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ABSTRACT

This study investigates technology use in education in K-12 schools and the status of preservice education for teachers in terms of familiarity with technology (i.e., computers, videodisks, CD-ROMs, and VCRs) through an analysis of articles written within the last five years. A brief introduction contains a statement of the problem and discussions of the significance, organization, and limitations of the study, as well as a glossary of terms. Annotations for 22 articles are then presented under the headings of Technology: K-12; Technology: Teacher Education; Technology: Needs Assessment; and Technology: Implementation Ideas. Articles under each heading are subdivided into research and opinions. A summary of the data leads to the conclusion that teacher training in the application of technology to education, not familiarity with technology, must be emphasized in preservice teacher education. The study concludes with recommendations in the form of a five part model for the implementation of technology in teacher education: (1) Computer Literacy Class; (2) Modeling--appropriate uses of technology by faculty; (3) Student Work--required assignments; (4) Student Teaching--modelling from the supervising teacher; and (5) Maintain Contact--use of communications networks for support and sharing ideas and practices. (Contains 24 references.) (ALF)

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# THE NEED FOR TECHNOLOGY INSTRUCTION IN TEACHER EDUCATION

FOR DR. CHARLES R. DUWALL, PH.D.

AS PARTIAL FULLFILMENT OF  
THE EXIT PROJECT

BY LORNE OKE

JUNE 11, 1992

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## INTRODUCTION

### Statement of the Problem

Undergraduate education is not preparing its graduates to use technology productively in the classroom.

*Cond*

### Significance of the Study

It is apparent that we have encountered a time in education like no other in terms of the development of technology. Computers are in our schools and are being used regularly. However, our teacher preparation programs seem to be adjusting very slowly to this new medium of instruction (Beaver 89, Turner 89). The largest road block to the preparation of our children for the future is the lack of teacher training in the use of technology (Scrogan 89). We must begin an implementation program into our college curriculum that will allow our teachers to step into the classroom of the 1990's with confidence (Bruder 89).

### Organization of Study

This study will move from the established base of technology in education in our K-12 schools, through information about where most of our schools of teacher preparation are at the present time. Analysis of what needs to be done to improve the present preparation and ideas for implementation will complete the study.

## Limitations of the Study

The study will be limited to articles which are no more than five years old, with only a few exceptions. This is a rather contemporary problem with very rapid changes so older articles will only be included if their ideas seem to transcend time in some way.

It is also to be understood that the word "technology" will refer to modern technology such as the computer, videodisc, CD-ROM, and VCR. It will not refer to older technology such as the slide projector and filmstrip projector.

## Glossary

CD-ROM - Compact Disc-Read Only Memory. An optical-disc technology with massive storage capability.

Computer - An electronic device consisting of interrelated components that can accept, process, and display data under program control.

Computer Literacy - Term used to describe the knowledge and skills necessary to function adequately in an environment utilizing computer and information technology.

Courseware - Computer Programs and related materials specifically designed for instruction.

Hardware - The physical components of a computer system.

Integration - The use of computers to support and enhance curriculum goals and objectives in all content areas and in any appropriate manner.

Multimedia - Technology beyond the computer such as, video, TV, laser discs and CD's.

Software - Programs that are used to direct a computer to perform specified tasks.

Technology - The variety of modern hardware and software elements which have application to education. (computer, video, TV, CD-ROM, laser disc, programs)

Telecommunications - The use of communication lines to transfer information from one computer to another or to a remote terminal.

Videodisc - A round plastic platter that can retain data and audio and video material in digital form.

## ANNOTATIONS

TECHNOLOGY: K - 12

### Research

Bruder, Isabelle. "Ninth Annual Survey of the States."  
Electronic Learning (Oct. 1989): 22-28.

In this article Bruder summarized the highlights of the 1989 survey. The survey sought information from the state departments of education in all 50 states, the District of Columbia and Puerto Rico. Its purpose was to "provide a national assessment of the level of interest and commitment to educational technology in K-12 schools". The survey found that again, funding was the major concern of most of the states. Yet, even with budgets being constrained, many efforts were being made to perpetuate existing programs and even create new ones. Many schools reported to not only using computers and TV's but also CD-Rom's and Videodisc players. Some did report however to be more concerned at present with letting our understanding of, and ability to use, the new technology "catch up" with the purchasing. Many states reported a desire to develop instruction before new purchases were made. Even with this emphasis however, 94 percent of the schools did not require technology training in order for the teachers to maintain certification. This article seems to bring out the question of "do we purchase first or learn to use first". Perhaps the answer is "we must do both at the same time"? The article also included a "Spotlight on Texas" via an interview with Geoffrey Fletcher, the director of the Division of Education Technology at the Texas Education Agency.

Scrogan, Len. "The OTA Report: Teachers, Training, and Technology." Classroom Computer Learning. (Jan. 89): 80-84.

Scrogan finishes the last of a three part series which examines the conclusions of the report by the Office of Technology Assessment. He presented the conclusion that "Technology in the classroom is significantly improving learning for some children". Which in turn raised some questions. Why is technology not reaching a broader base of our students? "Perhaps the most significant factor...is that the vast majority of teachers today have had little or no training in the use of the new technologies." This conclusion led to the realization that "training for teachers now looms as an ongoing requirement for professional growth". The report provided a summary of five findings on teachers, technology and training: 1. Technology's potential is largely unexploited, 2. The role of the classroom teacher is critical, 3. Most teachers want to learn technology, 4. Adopting technology is complex, and 5. Technology makes teaching more challenging before it makes it easier. The last one may be the most significant. With the many things we already ask our teachers to do, many don't want to put forth a great deal of effort on something with the returns so far off. Scrogan concludes with an emphasis that the report showed that just over half of the teachers now teaching feel they are prepared to use computers in their teaching and less than thirty percent of student teachers feel they are prepared.

The Wirthlin Group. "The Computer Report Card: How Teachers Grade Computers in the Classroom." Tech Trends. (Oct. 1989): 30-35.

This article was an executive summary of the survey commissioned by IBM to poll teachers at the K-12 level about their attitudes toward computers in the classroom. The survey found that computers were used for instruction in 98% of the schools that were surveyed. Two-thirds of the teachers personally use computers as part of their classroom instruction, and yet the survey showed that teachers perceive a gap between computers potential and their actual use. There was a strong indication that teachers believe computers are not a fad and that unequal access to computers could put students from less affluent communities at a disadvantage. The article went on to outline all of the statistical findings which basically concluded that technology can and should improve everything in education from attendance to literacy to instruction.

## Opinion

Bruder, Isabelle and Others. "School Reform: Why you Need Technology to Get There." Electronic Learning (May/June 1992): 22-28.

Presented in this spring edition of EL was a very strong argument for the necessity of technology in the instruction of our young people. The authors stated emphatically "We cannot talk about reforming American schools without talking about technology." They went on to say "The technological tools of the 21st century must be coupled with new visions about the work of teachers and students." The premiss of this article really came down to two simple truths. First, we must reform our present educational system and second, we must use technology to do it. The authors provided five different examples of model situations where technology was playing a significant role in the revolution of education. They also discussed the America 2000 educational goals set by the Federal Government and provided viewpoints on how these can only be met through technological advancement. The examples given show that the inclusion of technology can assist learning in a variety of ways. Technology can increase graduation rates, provide literacy for all students, reform science and math curriculums and encourage At-Risk learners. The authors concluded with these comments: "We have an enormous task ahead of us in education: We must prepare our students to live happily and productively in a century whose demands we can only imagine."

## TECHNOLOGY: TEACHER EDUCATION

### Research

Beaver, John F. "A Profile of Undergraduate Educational Technology (In)Competence: Are We Preparing Today's Education Graduates for Teaching in the 1990's? 1990 ED 332985.

John Beaver summarized some very direct findings in his article which arose from some research and a study of his own performed on Education Students at SUNY College in Buffalo, New York. His findings gave strong support for the opinion that we are still far from properly preparing our teachers to teach in the 1990's. Judith Turner was quoted as stating that few colleges have incorporated computers into their curricula. Moursund(89) supported this by summarizing his findings with this statement: "Colleges are doing a miserable job of preparing teachers for the Information Age". This comes at a time when already, some K-12 schools are not hiring new teachers unless they have an appropriate level of computer competence. The survey, which was taken by approximately 300 education students (juniors and seniors) showed results which supported the earlier stated accusations. In 1989 1/4 of the students claimed to have never used a computer while 68% had never used one in a college course. In 1990 (a repeat study) 18% had never used a computer anywhere while 54% had never used one in college. These statistics are disappointing with the only consolation being that at least they are moving in the right direction. Beaver does point out that much of the problem in teacher education is the educators, the faculty of higher education. There is a void in the amount of training that they have received, this void then is simply passed on to their students. We really need to realize that the answers to the technology questions involve many groups, not just our teachers who are presently in the classroom.

Brooks, Douglas, M. & Kopp, Thomas W. "Technology in Teacher Education". Journal of Teacher Education (July/August 1989): 2-6.

Brooks and Kopp presented a discussion of the research and its application to the development of technology instruction in teacher education. They analyzed the types of experimenting that is being done with technology in education and how that experimenting is being applied to instruction. Their conclusions really hinged on two findings. The first is that "major program themes are being overlooked in the research which is presently being done. Factors exist that are restricting experimentation". The second is that "teacher educators have a professional responsibility to provide leadership in developing the full potential of existing and emergent technologies in teacher training". There simply seems to be a lack of research and planning behind the movement of technology into education. The authors stated six significant factors currently affecting the lack of planning, coordination and direction with the application of technology to teacher training: "absence of coherence in preservice program design, the semantics of technology, funding priorities, costs, faculty development, and a lack of systemic research programs on the impact of technology on teacher training". The authors ended the article by answering eighteen questions that are important to consider for technology implementation.

Bruder, Isabelle. "Schools of Education: Four Exemplary Programs." Electronic Learning (March 1991): 21-24.45.

Bruder presented four education programs which took some bold steps to ensure their students would have the ability to use technology in their classrooms. Each had their own interesting and diverse approach to accomplishing the training of their teachers. At UMASS they implemented a program called MESTEP (Math English Science Technology Education Project). This gave the preservice teachers one semester in a school and one semester in one of a dozen local corporations. "The result is that it seems to have enhanced each student's sense of the value of teaching, and given them the opportunity to test the 'greener grass' in the business world." (70% are still teaching) Michigan State promoted a program of placement in the prep schools which already have educational labs established. George Mason provided a means of interaction between the fifth-year students and the college of arts and science where they have just finished four years of study. Penn State provided a video catalog of teachers who use technology in their classrooms in a variety of ways. The conclusion drawn was that "successful integration of technology into classrooms requires a combination of some preservice and a lot of ongoing inservice training".

Kinzie, Mable B.; Delcourt, Marcia A. B. "Computer Technologies in Teacher Education: The Measurement of Attitudes and Self-Efficacy." April 1991 21p. Paper presented at the Annual Meeting of the American Educational Research Association (Chicago).

This was a study done to analyze how practicing teachers and teacher education students felt about computers and their ability to utilize them in their instruction. The measures were administered to 328 university students in education courses. The article began with an interesting quote from the American Association for the Advancement of Science. "In the broadest sense, technology extends our abilities to change the world: to cut, shape, or put together materials; to move things from one place to another, to reach farther with our hands, voices, and senses." There is little doubt that technology must be in the forefront of the reformation in education. The studies done in this article reflected some very logical conclusions. One such conclusion was that the amount of experience a person had directly influenced their feelings of comfort and competence. Another was that "strategies to enhance teacher experience with computer technologies could contribute to the formation of positive attitudes and self-efficacy, and in this way influence teacher adoption, use, and modeling of computer technologies. Perhaps the most important conclusion was that in terms of long range success, schools would be much better served to "invest in the early training of teachers, rather than rushing new machines into the classroom.

### Opinions

Bruder, Isabelle. "Future Teachers: Are They Prepared?" Electronic Learning (Jan./Feb. 1989): 32-39.

Bruder went into detail in this 1989 article about the failures of preservice education. She deliberated how the Methods Instructors in teacher education have been slow in implementing technology because they don't have time to teach computer basics. Nor do college faculty in general have the time (some the desire) to train and experiment on applications for themselves. She pointed a finger at the states for lack of direction on their part (Only 18 states require any sort of technology preparation). She basically stated we are not properly preparing our future teachers. Her solutions? She supports her thoughts by including discussions with other educators in the field and states that we must give our preservice teachers a "basic handle" on technology. Then we need to encourage them to continue their inservice and graduate work to keep up with their own needs and development.

Hess, Caryl A. "A Computer Literacy Curriculum for Pre-Service Teachers. 1990 9p. ED# 320896

This document described a program at the University of Akron. The program is called OPEN and is a pre-service curriculum in computer technology. The program revolves around four stages: 1) overcome anxiety 2) practice until mastery 3) educate beyond and 4) network for survival. The third and fourth steps were really keys to what was seen as a good deal of success after only one year of implementation. The third step referred to educating beyond the Apple IIe (which the initial instruction was performed on) and the fourth step emphasized that in order to "keep up" it would be necessary to collaborate with others. Perhaps the best indicator of success was that seventy percent of their students who went directly into student teaching felt competent in using technology in their instruction.

Turner, Judith Axler. "Teacher-Training Colleges' Slow Move to Computers Blamed for Schools' Lag in Integrating Technology." The Chronicle of Higher Education. (July 19, 1989): A9-A11.

Turner presented another report on the lack of teacher training in our preservice education. She stated that if we really want technology integrated into our schools we need to have our teachers properly trained to its use. Described were three different models which most schools of education seem to fall into at present. The "assumption" model (students will pick up information on their own), the "three-credit-course" model (a computer literacy course) and the "integration" model (where technology is integrated into methods and teaching courses). Turner commended Lesley College as an outstanding example of a school using the third method. She also described the interest of some businesses, particularly computer companies, to participate in the advancement of technology.



## TECHNOLOGY: NEEDS ASSESSMENT

### Research

Erion, R.L. & Moeller, Lonell. "A Computer Literacy Course: A Needs Assessment." The Rural Educator (Spr. 1991): 4-8.

The authors of this article performed a survey of 159 students, 90 principals and superintendents and 117 teachers to ask questions in the context of three areas: "1) What characteristics relevant to use of computers do students typically bring into a teacher education program? 2) To what degree is knowledge of computers useful to teachers? and 3) What is important for teachers to know about computers? Several interesting features came from the study. It was found that there is a great deal of diversity in the experience and background of education students entering the program. Some had no experience while others had already used computers in business settings. Approximately two-thirds of teachers reported to using computers in some occupational sense. Most were Math or Vocational oriented however. An interesting discovery came from the principals and superintendents, in every subject area the superintendents placed a higher priority on computer knowledge than did the principals. As far as what was considered to be important for teachers to know there was a general consensus that applications were very important while programming and history were relatively irrelevant. Along with that point came the revelation that much of the anxiety held by students traced back to their high school programming course. "Overall, programming was not perceived as an important skill for teachers, but there is a strong indication that teachers need to be able to use the computer both as a management tool and as an instructional tool."

Fulton. Kathleen. "Preservice and Inservice: What Must Be Done in Both." Electronic Learning (Oct. 88): 32-36.

Fulton summarized and commented on the research from the OTA study. She presented clearly the attributes of the research and yet the reality of the fact that technology is not self implementing. It takes time to plan, and before computers make a teachers job easier they tend to make it harder. Fulton discussed the fact that only about one-third of our teachers have even had ten hours of computer instruction, much of which was at the literacy level. In fact, "despite the presence of computers in almost all K-12 schools nationwide, only half of the nation's teachers report ever using computers in instruction". Fulton advocated three ways of introducing technology to preservice instruction: 1) integrate the use of technology in subject matter methods courses, 2) place student teachers with supervising teachers who regularly and creatively use technology in their instruction and 3) establish computer networks to tie beginning teachers to resources and instructors that could assist them.

#### Opinions

Diem. Richard A. "The Role of Technology in Teacher Education: Preparation for the Twenty-First Century Classroom." (Feb. 1982): 13p. ED# 212596.

Along with some information given from surveys, Diem provided a rather enlightening summary of the models of instruction being used in education. They included five formats for technology instruction: 1) The General Education Course Work Model (a computer literacy class) 2) The Educational Technology Course Work Model (restructuring of the old audio-visual course) 3) The Integration/Application Model (educational uses of technology are spread throughout the education program) 4) Inservice/Certification Model (to conform to political pressure; referred to as the "teach me about it in two days model) 5) Technology Follow-Up Model (includes an introduction in preservice educ. and continues through the student-teaching experiences and on into inservice up-dates). Diem concluded by presenting three factors that must be considered by any implementation program: the future needs of the users, the applications of computers to educational settings, and the impact of technology on school settings.

Harrington, Helen. "Normal Styletechnology in Teacher Education: Technology and the Education of Teachers" Computers in the Schools, Vol 8(1/2/3) 1991 49-57.

Harrington presented some very direct points and perhaps the best overall perspective of any of the articles. She stated plainly that we are only achieving a basic level of instruction within our preservice programs in that we are only teaching about technology, we are not teaching how to use technology. We have to realize that the "effective use of technology within the organization of schools may require changes in the curriculum, the way in which teachers transmit the curriculum, the way in which students learn, and the way in which schools operate". We need to focus on "learning rather than teaching" which may be a different orientation for some educators. The author conceived three objectives we should have in programs for prospective teachers: "to prepare our students to use technology, to provide them with experiences that incorporate technology, and to enable them to develop a critical perspective on the use of technology". Harrington commented that too often it seems we only get to the first of the three. The article could be summarized with these comments: "the benefits (of technology) are enormous if we focus on the good ideas in the incorporation of technology and match those ideas with our program goals so that our objectives are supported"; and "we must make a distinction between preparing teachers to use technology and using technology to prepare teachers."

Munday, Robert., Windham, Robert., Stamper, Jennifer. "Technology for Learning: Are Teachers Being Prepared?" Educational Technology (March 1991): 29-32.

The authors presented some discussion about the needs of education in the future and then some ideas about how to meet these needs. Their first was the incorporation of technology into the curriculum through professors modeling its use in their classes. This might include video presentation, CD-ROM research and electronic mail communication. They also suggested a computer integration course where students were given specific instruction in the use of computer applications and software. Potential topics would be "computer-assisted instruction, application software, telecommunications, and multimedia, and interactive videodisc technology." Munday, Windham and Stamper concluded by stating that whatever implementation process is pursued, it must include a vision of the future and an emphasis on the continuous learning that must be prevalent in our teachers.

Ragsdale, Ronald G. "Teacher Development; The Implications of Using Computers In Education." Canadian Journal of Education 14:4(1989) 444-456.

In his article about the development of our teachers, Ragsdale presented some important points for consideration when planning the implementation of new technology. He supported the idea that there is still some disagreement in education circles as to just how computers should be integrated into the learning environment. He stated throughout the article that computer instruction must be more than just "how to" segments of applications or programming but must include moral and intellectual foundations. Through most of the article his focus was on the student, the curriculum and the teacher, instead of the technology. He demonstrated this focus with his definition of computer literacy; "students should be required to acquire computer skills that will assist them to master the rest of the curriculum". The question raised by this statement however is, do we need to change the curriculum. Ragsdale also reflected on the motivation of many teachers to integrate computers in their classrooms. He made the point that "teachers are a bigger threat to computers than computers are to teachers". If the focus and the emphasis is not in the proper place, new technology will not be successfully implemented no matter how hard we try. Ragsdale discussed the three levels of training: pre-service education, in-service training and graduate education. He stated that each of these should have a different focus yet all should include values and morals as part of the teaching. He also included a rather general, yet valuable summary of the categories of computer uses in education. These were: teaching about computers, teaching through computers, and teaching with computers. These three categories would each require a different focus of instruction which would obviously need to be taken into consideration.

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Troyer, Marilyn B. "Issues and Problems in Teacher Computer Literacy Education." Journal of Research on Computing in Education (Winter 1988): 141-154.

Marilyn Troyer wrote a very comprehensive article pertaining to the term Computer Literacy. She stated how this term is so often given a vague limitation and how it applies to different people in different ways. She also stated one very true reality, the K-12 schools and the business world have indeed embraced technology. This has forced the need for the evaluation and implementation of an effective computer literacy program within teacher education. The article also brought out the fact that there is still some debate as to just how much the computer can be or should be implemented into our schools. Some feel that accepting the microcomputer should not be a "given" in education and that we should focus on the impact of the computer on society rather than the actual instruction on the use of computers. Many are worried that this new technology will just be another, very expensive, fad in education. Troyer further discussed the debate of the necessity of programming within the ability of someone to be called "computer literate". Her conclusion was that we are continually moving away from programming as a need for all computer users. There simply is ample software for most users which negates everyone's need to know how to program. She also made a strong statement concerning the content of computer education for our teachers. Her discussion hinged on a lack of distinction between education for teachers who teach about computers and those who teach with computers. She also included a table of recommended content for computer literacy training. This would be an effective tool for someone who wished to develop a teacher education curriculum. Troyer finished her article with discussions on certification, opinions and needs of teachers, and classroom implementation after training. These all brought to light the fact that the need for further development in the teacher training curriculum is very necessary.

Wiburg, Karin M. "Teaching Teachers About Technology".  
Computers in the Schools Vol. 8(1/2/3) 1991

Wiburg began her approach to the technology issue by first stating that the current curriculum is not where it needs to be and that the implementation of technology should be a part of an across the board update of what is being taught. The introduction of technology will not, on its own, renovate our curriculum. "In short, technology can become a positive tool only when student teachers are taught about it in relationship to other aspects of the 'restructuring movement'." She continued by relating the changing role of the teacher as a facilitator of learning, instead of a deliverer of information. Along with this discussion, Wiburg brought to light another important point, that of restructuring our evaluation techniques. "Future teachers need to know not only about new roles and strategies for managing and organizing learning environments, they will also have to develop better evaluative methods which reflect these new educational approaches." This is a point which many authors seem to neglect.

## TECHNOLOGY: IMPLEMENTATION CONSIDERATIONS

### Research

Bosco, James and Others. "The Challenge of Electronic Technologies for Colleges of Education." Journal of Teacher Education (Nov./Dec. 1987): 25-28.

These authors developed an article based on the research done by the AACTE Task Force on Technology. They proclaimed the responsibility of the schools, colleges, and departments of education (SCDEs) to "play an increasingly dominant role in helping to shape the use of new technology in educational environments". They summarized ten critical considerations for SCDEs: 1) information technology in schools is not a passing fancy, 2) information technologies encompass a variety of equipment and applications in addition to computers, 3) information technology is a critical resource in the effective delivery of instruction, 4) information technologies are a means rather than an end in the educational process, 5) the use of information technologies is an important component in the training of all professional educators, 6) specialists in educational technologies are needed for both school and nonschool settings, 7) the leadership of deans is critical to the successful implementation of information technologies, 8) SCDEs must exert leadership in research and development activities related to educational technologies, 9) colleges of education should play a major role in efforts to achieve equity in the access to new technologies, and 10) colleges of education administrations and faculty have the responsibility to inform themselves about the new products which have educational implications. The authors also made four suggestions for getting started: know where you are, plan and build for the future, establish linkage, and exercise leadership by modeling effective use of new technology.

Niess, Margret L. "Preparing Computer Using Educators in a New Decade" The Computer Teacher (Nov. 1990): 10-15.

This article was a summary of the discussion of a panel of educators, which sought to establish the necessary competencies of a teacher in the 1990's. There was a broad base of educators included, from elementary teachers through to administration, and guidelines were established according to three categories: teachers, computer teachers, and computer coordinators. Each category was further divided into three levels: elementary, middle, and high school teachers. After a great deal of discussion and re-evaluation, some general thoughts were presented. One of these was that for much of the discussion, terminology seemed to be a problem. There was simply not a consistency in the terms used so that definitions seemed to be required with many statements. This no doubt slowed the process and shows us that steps need to be taken to establish consistency within the field of computers. The group also found that for most purposes, programming is something of the past. Because of the tremendous development of software, we simply do not need to have all of our teachers possess the ability to program. The last theme that seemed to resound was that there needs to be a shift from our teachers having knowledge about the computer, to our teachers having knowledge of how to use the computer in the classroom. The article finished with a summary of the competencies that were established by this discussion. They listed each category and the minimum abilities that the person in that category should possess. The trend went from a basic competency in knowledge of computer applications and how to apply them at the elementary level to programming and lab design ability at the high school level. These competencies could be used as goals for objectives in the development of an Undergrad Education Curriculum.

#### Opinion

Wholeben, Brent E. "Structuring The Undergraduate Computer Literacy Curriculum" Collegiate Microcomputer (May 1985) V 3 N 2 179-187.

In this article Wholeben presented a very thorough and well thought out curriculum for preservice education. He presented his concept starting from a rational for preservice education, through to an illustrated time-schedule outline for the necessary components of his contents. The progression outline began with awareness, moved to practicum, through developmental, and finished with incorporation. Wholeben detailed fourteen needs of instructional computing literacy within his progression. Some of these included: hardware, software, programming, CAI, CMI, computer instruction, Logo, evaluation, and special applications.

## SYNOPSIS

### Summary

There is ample evidence that technology is no longer a "thing" of the future, but is part of the present (Bruder, Oct. 89). There is also a rather substantial number of educators that feel our K-12 education curriculum is a vision of the past. Yet, with these truths in front of us, few colleges of teacher education seem to be responding to the challenge (Beaver, 90; Turner, 89). Many states are not encouraging technology initiation into college programs (OTA Report 88) and the faculty of our training institutions seem unchanged and insensitive to the rapid sweeping advances being produced through technology use in our schools and our society (Brooks and Kopp, 89). Because of this, most of our graduates of teacher education programs are simply not prepared to use technology to improve their teaching (Bruder, Jan. 89). They have not seen computers modelled in their classrooms of instruction nor have they taken a course which might outline for them how they might use technology to improve their methods and assist their students (Kinzie and Delcourt, 91). On the last "rung" of this ladder is the student, who is simply not being prepared for his/her future (Bruder and Others, 92).

## Conclusions

There are in fact several conclusions that can be drawn from this research and even though it is easy and seems appropriate to point fingers, I feel that it is important that we keep a few things in perspective. First of all, we must realize that we are, we hope, in the middle of this tremendous change in our education time line. What has come before has been years of a measurable amount of success. What we hope to achieve is a future full of success due to adaptation and promotion of technology. What we have now is a struggle to convert the previous system and its methods-while retaining its values-to a new system. A system which will not focus on the dispensation of information, but rather the facilitation of learning. Technology presents a very natural medium with which to produce this change and we have seen a great deal of financial resources go towards this end (OTA Report, 88). Yet in order to implement it we must first train our teachers how to use it. This training seems to be the largest obstacle in the way of our step into the future (Scrogan, 89). We really need to slow our purchasing momentarily and let our learning catch up. Many of our schools have technology, now we really need to learn how to use it.

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## Recommendations

There is evidence that some schools are graduating teachers who have an adequate grasp of technology (Bruder, 91) however, many preservice institutions are not reacting quickly enough to the challenges at hand. I feel the order of response to the technology issue should be this: First--the schools of education should plan a curriculum which includes an introduction to technology and they should provide incentives for their faculty to learn about technology and its implementation; Second--the college professors should realize their responsibility to professionalism and aggressively seek opportunities to learn about technology and its application to their situation; and Third--undergraduate education majors should realize the needs of the schools they are preparing to serve and aggressively seek any technological opportunities which are present.

Here is a model for the implementation of technology which could serve as a guide for a teacher education college:

I. Computer Literacy Class - add a class to the curriculum which would give all education majors a fundamental knowledge of technology. This would not be a methods class but a technology class. (could be involved with the restructuring of the Audio-Visuals class)

II. Modeling - have all of the education professors model appropriate uses of technology in their classrooms.

III. Student Work - require students to do assignments and practice units with technology.

IV. Student Teaching - place students with a supervising teacher who currently uses technology in their classroom.

V. Maintain Contact - link schools of education and K-12 teachers via telecommunications networks for support and updating of ideas and practices.

Perhaps the most prudent advice has come from several authors. We must instruct teachers on how to apply technology to their instruction, rather than what technology is. Technology instruction for education majors must keep this focus in order to become beneficial.

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