n Bytes About Computing: A Computer Literacy Primer

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Chess and Computers

David Levy and Monroe Newborn
More Chess and Computers: The Microcomputer Revolution and the Challenge Match

Tom Logsdon
Computers and Social Controversy

Ira Pohl and Alan Shaw
The Nature of Computation: An Introduction to Computer Science

James J. McGregor and Alan H. Watt
Simple Pascal

Gerald N. Pitts and Barry L. Bateman
Essentials of COBOL Programming: A Structured Approach

Donald D. Spencer
Computers in Number Theory

Ivan Tomek
Introduction to Computer Organization

Preface

It is refreshing to see excitement in education. Excitement stemming from sharing ideas, sharing priorities and sharing a growing commitment toward improving education through technological tools governed by human direction and involvement. Such was the nature of the comments echoed at the meetings and in the halls and in the lounges during our Second Annual K-12 Microcomputer Conference. Over five hundred teachers and administrators attended, setting an all-time high figure.

Over fifty different presentations were made during the two-day conference. Many were repeated by popular demand. Conference evaluations were exceptionally positive and elicited many fine suggestions for our next Conference.

One of the hoped-for goals in our first conference was to have it serve as a model for other institutions to copy. This goal has been achieved with enormous success. The Southern Illinois model of cooperative educational computer conferences has been transferred and successfully conducted at two other institutions of higher learning in Illinois, as well as transported to Missouri, Oklahoma and West Virginia.

We are indeed pleased to have helped neighboring states and sister educational institutions in getting their educational computer conferences going. Our philosophy has been and still is that the best communicators of computer technology are the teachers, students and administrators who have had firsthand experience with computers.

Therefore it should be restated that the goal of our conference was to bring together individuals who have had practical day-to-day experience in using computers for teaching and administration. We wanted our Conference to be a forum for reporting computer applications in practice, with the equally important goal of sharing ideas and experience. The conference in that sense differs significantly from other conferences that have primarily a research emphasis. We do consider presentations of action research as well as empirical studies to be very important and look forward to having presenters make them who desire to.

Not all presentations are included in these Proceedings, as not all participants wanted to write up their presentations. Many were content with sharing their experience orally with their audiences. Since the entire Conference consists of volunteers, we respected their choice.

Acknowledgments

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International Council for Computers in Education, for use of MicroSIFT's evaluation.

MECC (Minnesota Education Computing Consortium) for sample pages from Elementary 3.

Preparing the Proceedings

Preparation of camera-ready copy, including formatting and indexing, was undertaken by Miss Anne Hill, a master's student in the Department of Curriculum, Instruction and Media, using the university's mainframe computer and Waterloo SCRIPT. We are deeply indebted to her for her services and skills.

The Index

Most Proceedings do not include an index. When we tried an index in our first Proceedings, we felt it would be useful to our readers. We really didn't know this for sure, however. Many fine letters have since been received commenting on the Proceedings and thanking us for the index. Therefore again we have included an index of keywords, terms and names, and hope that this will prove useful to you. We hope you will enjoy reading the articles, and we very much encourage you to contact authors individually should you desire to.

Microcomputers in K-12 education is rapidly emerging, and our hope is that these Proceedings facilitate an understanding of how people are using them. Your comments and suggestions are always welcome.

Pierre P. Barrette, Editor

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Educational Computing: An Integral Part of the Comprehensive K-12 School of the 80s

Dale LaFrenz

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Dr. Dale LaFrenz's professional career with computers in education spans over twenty years. Starting as a high school teacher involved with the early use of computers in a time sharing mode, his interests expanded from high school math to the use of computers in all areas and grade levels. He was the first instructional computer consultant for TIES in Minnesota and then became Director for Instructional Services at MECC, Minnesota Educational Computer Consortium. At MECC he directed the world's largest educational time sharing system and was responsible for the development of state contracts for computer terminals and microcomputers as well as the development of instructional software for microcomputer systems. Dr. LaFrenz left MECC in 1980 and became Vice President in charge of electronic publishing for Scott Foresman and Company.

Dr. LaFrenz opened the 1982 conference as keynote speaker.

I'm here this morning claiming and hoping to represent a number of different interests. I think that I represent the general, large (and growing larger) group of educators interested in educational computing. I think I also represent the small but doggedly determined group of educators who've been laboring in the trenches for fifteen to twenty years, convinced of the efficacy of the role of the computer in education. I also represent the increasing group of parents who from day to day experience first hand that the kids of the 80s are different. (My four are!) We parents are convinced that technology not only can but must be part of the process that many of us--most of us--all of us in here somewhat fondly and reverently call education. I represent a determined group of educators whose convictions are similar and equal to those parents, but at the same time we educators are determined that the role of technology in the education process will not eliminate the school from the process, but that

technology will provide a new means, a new way, a new opportunity for learning in a variety of new as well as the old learning environments.

Further, I represent some of the professional organizations of which I am a part; most specifically AEDS, the Association for Educational Data Systems, where I have just recently retired from the board. In this role I have had an opportunity to view the growth of educational computing and the impact it is having on our own professional organizations, on our profession.

Of course I'm here representing the industrial side of educational computing, my current organization, Scott Foresman and Company, and thus also the many large and small commercial organizations that not only serve our education community--and serve it well--but also are very vital and critical partners in the educational computing movement.

That's what I think I represent--not as the sole representative but as being part of those organizations or those groups. I tell you that because that is the perspective from which I would like you to evaluate what I say, and it is the perspective from which I come.

Because of my current position I have been able to travel the country over the last eighteen months and I have spoken to many gatherings similar to this group of educators, parents, people who are interested in education--and more specifically, interested in educational computing. I am here this morning to report and share some observations, to tell you that across the country educators are excited about computers--kids are excited about computers--parents are excited about computers, and communities are excited about computers in education. Now all this adds up to a lot of excitement! But more importantly, from my perspective, there's action, and that's what counts. I am of course excited. There's new enthusiasm, there's renewed interest, there's an invigorating activity in our schools that's happening because of this thing called the computer in education. I say, let's face it. The computer's hot--let's run with it. But caution! Don't make the mistake of too many technologists. (You must have talked with them or heard them or read their writings.) These are the people who say that the solution to every problem is technology. They go a step further; they say if you have a problem, you apply technology as a solution--if it doesn't work, give it some more, because the solution is in technology.

I want to suggest that we behave as educators, using technology where it can help, and in ways that are consistent with what we know about kids, about learning, about schooling. To help you maintain a somewhat realistic perspective in regard to this shining new light, I'd like to share "Six Points of Reality" that come from Jack Roberts, the editor of Scholastic's new magazine called Electronic Learning.

1. The benefits of technology cannot be expected overnight.

   You wouldn't get that impression listening to the technologists, because all you do, in their view, is push the button and the solution is forthcoming out of technology.

2. Technology is not always the best tool for certain objectives.

   In other words, it's not a panacea. We have to learn how to apply it effectively and learn where we should apply it and where we should back off.

3. Technology itself has limitations.

   I think that goes without saying, but sometimes it's forgotten!

4. Not all students are being exposed equally to technology.

   Even in the districts where they have all kinds of technology there's still an inequity in terms of exposure to technology. (There are people who say it's for the "good" kids only. That's always seemed ridiculous to me. It's even more ridiculous with the advent of the microcomputer.)

5. Not all educators are equally excited or interested in what the technology can do.

   Present company excepted, but we do know some of our colleagues who tried the 35 mm projector in 1959, and when the thing got screwed up, they said, "That's it. I knew the . . . thing wouldn't work anyway"--and put it in the closet and haven't tried anything new since! They haven't heard about computers, they don't want to hear about computers. (I'll have more to say about them in a minute.)

6. The technology doesn't work by itself. You have to put it to work.

   And that's fairly key. Even though the darn things can walk and talk, etc., they can't come in and do what you want them to do--and I assume that is to help you in the teaching/learning process. I assume it's not to come in and do teaching. It's to come in and assist in a supplemental way, an ancillary way in your classroom.

I think these points are worth recalling as you go along, to come back to and focus on.

From my vantage point there are a lot of downers in education these days, but I like to look at the bright side. You have to be an optimist, and the microcomputer, in my way of looking at education, seems to be a shining light of optimism. It's like in Annie when everything is really down--it was bad--and Annie comes out on the stage and sings "Tomorrow." That's the way I like to look at things.

I assume that since you're here on this nice morning instead of doing other things, you are what I call "can do"-ers. You're out front, pushing ahead. We all know that's not easy because the "nay" sayers get in the way. When too many of the "nay" sayers pile up in front of you, progress seems unbelievably slow. Just remember "Borstelman's Rule": If everything seems to be coming your way, you're probably in the wrong lane!

What we have to have is commitment. We need a commitment to education, to education as it can be, not as it was. The "6 x 5"s are out--no more six rows, five each row in the classroom. If you haven't done anything else in the last 20 years, move the desks around a little and think about getting a microcomputer!

Commitment is different from participation--which reminds me of the chicken and the pig strolling down the street. They see the sign on the restaurant: "Bacon and Eggs, $1.95." The chicken says, "Hey, I'm part of that." The pig, being a rather proud sort, hunches up his shoulders and snorts, "You may be part of it, but with me it's a total commitment." We need the total commitment--maybe not quite to the level the pig has to give it.

All this excitement and action that I've been talking about creates some issues in educational computing. Let me give you my definition of that term "educational computing". You don't have to accept my definition, but at least you'll know what I mean.

I divide the world up into these three parts: The part that's called the instructional side--on my left over here--and the administrative side over there on the right, and in the middle there's this thing called "computer managed instruction," that is, applying the process of computer management to the process we call instruction. Then I take this piece--the instructional computing part--and divide it into three pieces: Over here the computer as an object of instruction, where I teach about the computer (some people call it computer science). On the other side, the computer as a means of instruction, which has an equally long or even longer list of names (computer assisted instruction, computer aided instruction, etc.). And in the middle, the thing that has come into vogue of late, computer literacy.

I'd like to talk just quickly about that middle one, computer literacy, because I think that needs some definition too. What I mean by it is an attempt to cover at least these three areas I have listed here, but maybe more specifically I could give you my continuum by which I let my head bounce with respect to computer literacy. On the one side (I won't say left or right!) of my continuum is what I call the sociological or sociologist approach to computer literacy. On the other side is the hard science approach, the computer science approach. That is to say, over here the folks are saying, "We really don't need to know much about the computer. What you really need, to be computer literate, is a pretty good knowledge of the impact of the computer on society, the positive and negative aspects of that impact." Over on the other side are the folks who say, "You don't know anything about computers and being computer literate until you know how to program in COBOL, SNOBOL, FORTRAN, ALGOL and a few other languages (Pascal and BASIC, I guess)." You have the hard core hardware/software machine people over there, versus the sociologists over on this side. I find myself closer to this side of the middle, if you will--the sociological side of the middle--and probably closer to the far side than to the middle when I talk about computer literacy in the K-12 comprehensive schools. I would like to have every student come out of my K-12 program able to write a program of even very short length. I'd like to possibly have them be able to sit down, give a computer a couple of commands and have it execute. I'd be more interested in having them know the role of the computer in society, the potential for some vocational aspects of computers.

Our world of educational computing is certainly not without issues. Back in the 60s I was one of those people telling the world there would be a computer in every classroom by 1970. Here it is '82, I'm still hollering the same thing, and it hasn't happened yet! People ask, "Why do you continue to do this?" Well, considering that my prognostication was for a computer terminal in every classroom, the question seems fair enough. My answer is in one word: microcomputers--and in two words, cost and effectiveness. Why didn't it happen--the computer in every classroom?

There are a number of reasons, and the first is the tough one for me to face, the fact that educators are reluctant to move quickly. We aren't known as a real fast move-out group. On the other hand, I'm somewhat defensive--about education, myself, and educators. I don't mind my saying that about us, but I don't want lawyers, or doctors, or those other folks out there, saying it. But when they do, I point out to them that we have some reason to be reluctant, to be cautious. We have hooked our wagon to a number of stars that have taken us over the cliff, and a number of those stars have been technology driven.

A second reason why we didn't move the way I thought we would in the 60s is very simply, the cost of this technology has been prohibitive--the hardware

costs, the communications costs were very very high. When I was trying to implement time-sharing terminals in every classroom I was out talking to teachers and administrators and school board members about the good deal we had for them at $600 a month for computer time--all you could use for $7200 a year--and by the way, you have to pay the telephone costs, the hookup, buy the terminals, etc. Costs were prohibitive.

A third thing was the availability of courseware, or rather non-availability of courseware, in spite of the PLATO system (which you well know in Illinois). We have not had, and in my opinion we still don't have, really good quality courseware. That is going to be the thing that will prohibit the growth I am predicting for now and in the future. To put things into perspective, from a hardware standpoint, on the instructional side: When I talk about computers in classrooms now I'm talking about an instructional unit that is a console with one of three transfer storage media (solid state ROM cartridge, disk or diskette, or tape). An instructional unit in my way of thinking is some kind of computer device for three or four hundred dollars through which you get output, using a console to transfer software from one of those three media.

On the administrative side we're talking about a bit more equipment but we're still talking about microcomputers--adding a couple of disk drives and a printer.

When I say courseware I'm talking about materials that have two dimensions. Software is necessary but not sufficient; there must be written materials, for the teacher, for the student. It must relate to the curriculum, with scope and sequence. That's what I mean by courseware. Quality courseware has these characteristics. For one thing, it's user friendly. Now that's a term that has grown up in the last year or so, but it has meaning to people who have been on the microcomputer and who have found it not user friendly. It has to be super-simple to use. Super, SUPER, SUPER simple to use, because the person I'm trying to convince is that one we talked about who tried the 35mm projector in 1959 and couldn't get it threaded. And it must be reliable, endurable.

Courseware has to have a sound pedagogical basis, and the written materials have to support it. I want the software part of my courseware to use the attributes of the microcomputer, to use color and sound, speed and good graphics, animation--and the good decision-making capabilities of the microcomputer.

It's the microcomputer that lets me be optimistic about cost. That $600 that I was going to use ten years ago for access to time-sharing now becomes over time a $600 investment for many many times the capability we could have had for $600 a month rental. We have "come down the curve", as they call it in the industry. In the last couple of years or even in the last couple of months--in fact in this month, costs have dropped dramatically.

The second word of my two-word answer about being optimistic was effectiveness. I could talk about effectiveness with respect to the outcomes--that is, the impact on the student--and I could talk about it in terms of student achievement, but I'm not here to do that today. I'm going to couch effectiveness simply in terms of the attributes of the technology, to say that the microcomputer brings a whole new dimension to effectiveness. Things that I categorize as convenience, portability, color, sound, speech, graphics and animation are added into the old computer. That is a new dimension of effectiveness. The potential for effectiveness of the microcomputer in the process of teaching and learning has increased tremendously. Even so the impact is being debated.

The one thing you can count on is change, very rapid change. I read The Futurists, Toffler and others and I say to myself, "That can't be true...all that stuff isn't going to happen...I'll believe half of what they're saying...and I'll double the amount of time it'll take... As a mathematical model I'm going to believe somewhere less than a fourth of what they're telling me." Then about the time I get comfortable and settle back, the futurists announce that they often make a mistake. They consistently make the mistake of believing it will take longer than it actually does.

Let's go back a year, to 1981. The prediction then was that video text broadcasting would begin as a commercial service bringing still pictures and printed data to the nation's TV screens, and there would be a couple of systems: TELETEX, sending limited amounts of information by broadcast TV signal and VIEWDATA, using phone lines. That has happened. It became commercially available in 1981. In fact, VIEWDATA became available in Ohio in 1980. That is, people sit down, dial up on their telephone and get information on their TV screen from large commercial data banks. In 1981 the French began substituting computer terminals for printed phone directories. In 1982, this year, the growth of the home computer service and inter-computer networks might lead to strong competition for the U. S. Postal Service. As millions gain the ability to transmit written messages electronically, postal rates will have to go up to compensate for reduced volume, which of course makes that other service more attractive...and we're in a supply and demand cycle. That's the thing to remember as I go through my little litany of what's going to happen in the next ten years--supply and demand. Nothing I tell you is technologically impossible; in fact, everything I'm going to say is technologically working. It's a matter of demand driving price down, creating greater demand. You've just seen it happen with microcomputers.

In 1982 the first flat television picture tube reaches the market. Small, black and white, expensive. So we hang the TV on the wall.

In 1983 reference books fade from the market, gradually supplanted by data banks accessible from home computers for a small fee. Two-way cable systems become widespread. Viewers can participate in opinion polls or they can vote, from an on-screen menu. They can select films, order goods from stores. They have that kind of service in Coral Gables, Florida, and in Cincinnati, on a limited scale. But big industry in the United States is pushing it--AT&T, ITT, IBM--the three-letter names.

In 1984 (infamous 1984!) picture phone service arrives. After some embarrassments, service is revised so that neither camera nor view screen becomes active until turned on by the user. That will eliminate the need to dress for phone calls (and will reduce calls from exhibitionists). That's in 1984. You've been to the science and industry museums. The picture phone has been there for ten or fifteen years. They're waiting for the consumer to get ready to use it. It's on the market for a hundred bucks, and then in a year it costs $85, and the cheaper it goes the more we're taken up with it. In 1984 the first flat tube color TV arrives (expensive, of course). Game playing by computer network becomes a national mania, players all over the country match wits, fast-paced games end in minutes, and extended games go into years. (That's already happening.)

In 1985 facsimile printers tied into home video systems give instant printout of newspapers and other information. Users can scan headlines and request full printout of stories that interest them, in the order they want. They can get sports first and stocks last, or however they want it. In 1985 even though appliances still have control panels, they will primarily respond to

vocal commands. Just what you wanted to do--talk to your microwave!

Which reminds me of the story about the brilliant brilliant scientist at--shall we pick on IBM? (I do apologize!) --who one day made an amazing, unbelievable discovery. But his social conscience told him this thing would put half the people in the world out of work. What should he do? He decided to go home and think about it, sleep on it. But when he went home he found that he had to deal with a serious household problem: The refrigerator was on the blink! Well, his wife said they could go out to dinner but she challenged him: "You're Mister Science. Fix this stupid thing or get a repairman." So he did all the things a high tech scientist would do--opened the door to see if the light went on...what to do next? Here comes the wife ready to go out and he doesn't want to be shown up, so he kicks the doggone thing and it starts going right away! He took the credit for knowing the right things to do...but that night he couldn't sleep for thinking about his important problem, so early in the morning he decided to go into the office and make his decision there. He gets in the automated tower elevator and the elevator says, "What floor, please?" He pushes the button for 15, and watches the indicator as it goes up--12...14. It stops between 14 and 15. What now? He starts fiddling with the buttons, nothing happens, and he says, "What in the heck could be wrong with this?" And the elevator voice said, "NEXT TIME, DON'T KICK THE REFRIGERATOR!"

I'm not really sure they're going to talk to each other, but obviously, according to these predictions, in 1985 we're going to talk to them and they're going to talk back to us.

Back to 1985: sky-high commuting costs will lead to distributed offices, where workers will stay home and communicate via their home computer terminals. Even though 1985 seems a long way off, three years, I think it's going to accelerate faster than that. In 1985 the flat color television screens grow in size, shrink in price, gain in popularity.

In 1986, book stores begin printing instant books (on recycled paper or instant microfiche), so now you can get new books printed in the reader's choice of type size--big for easier reading, small for easier carrying. Or in your choice of type font. Remember where I currently work, in electronic publishing. The publishing industry knows that books aren't dead, but they know they're going to take different forms, maybe not with pages like this, or on a shelf.

In 1987, hi-fi systems linked to computer data networks conquer the "music lover's itch." You whistle a tune and the system will identify it and play a recording of it.

In 1988, the flat screen wrist television arrives.

In 1989, full graphic or three-dimensional television appears.

I want to go back to 1988, to put this thing into a time perspective. At least 85% of you have something on your arm right now--it's called a wristwatch. You know it as it exists today--the $19.95 Casio or TI or whatever. Look what it has on it and look at the size of it. If you have a new one it's sleeker, smaller, does more and is cheaper than the one you could have bought six months ago. (Six months is the cycle in the industry, because the consumer electronic show happens every June and every January, whether you want it to or not, and the first time a major vendor comes with no new stuff the Wall Street Journal will announce they're on the way down...so they've got to have a bigger--no, not a bigger!--a smaller and better and cheaper everything.) Here's the time line on the watch. Back in '75 we were astounded because we had this

electronic wristwatch that was just performing timekeeping functions; it gave you the day and the hour. Then you could have an alarm, two time zones--all that in 1975. Along about 1980 we jumped into the data processing kinds of activities on your wristwatch. Then we go into the data communications area and then the medical functions area--I'm moving across ten, fifteen years of time from 1975 to 1990.

In 1990 we not only add a whole bunch of timekeeping functions to our wrist, but we also jump into new things: the calculator on the wristwatch (you may even have one on there now), a computer on the wristwatch (we're into that business now). In 1985 we've moved into data communications, possibly having a radio built in there (Dick Tracy all the way!). The watch is getting smaller and smaller. How are we going to get people with fingers small enough! (Pierre says over at the medical school they're cloning certain kinds of people to fit the wristwatch of the future!)

The fact is that in the 1985-90 time frame we have medical functions on the wristwatch--pulse monitor, blood pressure monitor, thermometer, bio-feedback and medical history.

I've shared with you my perspective of how things will happen. I assume that you will infer that I think this whole phenomenon has some impact on our business of education, of preparing people to work in a society that's moving at that kind of rate, in those kinds of directions. We need to accept the challenge of the 80s and use the microcomputer revolution as a means to achieve improvement in education.

For that you're going to have to recruit the assistance of many helpers from all segments of the community. As you look for these people, remember it's very difficult to soar like an eagle when you're in a bunch of turkeys! So get the right people in there.

About the proposal that keeps coming up to "repeal" the eagle as our national bird. I don't particularly favor the turkey but I do have a feeling the eagle might be just a little too imperial and too predatory a symbol to suit the nuclear age. I would suggest our national bird might be elected for a limited term. And I propose that for the 80s we select the woodpecker. This is a persevering bird that works for everything it gets, survives all seasons, accepts all life's blows (even its own) without flinching.

We used to worry our head off about the woodpecker and its head, but not any more. In Science 80 there's an article by James Hanson called "Why woodpeckers don't need helmets." He reported that nature's little jackhammer hits a tree trunk at a speed of about 15 miles an hour, about 235 times the jolt that the astronaut gets in a Saturn V blastoff. But our little gamester keeps his neck tensed at the instant of impact, while blinking a fraction of a second before to avoid a chip in the eye, and no harm done. What a creature--that works with the devotion of the Japanese automobile assembly line--and takes its fifteen mile per hour crash a lot better than the products of that assembly line do!

What does the eagle do? Soars around, glares, looks majestic, flashes a profile, and stays far above the action. The woodpecker digs in, puts its nose two inches from the job, goes to it. I see the eagle as our fantasy, and the woodpecker as our task.

My position is that education and educational computing need the woodpeckers in the 1980s. I suggest that as you recruit, you check your lane occasionally but keep on pushing ahead. Personally, I can't remember a more interesting and exciting educational challenge than we have today. I'm very pleased to be part of that effort.