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ABSTRACT

Educational changes in Wyoming that are linked to the emergence of new informational technologies are considered. Attention is directed to the following topics: assumptions for Wyoming educators as they plan to respond to the impact of technology on teacher education; the importance of educational goals and objectives; the national climate affecting higher education; current activity in Wyoming; the impact of emerging informational technologies on the individual, faculty members, and college programs; the use of new technology in inservice teacher training; and strengths and weaknesses in the Wyoming educational system that will affect the state's response to the new technologies. Recommendations include the following: there should be greater decentralization of decision making, particularly in the area of budgets, with greater flexibility given to departments for the purchase and integration of new equipment and technology into their programs; a statewide policy on how to integrate the new technology at all educational levels is needed; and teacher education programs need to constantly upgrade the curriculum to integrate the impact of technology in the public schools. Appendices include questions for planning, including implications of information technology for higher education and teacher education. (SW)

THE IMPACT OF NEW INFORMATIONAL TECHNOLOGY ON EDUCATION IN WYOMING

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THE IMPACT OF NEW INFORMATIONAL TECHNOLOGY ON EDUCATION IN WYOMING

Introduction

The impact of new informational technology has been dramatic and precipitous. At a recent meeting in Snowmass, Colorado, sponsored by the U.S. Department of Education and the Mid-continent Regional Education Laboratory, representatives from higher education in the State of Wyoming had a chance to reflect and talk about the impact new technology would have on education. Based on the information provided at the conference and the discussions held among the representatives from Wyoming, the following paper and ideas have been developed and put forth for information and future discussion. It is hoped that the ideas and questions presented in this paper will help awaken the various constituencies in the education community to the major impact that new technology will have on education. In developing the paper, the authors took freely from the ideas and reports presented at the conference. Ideas and commentaries provided by the participants in the conference have been appropriately referenced in the text. In this paper, we have limited ourselves to those changes directly caused and/or influenced by the emergence of informational technologies.

When reading the paper, one must be aware of the unique character of higher education in Wyoming. There is only one comprehensive university, the University of Wyoming, in the State. It is governed by the Trustees of the University. The College of Education at the University has the only teacher training program in the State. Local regions are served by seven community colleges, each governed by

separate elected Board of Trustees. Despite the separate governance structures, there is a great deal of cooperation among the institutions of higher education in the State. This cooperation facilitates efforts to serve the needs of the local public schools.

When reviewing the comments and the reports at the conference, two definitions of technology emerge. One definition of informational technology is a rather broad open-ended definition that includes all major forms of instructional technology, such as laser videodiscs, microcomputers, advanced robotics, and other forms of high tech currently being developed at a rapid pace. A more narrow definition of instructional technology has also been used and appears to be used more frequently. This definition centers around the integration and use of microcomputers in a broad range of educational activities. As this paper is developed, we need to be aware that much of what is being discussed and much of the impact experienced to date has been the result of the introduction of relatively inexpensive mircocomputers. However, based on the comments at the conference concerning advances in other areas of technology, it is reasonable to assume that, in the future, it will not be only the microcomputer, but other forms of technology as well which will continue to impact public education.

Assumptions

What assumptions should guide Wyoming educators as they plan to respond to the impact of high technology on teacher education?

1. The transition from the Industrial Society to the Information Society will impact all segments of education. The use of technology, in

particular microcomputers, is widespread within society in general. Therefore, planning an appropriate response to this revolution must necessarily involve all segments of the education community, from the public schools and the State Department of Education to the community colleges and the University. It must also include parents and other constituents of public education.

2. The revolution will be ongoing and rapid and not marked by a steady state. The rate of growth within the field of technology is not just rapid, it's exponential. All indications are it will continue at this same rate. Therefore, institutional planning should be oriented toward flexibility and perpetual change in the field for the foreseeable future.

3. The transition toward the technological revolution in education must be guided by educators well grounded in learning theory, curriculum development, and evaluation.

4. People should control computers. Computers should not control people. Basically, technology in the form of microcomputers will continue to be a tool. The field of education is capable of developing good curricular approaches, and those must not be sacrificed in the worship of technology. Both technology and curriculum theory will change. Our task will be to determine how to use teachers and technology appropriately.

5. The technological revolution will require not only the revision of curriculum for school children but also the integration of technology into the professional lives and practices of teachers and administrators at all levels.

6. Given the current economic situation within the State of Wyoming and the projections for lowered mineral royalty income in the foreseeable future, it is reasonable to expect that education's response to the technological revolution must be formed within existing human, fiscal, and curriculum resources, and that it will require a redistribution of those resources to respond to new priorities.

7. Institutions of education will have to set new priorities to accommodate the technological revolution and, in some instances, will probably have to abandon or modify significantly former priorities that do not contribute to the realization of an appropriate response to the Information Society.

8. Although the technological revolution will promote an infinite variety of specialized machinery which will in turn require an infinite variety of specialized skills, higher education in general and teacher education in particular should focus on developing generalists who are competent to deal with information technology on many levels and in many forms and who may be rapidly trained as specialists in selected areas according to their needs after graduation.

9. Similarly, in designing laboratories and other instructional facilities to serve the need for education in technological fields, higher education should work toward developing generic facilities which offer education in mainline developments rather than fringe or obscure specialty areas.

10. The transition to the Information Society will require extensive cooperation and intensive communication across all levels of education in Wyoming.

11. Given the lack of a statewide public television network, the vast distances and small populations involved, the transition to the Information Society in Wyoming should make the greatest use possible of extant or moderately-priced new technologies to accomplish the retraining of faculties and the promotion of new skills in schools and colleges. To wit, the Wyoming Higher Education Computer Network, teleconferencing, and video or videodisc instruction should be considered as possible modes of delivery for new information statewide.

12. The technological revolution and its impact on teacher education will necessitate an array of curricular revisions and new approaches to training and retraining those now involved in education as well as those wishing to prepare for careers in education. The University must assure preservice competency in computer literacy and must plan to provide appropriate inservice opportunities for teachers and administrators.

Goals and Objectives

At least three presenters emphasized that before we deal with the issue of the impact of new technology on teacher training, we must identify within education our goals and objectives. This sounds easy. It is, in fact, a very complex and difficult task. Often in the past, education's goals and objectives changed with the political climate in the State or country. Nevertheless, this is a key question. According to Larry Hutchins, we need to begin by answering the question, "What business are we in?" Willis Harmon phrased it a little differently, "What are we trying to do?" According to Harmon, we must clearly identify and explicitly state the expectations our society has for

education. Harmon believes that the values of society have been relatively conservative, but never clearly spelled out; therefore, making it difficult for educators to respond not only to society's values but also to its perceived needs. Stan Pogrow, when talking about the impact of microcomputers in the schools, raised the question in a very different way but with a similar end in view; i.e. before we commit to a massive infusion of technology in our schools, we need to straighten out the curriculum. Pogrow indicated that this "reconciliation" must be the first priority. Once we have the curriculum clearly spelled out, we will know exactly what our goals and objectives are and can then adopt appropriate technologies to meet them.

Obviously, it is not an easy task to obtain a consensus or agreement among all agencies involved in public education. It is even more frustrating to attempt to clearly define goals and objectives and maintain the support and enthusiasm of all people involved in the public schools. Nevertheless, if we wish to deal with the major issues facing public education today, it is critical that we define what it is we are trying to do and once we define the objectives, specify some procedures and processes for reaching these objectives.

Recommendation: State of Wyoming, under the leadership of the State Department of Education, needs to institute a committee with broad representation from all interested constituencies that will have the responsibility for clearly stating and defining statewide goals and objectives for the public schools. Based on the objectives defined by the State, the University of Wyoming in cooperation with the community

colleges must clearly define and state the goals and objectives for teacher education.

The National Climate

When reviewing the recommendations from the meeting, one must remember that the climate in the country has shifted dramatically during this past year due to the number of reports which have been published concerning public education. The fact that there is so much agreement among the reports indicates perhaps a developing national consensus concerning what our goals and objectives for elementary and secondary education should be. Ed Larsh summarized effectively the nine major points upon which most of the reports concerning public education agree. (1) We must raise academic standards. (2) Education will be a major political issue in the 1984 and 1988 elections. (3) Drastic changes are needed now. (4) Education is everybody's business and is too important to leave to educators. (5) The reports tend to be reactive to the economic issue of falling productivity in the country. (6) Education is a national issue since our defense is at stake. (7) Business and local communities are going to be heavily involved in education in the future. (8) We are going to need a system that provides for life-long learning. and (9) Students are going to have to spend more time in school. Larsh indicates that because all reports are emphasizing some common elements, states may consistently modify their curricula and requirements to meet the demands outlined leading to the de facto institution of a national curriculum.

Overreacting to the reports may lead educators to seek change before identifying their objectives and the most logical and cost

effective ways to meet those objectives. If we are not careful in the way we implement change, we may destroy the opportunity for integrating the new technology in our public schools. The fact that the call for change at the national level happens to coincide with an explosion of informational technology may mislead people to believe that technology is the solution to all our problems. This simply is not true. Many of the problems in education are, in fact, political issues which must be dealt with and solved at a local level. Although the integration of technology may solve some of the logistical problems in delivering quality instruction, it is not a solution to all the problems outlined by Larsh and the various commissions and reports on public education. If we believe that technology will solve all these problems, we are bound to be disappointed and in being disappointed may reject the technology that may help resolve some of the more difficult issues in elementary and secondary education in the future.

There are several issues which higher education needs to address. Both the NEA and the administrator organizations are coming up with their own models for teacher education. They are developing these models because they believe that current teacher education programs are not meeting the needs of the teachers, schools, or administrators. The bottom line is the teachers and administrators want to wrest control of teacher education from institutions of higher education. This does lead to a major issue that must be addressed: Who will control the curriculum and the training of teachers in the future?

If higher education faculty are unwilling or unable to change the curriculum to reflect the changes taking place in society and the public

schools, then the ultimate result may be the elimination of traditional teacher training programs. According to McCune, one of the internal issues that must be deal with in higher education is how we are going to organize higher education and teacher education in the future. The assumption is that technology will force changes in the way we currently structure teacher training programs and the form and content of those teacher training programs.

Recommendations: Faculty in the College of Education at the University of Wyoming must collectively deal with the issues raised in the report A Nation at Risk. Faculty must address the issue of academic standards and the implementation of curriculum changes that will facilitate the introduction of new technology into the undergraduate curriculum. The College must also develop models of change which will allow for direct consultation and input from both teacher and administrator organizations. Cooperative working relationships must be developed with these organizations if the teacher training program is to maintain their support in the future.

Current Activity in Wyoming

At the current time, school districts are making and have made massive purchases of new technology. These purchases have been made without a major attempt to define the goals and objectives of education at the state level. Schools have purchased the technology and expect teachers to incorporate it into the curriculum. In many instances, teachers are being forced to modify curriculum to fit the available technology instead of identifying technology which may help teach the curriculum which has been identifed and specified in the districts. The

danger in this state of affairs is that the technology will drive education and not become a tool of educators. In a situation such as this, teachers may perceive the new technology as hindering and interfering with the accomplishment of curriculum goals and objectives and as a result, may reject the technology and fail to use it in a productive and supportive way.

Although the introduction of new technology has not been systematic, it has introduced large numbers of public school teachers to the microcomputer and has resulted in many of these same teachers being trained in its use including basic programming skills. Public school teachers have learned to use this tool and their students are developing substantial computer skills. These two factors will necessarily impact higher education, which has lagged behind in the development of microcomputer facilities and faculty learning computer skills and applications. The University is just completing the development of a microcomputer laboratory in Education. The next major task will be the inservice training of faculty who wish to develop microcomputer skills for the future introduction of microcomputers into the curriculum. Very few faculty have been formally trained in the use of microcomputers.

At the current time, teacher educators are reacting to the forces in the local public schools and are not acting in a proactive way to exercise leadership in the development and integration of technology into the classroom. Some action needs to be taken quickly so higher education will be able to deal with a new generation of students who will be coming out of the public schools with several years experience using microcomputers and other forms of advanced technology. In a very

short period of time, the students in our classes may have more technical skills than the faculty trying to teach them.

A recent trend in the State has been a demand by school districts that newly hired teachers be computer literate. When asked what is meant by computer literate, no district has yet given clear definition, but most are insisting that whatever it means, our students need the skill.

Even at the University, all resources to date have been used to help provide inservice to public school administrators and teachers with little effort being placed on upgrading University faculty. If this policy continues, the faculty will be totally out of touch with the technological advances taking place in the public schools.

As Scanlon mentioned in his address, we will not feel the impact of technology until there are approximately five to ten microcomputers in each classroom. At this point in time, we will be developing an entire population of school age children who will be computer literate by the time they leave high school. These students will have a major impact on higher education when they arrive in universities and expect the same levels of technological sophistication that they have been used to during their 12 years of elementary and secondary school. Given the level of technology available in Wyoming public schools, this scenario is only a very few years away.

The community colleges will continue to have a great deal of influence on the teacher training programs in Wyoming. At the current time, between 40 and 50 per cent of all education students at the University are transfers from Wyoming community colleges. The faculty at the community colleges, particularly those in education departments, are

aware of the need to incorporate new technology into the basic curriculum and are taking steps to accomplish this as hardware becomes available. Community college students are being advised to take introductory courses in programming and data processing when the courses are available. It is currently estimated that 60 to 80 per cent of the students will be able to take one of these courses in their two years at a community college. This trend of having large numbers of graduates from the community colleges coming to the University computer literate, will place additional pressure on the University to have prepared and in place a curriculum that recognizes these skills and makes appropriate use of them.

It will be very difficult for the College of Education to attempt to provide traditional lecture courses talking about technology when students themselves have had hands-on experience using and implementing both the technology and theory behind quality instructional design and development. Students who are used to individualized instruction, self-paced learning and access to advanced forms of technology will not be very accepting of an educational system that is using a traditional approach which is outdated and does not respond to individual students and their needs.

Recommendations: The State Department of Education must develop a systematic plan for the purchase and introduction of instructional technology into the public schools. The University must develop ongoing inservice training for faculty in the use of microcomputers and other instructional technology. Various constituencies dealing with education in the State must clearly and explicitly define what is meant by

computer literacy and specify how the competencies involved will be evaluated and certified.

Impact on the Individual

According to Willis Harmon, much of education is training. In the new Information Society, anything you can train a human to do, you can train a machine to do cheaper, more accurately, and quicker. This indicates we may need to change our focus of education from training to other things such as the development of creativity and interpersonal skills.

Technology will eliminate the tedious jobs in our society. We are finally succeeding and freeing people from monotony, and we should not perceive this as a problem. In fact, this has been a goal of the Industrial Society for a long time. Because people will have more free time, education must find ways of preparing people for a future in which what they do in terms of work, will require less time, effort, and creativity. People will need outlets for their own creative needs and abilities beyond the world of work and schools will have to prepare people to participate in these activities.

Ed Larsh also had some comments on this topic. Although partially agreeing with Harmon, he was not so sure the outcome was positive for the individual. In the area of work, contrary to what others believe, most of the jobs that our students of today will be doing in the future will be rather mundane, boring activities. Many of the creative aspects currently engaged in by individuals will be handled by advanced computers. Many of our students in the future will be overprepared and

overqualified for the work available. Education will have to teach these people to rechannel their efforts into outside activities.

The change in the society will require a different kind of teacher and a different curriculum. A renewed emphasis on counseling or interpersonal skills will be needed in addition to a knowledge base. Teachers will also have to develop a high level of awareness and an ability to use more sophisticated evaluation and assessment techniques particularly with the increased individualization of instruction. One of the key issues to be dealt with is what can we eliminate in the curriculum. This is a political issue that must be addressed within each institution. As we add requirements for technology use to the current teacher education curriculum if we wish to maintain our programs within a four-year sequence, something will have to be eliminated.

Another issue to be dealt with by higher education is to answer the question, "How can we use teachers to do things machines can't do?" Teachers, in the future who only have cognitive knowledge and who have not developed to a high degree their interpersonal skills, will be obsolete since machines will be able to disseminate the knowledge more quickly and more efficiently. This has major implications for teacher training programs. They need to reorient their curriculum to developing people who are more like counselors than traditional teachers. At the current time, teaching of interpersonal skills rarely exists as a formal part of the curriculum in teacher training programs.

Recommendations: Teacher education programs must reevaluate the skills they are providing future teachers. A renewed emphasis must be placed on the development of thinking skills and fostering creative

abilities. The educational establishment must be careful not to create high expectations in students for employment beyond what will be available in the new society. Teacher training programs must place an increased emphasis on the teaching and evaluation of interpersonal skills.

Impact on Faculty

Based on the discussions at Snowmass, it becomes clear that the emerging informational technologies will have a direct and lasting impact on faculty in higher education. Much of the impact may be perceived as threatening by the individuals involved. There is a clear implication that faculty members who are willing to change, modify their behavior, and develop skills in the use and application of the emerging technology will be the ones who will become critical to institutions of higher education. Other faculty who resist the change and fail to develop their skills in the use of new technology may quickly become obsolete and find their positions threatened. Since the changes are already upon us, it is critical that institutions of higher education organize faculty committees to deal with the impending changes. Some of the issues to be dealt with are sensitive and may create a rather negative emotional response from the faculty involved.

The first issue that needs to be addressed is that of faculty obsolescence. Faculty who do not have the same level of technological skills as their students may not have a future in a higher education environment which is moving more and more toward the integration of technology into the instructional arena. Not only is faculty obsolescence a problem, but as technology becomes more sophisticated and

is able to handle much of the routine instruction another issue which is raised is the number of faculty that may be needed in a given program. For example, if basic English instruction can be conducted using a microcomputer, it would be cheaper in the long run to purchase microcomputers for each student then to hire new faculty to teach additional students in English classes. A microcomputer would be a one time purchase which could be used over and over again while the commitment to a faculty member today in terms of giving that individual tenure is basically a million dollar commitment on the part of the institution.

Related to the issue of obsolescence, is the whole notion of faculty development and retraining. Those faculty who see the handwriting on the wall and wish to develop the necessary skills to maintain their careers in higher education will have to be provided the time, means, and support to develop new skills. This will require a major investment of resources for ongoing faculty inservice and retraining.

All of these changes may very quickly have an impact on traditional tenure and promotion standards within institutions of higher education. When looking at the long-term commitment that tenure implies, colleges in the future may wish to have as one of the requirements the ability to demonstrate technological skills and/or the ability and interest to develop these skills in the future. Faculty members who do not clearly have an interest in developing skills in the new technology or faculty members who demonstrate little potential for creative innovation may not be the types of individual that an institution wishes to maintain on its faculty. All of these changes will require that institutions and faculty sit

down and redefine the role of the faculty member in the future and the expectations for the faculty member in terms of promotion and tenure given the changes taking place in higher education.

Recommendations: Institutions of higher education in the State must quickly move to work with the faculty and clearly define their new role in a new society. This will require the immediate inservice training of a significant number of faculty who, by virtue of this training, will be more sensitive to and aware of the impending changes. In the hiring of new faculty and the tenuring of current faculty, institutions must be more explicit in their expectations for future performance and be less willing to grant tenure to faculty who do not demonstrate the ability to integrate technology into the curriculum and demonstrate an ability to be flexible and adaptive to the future changes within the institutions.

Impact on College Programs

When engaging in strategic planning with faculty, we must begin to look seriously at the future and how higher education can serve the needs of teachers and students who will live in the 21st century. Higher education could, with faculty input, discuss both changes and the organized format and content of degree programs currently offered. These programs would be reviewed in terms of skills being developed which will be needed by the society in the future. One of the goals of such a meeting should be the reduction of degree options, particularly those which hold no relevance for the future and the possible elimination of courses which are not skill related nor tied to goals perceived as critical for future educators. Such a change would allow the redirection of resources and people to areas in which there will be future demand.

Faculty need to evaluate each component of the curriculum and identify whether or not the curriculum needs to be modified. Any parts of the curriculum that are kept should have extensive justification indicating what skills are being taught to teachers and some indication of why these skills will be needed in the future. In this process, we need to look at some very traditional courses and decide if we need to keep them. We need to ask how such courses serve teachers who will be operating in the future.

We simply cannot stay attached to old systems that no longer work because historically we have done things this way or that way. Related to the issue of the curriculum is whether or not the College of Education should in fact be training people in areas that do not lead to teacher certification. If we are operating under restricted budgets and must reallocate our resources, is there a need in the State of Wyoming for training in nondegree, noncertifiable areas? Can we make use of our current certifiable degree programs to accommodate people who may be training for nonschool jobs?

The evidence suggests that the curriculum of the future must be modifiable to make use of the new technology. People need to start looking at curriculum changes now to allow for the introduction of new technology to increase student learning and involvement. In the future, schools will have a great deal more control over students in terms of individualized instruction by use of computer technology. We need to develop strategies for implementing these technologies and helping teachers to use them. This means higher education will have to engage in massive faculty retraining and staff development in order for faculty to

understand and use the new technologies, particularly microcomputer and videodisc technology.

In higher education where some programs and courses may need to be eliminated, faculty involved in them can be trained to deliver and teach courses on microcomputers and provide inservice programs to teachers in the field. Since this is a relatively new field, it is easy enough for higher education to invest faculty development money and bring faculty up to a reasonable level of sophistication in a short period of time. These faculty can provide inservice to their colleagues and local public schools. They can also serve as resource people to other faculty and students.

Recommendations: Faculty committees need to be instituted to deal with the immediate modification of the curriculum to allow for the introduction of new informational technologies. Institutions must set priorities to identify those programs which will receive increased support and those programs to be reduced or eliminated to allow for the introduction of new technology within current budgets. Faculty committees need to be instituted to help define and identify retraining and staff development needed in order for faculty to develop skills in the use of technology. Faculty and administrators must look at all programs course by course and degree by degree to determine what options will be obsolete within the near future and take the initiative to modify and/or eliminate these programs and courses soon.

Inservice

One of the major areas that has already been and will continue to be impacted by the new change is the increased demand for inservice training for teachers already in the schools. In Wyoming, the technology has already been purchased by many districts, and some people in the field feel threatened by demands being placed on them to make use of it. The University, in concert with the State Department and community colleges, must develop a more systematic means for the assessment of inservice needs and the delivery of inservice throughout the State, particularly in rural areas. One advantage the new technology has may be the development of materials and inservice programs which can be delivered, not live, but through computer simulation and in the future on videodisc to all schools in the State, even the most rural isolated areas. The University of Wyoming needs to take a leadership role in helping to provide and develop a model for inservice which will meet the needs of administrators and teachers throughout the State.

The State Department of Education needs to take on a bigger role in the coordination and evaluation of equipment, software, and programs. As mentioned previously, the public schools have made a major commitment to the use of technology in Wyoming and this commitment will force related changes in higher education. Public schools must come to understand that there are limited resources available to provide the necessary training and inservice programs for the use of new technology. As we concentrate these resources on workshops for teachers to deal with microcomputers and software evaluation, it will mean reductions in other inservice programs. In the University and community colleges, we do not have a

sufficient number of people adequately trained at the current time to provide the quality and quantity of inservice needed. Resources will have to be made available to upgrade faculty skills in order for them to be able to provide quality inservice to the public schools. In trying to meet the needs of the public schools for incorporating the new technology into their curriculum, the University is being forced to shift resources from other programs into the purchase of new high tech equipment which may create future problems in other academic areas being underfunded to meet this need.

In providing inservice to public school teachers, one model which is being tried is called the portal school model which was developed by the Science-Mathematics Teaching Center at the University of Wyoming. The portal school model works like some of the older National Science Foundation projects where key teachers are brought in from districts around the State and are subjected to an intensive on-campus experience in the use and application of microcomputers. These specially trained teachers are then sent back to their own districts to provide inservice and training to other teachers and administrators under the supervision of faculty at the University. Given the lack of equipment at the University and the extensive equipment available in school districts, this appears to be a very cost effective way of providing quality inservice training over a large geographical area and may be the only cost effective way of delivering this training to some of the rural isolated schools.

The attempts to provide inservice training, particularly in the field, must be done in an atmosphere of facilitation and not

evangelization. For the most part, the people we will work with are self-conscious about their use of the computer. We need to do everything we can to reassure them of our attempt to incorporate technology in doing what they already do well, namely, instruct students in our schools.

In terms of staff training within the College of Education, it may be necessary to send some faculty to other locations for specialized training to permit a shift in career path or career development to serve this special need. In terms of inservice work. the State is fortunate that many, if not most, school districts have adequate computer hardware located within their district. The problem then for us becomes one of developing curricular offerings and the staff to deliver them out in the State. Unfortunately, the budget does not now allow adequate resources for acquisitions of software, and possibly for the maintenance of existing equipment. Such limitations must be rectified in the future.

Recommendations: The University and the State Department of Education need to develop a model for providing inservice, particularly on the new technologies to the public schools in the State. The State Department must exercise leadership in the evaluation of equipment software and programs and provide this information to schools in the State. The University and other institutions of higher education must place a priority on the allocation of resources to support the training in as well as the implementation and application of instructional technology within the curriculum.

Weaknesses in the Wyoming Educational System

There are deficiencies in the educational system that might prohibit an adequate response to the emergence of new technologies. The University of Wyoming will need to take into account a number of problems and develop strategies to solve them as it considers the integration of information technologies in its curricula.

1. Among the major problems that the University faces are those related to its budget and planning processes.

a. The State's biennial budgeting process necessitates a three-year planning process at the University. This, in turn, means that University faculty and administrators must plan as much as three years in advance for the expenditure of funds appropriated by the legislature. The rapidity of the technological revolution has already impacted the University negatively to some extent. Biennial plans for the period July, 1982-June, 1984, conceived in 1981, did not take into account the need to modify facilities and to acquire significant amounts of equipment to accommodate the incorporation of information technology in the curriculum.

b. Compounding problems created by biennial funding are those created by budget inflexibility. The University's limited equipment budget has forced the implementation of an unrealistic ten-year replacement norm for instructional and other equipment. The scheduled distribution of equipment funds to maintain core academic programs does not readily allow for a major shift in funding to new acquisitions.

c. Additional budget inflexibilities create additional problems. Statutory prohibitions on shifting funds among expenditure categories,

i.e. between personnel and equipment, for example, necessarily limit the University's flexibility and ability to respond in a timely fashion to the need for major investments in information technology within a biennial period.

d. Within the planning process, where priorities are set as much as three years in advance, we find major disruptions. Programs are necessarily changing to meet evolving priorities that were never considered at the outset of the biennial planning process. Thus, priorities that were approved in the planning process are losing ground and this is impacting long-term development of departments and programs.

2. The State of Wyoming's economic forecast for the 1985-86 biennium is sufficiently bleak to lead us all to believe that there is only one steady-state factor in the institutional response to the new technologies, i.e. that we will be living within a zero growth budget which will require that we reallocate and redistribute funding within the institution to meet the needs for modification of the curriculum. This will necessitate intensive program review. In the worst case, it may force closure of some programs that do not contribute significantly to the institutional mission in an evolving information society.

3. The University must necessarily address the problem of technical illiteracy in the educational community itself.

a. Some faculty, having little exposure to or experience with high technology, necessarily regard the integration of technology into the curriculum with considerable skepticism. The institution must make an effort to accommodate these individuals' concerns and to educate them to the Information Society.

3. The problems relating to technical illiteracy are compounded when faculty have had earlier, bad experience with technologically-assisted instructional programs. There are faculty and administrators within the institution who have become prejudiced against high technological innovations due to past failures of technology equipment in instructional programs.

4. From the University's perspective, implementation of informational technology in the curriculum must necessarily include broad consultation with the community colleges, the public schools, and the State Department of Education. The educational diversity within the State, which we normally regard as a strength, may make it difficult to organize a singular approach to implementation of informational technologies in schools and colleges, although this approach may be the most cost effective. The University should consider strategies to pursue in the planning and implementation processes to involve from the outset the seven community colleges, 49 school districts, and the State Department of Education and to work toward a consensus plan. We must take into account the individuality of the institutions, the complexity of relations between them, and the absence of any authoritarian governance body. If decentralization is to be a feature of the new society, Wyoming certainly has the advantage of being well in advance of most other states and systems of higher education in this regard.

5. In its service role, the University may expect to be severely handicapped. With the exception of the Wyoming Higher Education Computer Network, the State lacks any statewide telecommunications systems. This deficiency coupled with the lack of a serious commitment to the

development of such tools both within and outside the institution could lead to a collapse of the University's service mission and hence, its support systems and leadership role within the State.

Telecommunications systems could help the University immensely in meeting its service responsibilities and in providing off-campus educational opportunities for inservice teachers and other constituents. The University should seek to abandon its traditional "extension" approach to off-campus education in favor of a technologically-assisted delivery program that would permit it to extend more and better services to its constituents across the State's 98,000 square miles.

As we consider the impact of information technology on the University and its teacher education programs and services, we should be aware that University personnel are now committed to traveling over 200,000 miles per year to deliver instruction and services to our statewide constituency. The inservice training requirements for teachers and others in computer literacy and related skills should not be addressed in the same way that we have attempted to handle our outreach mission in the past. In other words, a doubling of the University's effort to include intensive instruction in the information technologies statewide should not also require a doubling of our mileage per month. Instead, the University should look to technology itself to assist in the delivery of this instruction and should develop cooperative relationships with the school districts and the State Department of Education, and enhance cooperative relationships with the community colleges to facilitate this delivery.

Recommendations: Institutions of higher education must let the legislature know the negative impact that biennial budget planning can have on the flexibility of institutions and the ability of institutions to adapt to quick and rapid changes. Institutions must also have the budget process changed to allow shifting of funds among and between categories. Institutions of higher education must be willing to make cuts and eliminate programs which have been supported in the past but for which there is little need in the future. The University must do a better job of making a case both on campus and in the legislature for funds to expand and develop better instructional technology and media facilities throughout the State.

Strengths in the Wyoming Educational System

There are strengths or advantages in the educational system that might aid an adequate response to the emergence of new technologies.

1. The University is now devising a plan for internal implementation of information technologies. Planning is underway for introduction of a new broad-band telecommunications system for the University, to include expanded telephone service, out-WATS lines, ano eventually teleconferencing, networking, and electronic mail service.

2. The University is fortunate to participate in the Wyoming Higher Education Computer Network which serves the University and the seven community colleges. This instructional resource may be invaluable as we begin moving toward the implementation of information technology in the curriculum.

3. The on-campus, main-frame academic computing facilities are excellent and well used by students and faculty in selected disciplines. Student access is good.

4. Despite budget inflexibility and constraints imposed by biennial budgeting, the University has been able to begin establishing small computer laboratories in selected academic areas. The microcomputing laboratories in the Science-Mathematics Teaching Center, Agriculture, Education, and Commerce and Industry will be important resources to take into account in planning for computer literacy in the curriculum. Although most of these computer laboratories are not now able to reflect comprehensively the diversity of information technologies in use in the private sector and the public schools, a generalist approach in this area should be preferable for the training of undergraduate students.

5. Beyond modest advances in microcomputer laboratories and courses, the University has begun a plan for administrative computing. It has invested in videodisc equipment for faculty training and experimentation in this area and has introduced a videotape production facility on campus.

6. The Science-Mathematics Teaching Center, the departments of Mathematics, Computer Science, and Educational Foundations and Instructional Technology have developed special introductory microcomputing courses for inservice teachers.

7. Although itself lacking an adequate supply of equipment for instruction either on or off-campus, the University has been fortunate to enjoy good working relationships with many school districts which

have made equipment available for off-campus courses involving the new technologies.

8. There has just been completed a plan for the development of teleconferencing to connect, on the same model as the Wyoming Higher Education Computer Network, the University and the seven community colleges into a statewide learning network. The University should proceed with the dissemination of this plan and entertain suggestions and cooperative involvement from the community colleges to facilitate its implementation within the next two years.

9. Over the past four years, the community colleges and the University have developed effective articulation processes which should facilitate planning and consultation for the introduction of information technologies in educational programs.

Recommendations: Continue building on the strengths of various units within higher education. The University must give greater leeway and support individual initiatives and departments in colleges to integrate and implement informational technology throughout the system. This will require greater decentralization of decision making particularly in the area of budgets with greater flexibility being given to organizations at a departmental level for the purchase and integration of new equipment and technology into their programs.

Recommendations

All agencies involved in education must develop acceptable statewide goals and objectives. This task needs to be accomplished before we continue purchasing and introducing new technology into the schools.

We need to develop some statewide policy on how to integrate the new technology at each level of education: elementary, secondary, and higher education. The current unsystematic purchase and use of new equipment will only create more confusion in the schools. This is an area where our State Department of Education needs to exercise leadership.

In devising an approach to strategic planning, we need to develop a model which will provide input from teachers, administrators, school boards, community colleges, and the University.

There is a critical need for all educators in the State to come up with an acceptable statewide definition of computer literacy and then as a group, to develop a competency test which can be used to assess whether or not a student is computer literate. As other states require their secondary school graduates to be computer literate, there will be growing pressure to introduce the requirement in Wyoming schools. In addition, the University of Wyoming must take a look at the possibility of incorporating a test based on the statewide definition of computer literacy as part of its basic skills assessment program currently being carried out. Students failing to meet the criteria would be forced to take remedial instruction to develop a minimal level of computer literacy before being allowed to enter the teacher education curriculum.

Individuals taking a leadership role and attempting to bring about an infusion of technological change in education can meet with the various subject area teachers at their annual meetings held throughout the State. These groups and their elected officers can be used as a sounding board to obtain input concerning the best way to go about

integrating the technology into the classroom and into the teacher training programs.

We need to conduct surveys to determine State priorities for resolving some of the issues involved in integrating the new technology in public schools. This is one way to get input from all the groups with a vested interest in public education.

The College of Education must develop a mechanism to respond to and integrate changes as they occur. A mechanism will have to be developed to constantly upgrade the curriculum to reflect accurately what is going on in the public schools. At the current time, the curriculum virtually ignores the impact of technology on teachers and students at the elementary and secondary levels.

Cooperation and communication at all levels of teacher training will be needed as we attempt to meet expanded demands for learning with existing resources. Faculty members will need new skills and tools, along with the incentive to obtain them. Fiscal demands on the colleges and the University will be increased as they set new priorities and reallocate resources to provide skills, tools, and resources to the faculty. Curricular changes cause stress as topics are added to a course causing others to be shortened or dropped to make room for the new. All of these choices will test the quality of the persons involved in the process.

The demand for massive learning experiences with computers requires that higher education in Wyoming devise a cooperative delivery system that utilizes effectively every resource available. To get the necessary support for the integration of technology into teacher training

programs, we must have faculty involvement and obtain their support. Strategies need to be developed for faculty change. These strategies must be developed in such a way that faculty have input into the strategies and do not feel threatened by the change which is to come.

Based on the accelerated change and the major impact technology will have on the public schools, it is clear that there will have to be a major staff development effort aimed at education faculty. Some of the issues that need to be dealt with by higher education are: (1) The rate of technological growth and how to systematically integrate the technology into the curriculum. (2) How do we attract good students to the teaching profession? As teaching becomes more technologically sophisticated and requirements for teachers expand to include a higher level of interpersonal skills in order to meet the new goals and objectives of teacher education programs, we will need to attract a brighter, more articulate, more dedicated student. (3) How are we going to adjust our programs to deal with the inequities which may exist between a student who has had an education built around new technology versus a student who has not had the opportunity to develop technological and computer skills? (4) The issue of what to teach and what not to teach using the technology must be dealt with and dealt with quickly. (5) How do we train faculty to understand the changing roles of teachers and how do we modify our curriculum to reflect this changing role so that the curriculum will change as quickly as the roles of teachers are changing?

In planning for the integration of information technologies in teacher education programs, the University must consult broadly and solicit input from the State Department of Education, 49 school

districts, and seven community colleges. The standard articulation processes under which the University and the community colleges have been operating for the past three years should facilitate this consultation and provide a sound basis for planning.

In Fall, 1983, the University in cooperation with the community colleges and the State Department of Education should offer a one-day teleconference at eight centers: the University at Laramie and each community college site at Casper, Cheyenne, Powell, Riverton, Rock Springs, Sheridan, and Torrington. The program for the one-day teleconference could include three one-hour lectures by outside experts, probably focusing on megatrends; the information society; and information technology in the schools. After each major lecture, the program could shift to local discussions led by a coordinator who would follow a standardized discussion-question format. Discussion groups at the local sites would include University and community college representatives as well as teachers and administrators from surrounding public school districts. Statewide discussion via teleconferencing and led by the Dean of Education could close the one-day session and outline an agenda of issues to be pursued in local meetings throughout the remainder of the Fall Semester.

After the initial teleconference, on-site articulation conferences at each of the community colleges should be organized to include public school representatives, community college faculty and administrators, State Department of Education officials, and a team from the College of Education. A standardized agenda for planning should be prepared and discussed at each of the sites with a follow-up tentative plan

distributed in December. In the Spring Semester, the College may solicit reactions to the plan and bring them back to the faculty so that closure may be effected in formal planning by the end of the 1984 Spring Semester.

PRESENTATIONS CITED

Harmon, W. The Information Society: Implications for Relevancy

Larsh, E. Globalization and Relevancy: Can We Meet the Challenge?

McCune, S. Environmental Collapse and Strategic Restructuring of Schools.

Pogrow, S. Integrating Technology into the School.

Scanlon, B. What a Computer Literate School Looks Like: Curriculum, Instruction, and Administration.

All presentations were made at the PEER conference sponsored by the Mid-Continent Regional Educational Laboratory (McREL) and the U.S. Department of Education, Region VIII Office at Snowmass Village, Colorado, July, 1983.

APPENDIX

PLANNING FOR PLANNING:

DISCUSSION QUESTIONS

I. What is the potential for information technology to impact education?
   A. When?
   B. How?
   C. Character of impact? Durability?

II. What are the pertinent strengths and weaknesses of our educational system and institutions that will affect our ability to respond to the high technology revolution?
   A. What are the deficiencies in the system or institutions that might prohibit an adequate response?
   B. What are the advantages of the system or institutions that might stimulate an adequate response?

III. What are implications of this impact for higher education, generally? Opportunities and threats?
   A. Operationally (administration, management, planning, budget)
   B. Curriculum (revision to include, refocus)
   C. Constituent groups--who are the client groups to be affected?
      1. On-campus
      2. Off-campus
   D. Faculty and staff development
   E. Change character of faculty time commitment, job description, function in education
   F. Delivery mechanisms

IV. What are the implications of this impact for teacher education programs?
   A. Personnel
      1. How will the integration of high technology change the role of faculty and staff already employed?
      2. How will the integration of high technology change our criteria for selection of new faculty?
      3. How will the integration of high technology change our action on tenure and promotion decisions?
      4. How will the integration of high technology change our staffing and instructional delivery approaches?
      5. How may the College and University best prepare current employees to accept the need for change and to participate in the transition effectively?
      6. How may retraining of faculty and staff to assume new roles be effected most efficiently and with the least deleterious impact on individuals?
      7. What additional development opportunities, such as educational leaves, summer grants, mini-sabbaticals, in-house mentoring, should be devised to assist faculty in acquiring new skills appropriate to the hign technology milieu?

8. Given the possibility of retraining, are current faculty and staff resources adequate to effect the transition?
   a. If not, what additional resources are required and how may they be garnered?
   b. If so, what are the specific personnel reallocations to be effected?

B. Undergraduate Curriculum and Students
1. How will the role of the teacher in the schools be changed by high technology?
2. Given this role change, how should the teacher education curriculum be modified to prepare teachers better for this environment?
3. What are the minimum technical skills/competencies that each graduate teacher will need to possess? by 1986? by 1990? by 1995? by 2000?
4. What portions of the current curriculum structure will require revision? deletion? enhancement? if we are to equip students to fulfill the changing role of teachers in the high technology environment.
5. What are the minimum new components which must be added to the undergraduate curriculum if we are to equip students to fulfill the changing role of teachers in the high technology environment?
6. What effect will/should the integration of high technology into the curriculum have on admissions requirements for teacher education programs?
7. What effect will the integration of high technology have on pre-requisite requirements for upper-division course work in each discipline area? in methods courses? in practica?
8. Are there courses, programs, departments that may be rendered obsolete by the high technology revolution?
9. What will be the cost of adjustments? Where will the resources come from?
10. To what extent is reallocation of resources feasible? desirable?

C. Graduate Curriculum and Students
1. How will the impact of high technology change the market for graduate education in Educational Foundations, Special Education, Curriculum and Instruction, Educational Administration?
2. Does the information society offer the University opportunities for graduate program development, modification, reorganization that would not be possible without it? In what areas?
3. What components of the current graduate curriculum might beneficially be phased out to permit introduction of new, more up-to-date programs?
4. What effect will the integration of high technology into the schools and the University curriculum have on our admission and prerequisite requirements for graduate education? At the master's level? At the specialist level? At the doctoral level?
5. How should the graduate curricula in each field be modified to assist students to fulfill a changed role and to function in a rapidly changing environment?
6. What will be the cost of adjustments? Where will resources come from?
7. To what extent is reallocation of resources feasible? desirable?

D. Service Responsibilities
1. Who are our clients?

2. Where are they located?
3. What service activities are we now providing and at what level?
   a. Which of these may be terminated? when?
   b. Which of these may be postponed? for how long?
   c. Which of these must be continued? at what level?
4. What are their educational needs?
   a. Degree-oriented or nondegree?
   b. Credit or noncredit?
   c. If credit, lower division? upper division? graduate credit?
5. How to reach off-campus clients most rapidly and most effectively?
   a. What role might the community colleges play?
   b. What role might the school districts play?
   c. What role might the State Department of Education play?
6. What new service programs should we provide to respond to 4a-c?
7. What will these services cost?
   a. Identify categories of expenditure?
   b. Cost per fiscal year? for how many years?
8. How may resources be garnered to support them?
   a. Reallocation internally?
   b. Piggy-backing on existing services/programs?
   c. Service fees?
   d. Contracts?
   e. Grants?
   f. Private benefactors?

E. Allocation of Support Budgets
   1. What are the short-term and long-term costs of expanding information technologies in the curriculum?
   2. How will this change impact support budgets?
   3. How will the change impact consumers of support budgets?
      a. With curriculum revision, are there programs where support costs will diminish?
      b. In what areas will support costs increase?
      c. What economies might be realized by internal reorganization?
      d. What savings will accrue to departments with implementation of the new telephone system? How might these be used?
      e. How will the college's equipment maintenance funding be impacted?
         1) Should service contracts be purchased? Cost?
         2) Should maintenance/repair be handled internally? Cost?

F. What is a reasonable equipment replacement schedule? Annual cost?

V. What are the preliminary constructs of a long-range plan to respond to the transition in teacher education?
   A. What assumptions should guide Wyoming educators as they plan to respond to the impact of high technology on teacher education?
   B. What might be the salient features of a phased plan to integrate informations technologies into teacher education programs?
   C. How might the University proceed in the development of a consensus plan for teacher education in the State (articulation process)?
      1. Who should be involved?
      2. What is the timetable for these discussions, sequence of involvements?

3. When might a full plan be completed? Adopted? Implementation begun?

D. What current activities/facilities/personnel may be incorporated into the plan?