Technology training in preservice education programs: a review of the literature

Catherine A. Gersema

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Technology training in preservice education programs: a review of the literature

Abstract
Education is radically changing with the dawn of the information age, where the ability to access, analyze, and manipulate information is a basic survival skill. To become more technologically adept, elementary and secondary schools must provide technical training to their students. However, trained students are the result of trained professionals. Recognizing the burgeoning need to provide skilled professionals, institutions of teacher education are integrating educational technology programs in preservice education.

This review of the literature reports on technology implementation at teacher training institutions where educational technology is being infused into the preservice curriculum through adherence to guidelines from ISTE and NCATE. Course content consisting primarily of computer and media is taught by faculty who must overcome barriers to their technical illiteracy. Best practice models of technology integration are formed by student-centered learning situations that involve constructivism and collaboration.

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Technology Training in Preservice Education Programs:
A Review of the Literature

A Graduate Research Paper
Submitted to the
Division of Educational Technology
Department of Curriculum and Instruction
in Partial Fulfillment
of the Requirements of the Degree
Master of Arts

UNIVERSITY OF NORTHERN IOWA

by
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July 1997
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Titled: Technology Training in Preservice Education Programs: A Review of the Literature

has been approved as meeting the research requirement for the Degree of Master of Arts.

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Abstract

Education is radically changing with the dawn of the information age, where the ability to access, analyze, and manipulate information is a basic survival skill. To become more technologically adept, elementary and secondary schools must provide technical training to their students. However, trained students are the result of trained professionals. Recognizing the burgeoning need to provide skilled professionals, institutions of teacher education are integrating educational technology programs in preservice education. This review of the literature reports on technology implementation at teacher training institutions where educational technology is being infused into the preservice curriculum through adherence to guidelines from ISTE and NCATE. Course content consisting primarily of computer and media is taught by faculty who must overcome barriers to their technical illiteracy. Best practice models of technology integration are formed by student-centered learning situations that involve constructivism and collaboration.
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CHAPTER ONE

Introduction

In his book *The Future of Capitalism* (1996), Massachusetts Institute of Technology economist Thurow argues that in the information age the only sustainable form of natural resources will be knowledge and the accompanying skills of information gathering, analysis and manipulation. Negroponte (1995), head of the MIT Multimedia Laboratory, asserts that our society currently values atoms but as the society becomes more deeply enmeshed in the information age, it will come to value electrons as those bytes of information become the necessary commodity to sustain one's economic position (1995). Thurow (1996) points out that "productivity has grown much faster than demand" in the auto, steel, and machine tool industries (p. 169), and this has meant a decline in high wage jobs in the first world even as total employment has increased. Lower paid workers in third world countries now manufacture many of the products that the highly industrialized first world once produced, thus creating changes in earning potential as well as shifts in employment. In contrast, knowledge can only be employed through the trained and experienced skills of individuals; therefore, even though information moves quickly, developing the skills to utilize it takes several years. Thurow and Negroponte agree that technology skills and information resourcing and manipulation are the basis of future economic success. A study by Schultz and Schultz, conducted in 1990, reported that 17 million jobs then required computer skills.
and that 3 million more jobs were being computerized annually (Cited in Beard, 1993). It is easy to see why social consensus is building for technology training in the nation's schools. One example of successful consensus building is the Iowa Technology Initiative which allocated 150 million dollars to be spent over five years for the improvement of technology in the local schools (SF 263: School Improvement Technology Program, 1996). A second example is President Bill Clinton's announced plan of connecting every school to the Internet by the year 2000 (Hudelson, 1996).

Purpose

With its emphasis on knowledge and technological skills, the information age challenges everyone; however, for educators the challenge is even more exacting since their mission is to prepare students for a future that can only be anticipated. This problem is doubly compounded for teacher education institutions involved in preparing future teachers to equip students with the knowledge and skills that they in turn will need for the projected but unknown future. As difficult as this challenge is, certain generalizations about successful preparation regarding the integration of technology into teacher education programs can be made. The purpose of this paper is to review the available literature and to discuss its implications regarding the need for teacher training institutions to prepare their students to be experienced users of technology in the K-12 schools, the programs and methods used in providing technology training at
teacher education institutions, and the use of faculty models in teacher education programs.

Research Questions

What does a review of the literature show that teacher education programs are doing to implement technology training? How is this training implemented? How are faculty models created?
CHAPTER TWO
Review of the Literature

That dynamic technological shifts are now deeply influencing the way education is presented there can be no doubt. Belathjy (1995) lists the major education technological changes as follows:

(a) Decline of interest in direct instructional software within the field of literacy education, and simultaneous growth of interest in “application” software more amenable to developmental educational philosophies

(b) Development and popularization of the “electronic book”

(c) Increased memory capabilities of the computers, allowing uses of high-quality phonemic voice synthesis in place of the older robotic sounding voice synthesis

(d) Integrated multimedia packages based on CD-ROM and/or videodisc technologies

(e) vastly increased availability of computers in homes (p. 4-5).

The one room schoolhouse served its purpose to meet the needs of the community that engendered it. These communities or neighborhoods were smaller and more isolated than our communities today. The onset of the information age caused the technological transformations that tear away the isolation of the small communities and neighborhoods, allowing all areas to be networked into the global village or world community. Institutes of teacher education now prepare
students to be educators in this global village where information gathering and manipulation is nearly instantaneous. The technology training goal for these institutions is twofold. First, teacher training institutions seek to teach the new technologies to preservice educators who usually have little or no background with these technologies. Second, the institutions must aim to educate the preservice teachers to integrate the technologies into the K-12 curriculum.

Not only are such goals difficult to achieve, they are further complicated by the difficulties preservice teachers confront as they become practicing teachers. Marcinkiewicz (1996a) points out the challenge is made even more difficult since – as preservice teachers become practicing teachers – their technology use generally declines to the low level of that of their experienced counterparts. His research suggests that preservice teachers will maintain a high level of use if a high degree of “self-competence” has been achieved, a factor institutions of teacher education can influence. A second predictor of high technology use is the perception that computer integration is expected (Marcinkiewicz, 1996b). Institutions of teacher education can also influence this predictor.

Despite the acquisition by public schools of approximately six million computers (Northrup & Little, 1996), few teachers have integrated computer use into the curriculum to any satisfactory amount (Marcinkiewicz, 1996b). Sheingold (1992) asserted that the problem of technology
integration is more mental than technological as technologies continue to be considered peripheral rather than integral components to teaching and learning. In general, practicing teachers have had to learn independently about utilizing and integrating technologies into the classrooms since this training was probably not part of their preservice education (Northrup & Little, 1996). Even for the more recent teacher education graduates, the technological competencies may have been minimally attained (Northrup & Little, 1996). Furthermore, many beginning teachers frequently require as much technology training as do veteran teachers (Parker, 1993). To complicate matters even more, the problem of systemic change in classroom reform is made more difficult because teachers generally teach the way that they were taught in teacher-centered classrooms rather than in student-centered ones (Bliss & Mazur, 1996; Hatfield, 1996; Sheingold, 1992).

Taylor (1994) reported that many experienced teachers rely on recent graduates of teacher preparatory institutions to help them meet their technology training needs. Teachers are not the only ones seeking such help. One trend this writer has noted is how the need to find technically adept personnel has influenced the hiring practices of administrators who admit to hiring recent graduates for teaching position in lieu of an experienced or more qualified candidate in hopes that the novice will bring technological expertise to the school (Northrup & Little, 1997; J. B. Della Vedova, personal communication, April 17, 1997; J. Jess,
personal communication, July 19, 1996). The drawbacks of hiring inexperienced teachers in order for them to provide the needed training for existing faculty in the school districts should not be ignored, especially since such a practice may result in hiring less able teachers solely because they are perceived as having technological competencies. Secondly, with the many obligations confronting the novice teacher, it hardly seems fair to assign him or her the responsibility of providing their peers with technology training/staff development. A third problem with such training is its horizontal nature rather than top-down structuring. Without leadership from administrators or the presence of highly motivated teachers, this training will be both fragmentary and inconsistently delivered (Sheingold 1992).

Technology Training at Teacher Institutions

To produce the necessary systemic change required to transform elementary and secondary schools to meet both the needs of the information age as well as the current demand for technologically proficient teachers, the need for key competencies in both preservice and inservice teachers requires that technology education be provided and standards be established. In their argument for benchmarks, Northrup and Little (1996) point out that 50% of all teacher preparation programs require a course in instructional technology for undergraduate education majors. This course is taught in addition to a methods and content course. In the 50% of the institutions where a separate course is not
required, technology training is provided by integrating technology and teaching about it as seamlessly as possible into the methods course (Northrup & Little, 1996). At this time, the latter approach does not appear to work and research shows that the more successful method of delivery is through the separate course (Northrup & Little, 1996).

A survey conducted a year later by Hargrave and Hsu (1997) states that technology integration into the educational curriculum is the resounding theme of university faculty, educational researchers, experienced K-12 teachers, and professional organizations. The report asserts the necessity for hands-on experiences for students to accomplish realistic educational assignments (1997, p. 1). According to Hargrave and Hsu, 65.1% of teacher education institutions require preservice undergraduates to take a three hour credit course which focuses primarily on instructional technology. Computer technology topics took an average of 61% of course time (1977, p. 5). Only four institutions of the 55 participating teacher education institutions in the Hargrave and Hsu survey focused on instructional media topics; thus, the primary emphasis of the instructional technology course remains on computer technologies (1997).

Guidelines

To ensure quality programs in technology education for teacher training institutes, two professional societies have developed respective standards for program accreditation. To gain a better understanding of the goals and objectives involved in developing a quality program, this section of the
paper will examine the standards set by each group, first at the undergraduate level and then at the graduate level.

**ISTE Guidelines.** In developing its standards for accreditation of technology programs in teacher education institutions, the International Society for Technology in Education (ISTE) has specified guidelines to be followed for endorsement of teacher education programs in the field of computer/technology literacy (See Appendix A). The ISTE matrix defines computer/technology literacy as involving (a) issues of technology use in society; (b) fundamental vocabulary and operation of computer/technology-based systems; (c) use of tool applications for personal, academic and instructional productivity; and (d) use of the computer as a tool for problem solving. These guidelines detail the development of computer/technology programs that integrate a variety of computer uses and related computer technologies.

The guidelines in computer/technology literacy include instruction in these major areas:

1. foundations for use of computers and technology in education settings
2. specialty content in computer literacy; and
3. professional teaching preparation relating to use of computers and technology in instruction.

The ISTE guidelines address several issues to meet these components. Ethical and legal issues as well as the historical development of the computer is required. Both knowledge and evaluation of hardware and software selection figure prominently, as do various computer skills which
involve the following: using computer peripherals, computer integration into the curriculum, and the ability to access information with the computer and various telecommunications tools. Problem-solving and computer programming skills are addressed several times. Much emphasis is placed on computer classroom arrangement and computer laboratory policies and procedures. However, distance learning is mentioned only once throughout the guidelines.

The ISTE guidelines require programs that require studies in various methodologies of teaching computer technology use involving programming and problem-solving skills, and information access. Observation and/or teaching experience in both lab and classroom settings are required. The penultimate guideline calls for awareness of computer/technology literacy curriculum and the need to maintain updated curriculum that keeps pace with technological changes. The guidelines conclude with the requirement for experiences in the changing teacher/learner roles in planning computer/technology literacy teaching activities.

The only advanced level identified by ISTE is a masters program and maintains the focus on computers. The guidelines specified in the matrix are set to prepare educators for assuming leadership roles that support computer/technology use in schools, districts, and other educational agencies including non-traditional educational/training situations. Persons completing an advanced program will be prepared to serve as a district-level computer coordinator, computer
specialist for a school or director of computer-related training for a business. These guidelines for the Masters Program in Educational Computing and Technology involve meeting a prerequisite that documents the candidate’s ability to meet the competencies established in the Computer/Technology Literacy Matrix for undergraduate program approval. The foundations and the specialty content preparation of computer/technology literacy requirements call for graduate students to demonstrate the ability to these attain these goals through documentation of previous coursework. The second section of the matrix is also a specialty content preparation goal that seeks to prepare candidates to be leaders in selection and maintenance of computer technologies. Various computer skills and skills using computer peripherals are called for along with a grounding in educational research, instructional design, information access and delivery systems. Knowledge of computer programming languages, computer networking, and computer authoring tools are further components of the specialty content area. Software skills — installation, evaluation, and maintenance — are also included in this section. The third and final major section involves professional preparation with studies in educational computing and technology leadership skills for K-12 education. These leadership skills involve knowledge and skills of resource and facilities management as well as budgets and planning, acquisition procedures, and technology maintenance. Involved in this professional preparation
section are developing the skills and knowledge for instructional program development including curriculum design and leadership strategies for technology-rich environments. The remaining professional preparation subsections are organized around developing the abilities to teach staff development to all levels of educators (i.e. administrators, support staff, and teachers).

**ECIT Guidelines.** As a part of the Association for Educational Communications and Information Technologies (AECT) guidelines have also been prepared by Educational Communications and Information Technologies (Earle, 1997b). Similar to ISTE, ECIT also has developed guidelines for both the undergraduate and graduate program approvals. ECIT guidelines for both groups involve a variety of technologies which are based on five domains and twenty subdomains (e.g. Appendix B).

The undergraduate program addresses the five domains of design, development, utilization, management, and evaluation. With the addition of the subdomains, the program can be tailored to meet the intended roles of the graduates. In contrast to the ISTE guidelines which focus almost entirely on computer skills, the ECIT/AECT requirements are broader in scope and allow a wider variety of technological skills to be developed. For instance, the section called Curriculum for Basic Programs (Earle, 1997b) addresses the knowledge base of the five domains. Each teacher education institution is expected to vary its concentration in each of the domains since each program's emphasis is shaped by "realistic
assumptions about the roles its graduates will perform" With this in mind, computer skills are still considered an essential part; however, media design and production are included with the accompanying photographic, audio, television/video editing skills (Earle, 1997b, p. 11). The allocation of physical facilities, resources and information management, and delivery systems must be addressed in seeking accreditation. The evaluation domain consists of problem analysis, criterion-referenced measurement, and both formative and summative evaluations.

In meeting the matrix for coursework and/or experiences that fulfill each guideline, five broad guidelines are addressed: (1) planning for the professional roles graduates will adopt (2) preparing personnel in educational communications and information technologies (3) studying cognitive, humanist, behavioral, ethical, and multicultural studies as appropriate to the individual's needs in understanding the background of ECIT (4) Making available both direct and simulated experiences appropriate to the goals set by the teacher education institution (5) designing the curriculum to conform to AECT and other accreditation institutions guidelines to establish and/or maintain the educational communications and information technologies program (e.g. Appendix C) (Earle, 1997a).

The intended audience for the guidelines for advanced ECIT programs are faculty and administrators who have the responsibility and control of educational technology programs. Although the five domains and twenty subdomains of
the basic program are included in the advanced ECIT programs, the accreditation requirements are stricter and more inclusive. The matrix for the advanced program involves meeting the same requirements, however, on a more advanced level, evidenced by the breakdown of the guidelines and the faculty requirements which expect each member to show evidence of professional teaching performance and scholarly productivity by way or research projects, publications, media productions and expert consultations (e.g. Appendix D) (Earle, 1997b).

Uniform Guidelines

In their argument in favor of benchmarks, Northrup and Little (1996) assert that 59% of practicing teachers believe they are inadequately prepared to use instructional technologies. Despite training, once graduates have left the environs of the university, they confront barriers that keep them from incorporating technology into their courses: “lack of knowledge about newer technologies, lack of support from administration, and lack of time for learning to use the technologies” (Northrup & Little, 1996, p. 213). Another study (Newren, Graf, Jensen, & Smaldino, 1995) asserts that both the diversity of topics and the overwhelming amount of technology information in textbooks inhibits the development of consensus about content in preservice technology curriculum. Certainly one benefit of uniform benchmarks, which would be used to provide a generalized concept of what technology preparation teacher education institutions provided, would be that K-12 school administrators would be
able to make certain assumptions about the common background of teachers entering the profession. However helpful as this idea sounds, technology is not provided uniformly in K-12 districts throughout the United States nor do administrators uniformly support and enable technology training in their districts. Their reasons for lack of support vary from financial to philosophical to a general lack of leadership. One benefit of benchmarks would be its assistance in helping K-12 administrators to establish a common ground for technology planning and integration in the elementary and secondary schools, which would involve the following levels of technology training:

(1) Awareness: knowledge of or about the technology
(2) Skill: can use the technology to perform a task
(3) Instruction: can use the technology in instruction as a tool
(4) Integration: the technology is used to support the learning process as it pertains to the curriculum. (Smaldino, 1997, personal communication, July 7, 1997)

For successful integration of technology in teacher training, Topp, Mortenson, and Grandgenett (1995) assert that three key elements are necessary: equipment, faculty training, and expectations. Further reading convinces this researcher that faculty training must include methodology. For instance, Beard (1993) considers that broad-based conceptual skills are more likely to transfer to future situations than highly specific skills that may soon become
obsolete. Thus, he reinforces the tenet that skills taught in isolation remain isolated skills. Regarding the nature of the transfer of computer skills, Beard proposes that educators teach students to utilize particular software packages instead of teaching sweeping introductions to computers.

Not surprisingly, when it comes to technology integration, institutions of higher education confront many of the same problems that K-12 schools do: (1) lack of equipment, both hardware and software (2) lack of training on purchased equipment (3) lack of administrative support (4) failure of school district personnel to maintain equipment (Northrup & Little, 1996; Topp, et al., 1995).

**Course Content and Delivery Methods**

**Course Content.** Deciding what to include in preservice technology education courses has its own challenges:

One need only peruse the table of contents of several existing educational media and technology textbooks to realize the diversity of topics, perspectives, and treatments of the content included in these books. This is the content which may serve as the basis (totally or in part) for many educational media and technology course syllabi. How can any program that prepares preservice educators be expected to wade through this wealth of information and form it distill a course that offers the best thought from this field while representing the needs of their institutions and students? (Newren, Graf, Jensen, Smaldino, 1995, p. 3)
Besides the difficulty in narrowing down the subject matter, teacher educators must also know about different forms of technology and media as well as the instructional tools they seek to integrate into the curriculum (Newren, Graf, Jensen, Smaldino, 1995). Hargrave and Hsu (1997) report that the primary focus of computer-based instruction dealt with problem-solving and simulations. Since the Hargrave and Hsu study found that desktop publishing was almost universally modeled at teacher education institutions, it is not surprising to learn that the tool software most often used involved word processing and graphics. The telecommunications component most often involved email (88%) and Internet (86%) (Hargrave & Hsu, 1997, p. 6). Programming languages of LOGO, BASIC, and Pascal are taught at fewer than half of the institutions surveyed by Hargrave and Hsu (1997). This writer has noticed that the most commonly used programming code for educators appears to be HyperText Markup Language (HTML), the language of the internet (personal observation). In the area of educational media, the most frequently covered topics were transparency production and video recording while video editing and television production were mentioned by the greatest number of participating schools (Hargrave & Hsu, 1997).

At the University of Northern Iowa, the desired competencies are listed on the form entitled “Undergraduate Teacher Education Technology Competencies.” The form lists 34 technology implementations desired for student awareness as a minimum competency. (Keyboarding is listed but is considered
too elementary to be included for instruction at the college level.) Of these 34 technology competencies, students are expected to attain the skill level for a specified 18 of them (e.g. Appendix E). In contrast, at the School of Education at Drake University, the infusions in the teacher education program are listed primarily by the software applications to be included in the respective courses (e.g. ERIC searches and Netscape in the Human Development course.) (e.g. Appendix F.)

Preservice Technology Course Delivery. Once colleges of teacher education have determined what technologies they plan to include in the curriculum and have purchased necessary equipment for this, the next challenge is to develop what is the best method to achieve effective learning. (This author hopes this brief treatment of the requisite technologies in no way diminishes the importance of the planning, purchase, and installation equipment.) The trend toward delivery via a separate instructional technology course continues to increase. Northrup and Little (1996) reported a 50% split in the implementation of course work by schools of education, that one half of the colleges require a technology course in addition to technology exposure in a methods course while the other half seek to seamlessly integrate technology into the curriculum, thereby dispensing with the necessity of a separate course. Nevertheless, the Hargrave and Hsu (1997) report, prepared just one year later, shows that the implementation of a separate course is growing. Seventy-three percent of teacher preparation institutions currently teach technology instruction in a separate course.
Newren and Lasher (1993) reported that the delivery methods most commonly used involved reading, lecture/demonstration, and hands-on laboratory practice or projects. However, during this literature survey, the trend toward student-centered classroom delivery appeared repeatedly. This systemic change has been helped the growing development and use of application software (Sheingold, 1992; Grau, 1996; Nicaise & Barnes, 1996; Roblyer, Edwards, Havriluk, 1997). The integration of application or tool software into the curriculum encourages both problem-solving and transfer skills (Beard 1993). Transfer occurs when knowledge or skills learned in one application are applied to other situations, and its effects can be positive, negative, or neutral (Beard, 1993). Positive transfer occurs when learning from a prior situation results in improved performance in the another; while negative transfer takes place when poorer performance is caused by previous learning (Beard, 1993). A higher degree of concept attainment occurs when software technologies are utilized for authentic task completion (i.e. writing a research paper as opposed to keyboarding instruction) (Beard, 1993). With the rapid advancement of information transfer technologies (Thurow, 1996), the recognition that a set body of information is inadequate to meet the educational needs of students, many educators are emphasizing the more general capabilities of "learning to learn" (Roblyer, Edwards, and Havriluk, 1997, p. 55). Application results in metacognition and complexity. Getting involved in the process as the means to reach a goal
results in better retention than when the goal is learning only to manipulate the software (Fowler and Zhang 1994).

Two course delivery methods that appeared frequently in the survey of the literature involved constructivism. Seeking to involve students in meaningful and "authentic" (e.g., related to real-life situations), constructivists arrange "instruction around problems that students find compelling and that require them to acquire and use skills and knowledge to formulate solutions (Roblyer, Edwards, Havriluk, 1997, p. 58). Constructivists believe that students come to the classroom with innate curiosities and goals and that they actively seek knowledge (Nicaise & Barnes, 1996). Constructivists emphasize involving student in the learning process rather than seeking a single correct answer (Roblyer, Edwards, Havriluk, 1997). In the constructivist classroom, the teachers fulfill the role of guide, scaffolder, and task presenter rather than information provider and test creator (Nicaise & Barnes, 1996). Constructivists argue that students learn more in student-centered, student-directed, collaborative classrooms supported with teacher scaffolding and authentic tasks (Nicaise & Barnes, 1996). Much of the teaching with information technology depends upon a workshop approach where students use IT tools to develop their work. (Davis, N., Kirkman, C., Tearle, P., Taylor, C., & Wright, B. 1996). As opposed to the teacher-centered classroom, the role of the teacher in student-centered classrooms forces teachers to accept changes in their authority even as they involve
more students in the learning; however, Sheingold argues this change is not the same as giving authority up (1992).

**Influence of Collaborative Learning**

In earlier societies, the responsibility for information storage resided with specified individuals or structures. In tribal societies and city-state communities, the history of the people was stored primarily in verses memorized by the local historian. With the development of libraries, warehouses of written storage were established. With the information age, knowledge storage is ubiquitous (i.e. the Internet and the World Wide Web). This ubiquitous nature of knowledge and technology results in recognition that no one individual can know it all; hence, collaboration is a necessity. Utilizing collaboration enables students to work together to create, analyze, and share knowledge (Naidu & Olsen, 1996). Such collaboration frequently involves the use of the internet to promote the sharing of information through email, information retrieval, both text-based and audio conferencing, electronic document exchange and transfer (Hargrave & Hsu, 1997; Naidu & Olsen, 1996). Computer networking promotes human interaction for information gathering and processing. It enables learners to enrich their own learning experiences through the contributions of other learners (Naidu & Olsen, 1996). Ultimately, computer-supported collaborative learning moves the learner from a position of isolation to a networked community of learners with the ability to access other learners, tutors, lecturers and resources (Naidu & Olsen, 1996). Encouragement of
collaboration, both peer-to-peer and peer-to-mentor, results in higher degree of confidence and reinforcement of the learning (Hatfield, 1996; Zachariades & Roberts, 1995). Collaborative learning involves other technologies than the computer. This author has observed that collaboration works especially well when the task or project is too big for one person to accomplish alone. Examples of such projects are multimedia creation and media production (i.e. audio/slide projects, film production).

Faculty Modeling at Teacher Education Institutions

Hargrave and Hsu (1997) state that the "resounding theme" of technology information and teacher education is integration. For technology integration to occur throughout the spectrum of teacher education institutions, Northrup & Little (1996) claim that faculty training is the first requirement. Ideally teacher education faculty members should model technology integration (Northrup & Little, 1996); however, such modeling is slow to develop in teacher education institutions for the same reasons it develops slowly in the K-12 schools (Northrup & Little, 1996). Generally, technology adoption begins with one or two innovative individuals (Davis, et al., 1996; Sheingold, 1992). Northrup and Little (1996) assert that teacher educators must possessive minimal technology competence, "basic survivor skills" (1996, p. 214). To prepare technology using educators, faculty models must also be designed around three levels: awareness, experience, and integration (Topp, Mortenson, & Grandgenett, 1995). In developing faculty models
at the University of Nebraska at Omaha, the first level of awareness was introduced and developed by purchasing equipment and making it available for both faculty offices and labs (Topp, Mortenson, & Grandgenett, 1995). Faculty learning opportunities which involved the role of technology in research and instruction, were planned and provided during summer intercessions and in lunch presentations; however, the role of expectation by administrators for faculty technology integration cannot be overlooked (Topp, Mortenson, & Grandgenett, 1995). Faculty members need to feel that not only are they expected to use technology for all appropriate situations, but also that they such effort will be supported (Topp, Mortenson, & Grandgenett, 1995).

Barriers do exist that discourage faculty members from integrating technology into their courses. Faculty need time and training for acquisition of technological skills. Indeed, Northrup & Little (1996) cite three factors that inhibit faculty integration of technology: (1) lack or technology training, (2) limited knowledge in presentation of technology prepared material, and (3) lack of reassigned time from teaching responsibilities to develop technology-based work. The last item, lack or reassigned time, inhibits technology integration since faculty are expected to infuse technology into their courses at the same time that they are expected to produce scholarly work for professional review. Furthermore, Bliss and Mazur (1996) assert technology integration is frequently unsupported when department administrators give only lip-service to risk-taking. Technology integration works
best when motivation is high according and frequently this motivation arises from student generated enthusiasm, which frequently results in influencing faculty members to experiment and integrate technology into their curricula (Davis, et al., 1996). One effort to capitalize on student generated enthusiasm and the recognition that some students may have superior technology skills compared to their faculty mentors involved a project at Iowa State University that paired graduate students with interested faculty members (Zachariades & Roberts, 1995).
CHAPTER THREE
Discussion

The dynamic changes of the information age are rapidly altering the way educators deliver instruction. With increased availability of technologies including computers and audio/visual technologies, learning can now emphasize the various methods of acquiring, analyzing, and using information as opposed to learning specific items of information (Roblyer, Edwards, Havilruk, 1997). These technological changes in information access and manipulation are occurring so rapidly that personnel from all levels of education, from K-12 to post graduate, confront not only the need for training but also systemic changes in the way learning is delivered. The emphasis on information acquisition, analysis, and problem solving forces the need to change from teacher-oriented methods to student-centered delivery of learning. In an effort to meet the need for technologically trained educators, institutions of teacher education are establishing courses that infuse technology both through modeling and iteration. ISTE and AECT have established guidelines for the National Council for Accreditation of Teacher Education (NCATE) to promote quality instruction about and with technology in teacher training programs. Systemic change catalyzed by technological progress influences delivery methods through constructivism, collaboration, and authentic assessment.
Challenges

Technology integration usually occurs with one or two innovative teachers who are willing to take risks that may be unsupported by administrators who put up barriers to such innovation either through failure to plan and budget for technology equipment or unwillingness to provide the time necessary for training and integration to occur (Davis, et al., 1996; Hatfield, 1996; Sheingold, 1992). In this way, innovative learning remains isolated because it influences only a few individuals and not large groups of students. Collaboration by students is another method of tearing down the walls of isolation to promote information gathering and manipulation in the information age.

Currently, no ideal technology curriculum exists although surveys of technology training courses at institutions of teacher education, indicate that course content would include a variety of computer technologies (applications, multimedia, tutorials, and utilities), development and use of audio/visual aids, video editing and integration, telecommunications (Hargrave & Hsu, 1977; Newren, Graf, Jensen, & Smaldino, 1995). A benefit of a commonly agreed upon curriculum would better enable administrators to plan technology purchases and facilities management; however, uniformity would inhibit innovation. To avoid this problem, standards would need to broad and to include a variety of media, not just computer technology. A more serious problem with the implementation of standards is expressed by Robinson (1995) who asserts that the search for
a national curriculum caused technology diffusion to result in technology disintegration. In examining the available literature about technology curriculum at teacher education institutions, this author wondered if a single, three hour course is adequate to transform the preservice education into the innovative, practicing teacher of tomorrow or if a four hour course or a second three hour course would better meet these needs.

Other barriers to technology education exist. While reviewing the literature to be surveyed, this writer repeatedly encountered the assertion that facilities at colleges of education should be state of the art, an ideal which is seldom met. The lack of funding for technology, which is expensive, generally prevents this goal. Also, with the speed at which technology is changing, any state of the art equipment is quickly outdated. Fowler and Zhang (1994) address the issue of computer obsolescence when they discuss Moore's Law which states that the number of transistors on a microchip doubles every 18 months; this doubling results in smaller, faster, cheaper hardware that requires faster processors (Fowler & Zhang, 1994). Ultimately, the resulting new hardware is capable of running more complex software and peripherals. Thus, "state of the art" changes every 18 months. This author knows of no educational institute at any level that can afford a new state of the art this often.

Benefit of Technology Training at Teacher Institutions

Computer use of preservice teachers generally declines to the lower levels of use of practicing teachers within a
year after graduation (Grau, 1996; Marcinkiewicz, 1996a). However, studies indicate that when preservice teachers have developed high levels of self-competence, they are more likely to maintain the higher levels of use (Grau, 1996; Marcinkiewicz, 1996a; Marcinkiewicz, 1996b). In order to teach preservice teachers to use technology to expand the learning of K-12 students, Hargrave and Hsu (1997) state that university faculty educational researchers, experienced K-12 teachers, and professional organizations call for the integration of technology into the educational curriculum of the preservice teachers.

The benefit of authentic assessment that technology allows through application software, media production, and simulations could result in more time spent on learning and less but more productive time spent on assessment. This writer appreciates the recognition that students involved in using application software to accomplish specific tasks (i.e. using word processing to complete a research paper) results in higher skill retention than the teaching of isolated skills.

Motivation and Innovation

Evidence suggests that technology development usually begins with one or two innovative individuals and then proceeds to the technology coordinator who standardizes the hardware and software then shifts the focus to the curriculum. The ideal situation of technology infusion develops from this point; however, the ideal is hardly ever reached (Davis, et al., 1996). The entire problem of
integration is compounded when computer technology is put in the same category as the chalkboard (Davis, et al., 1996). This author regrets that such occurrences take place but knows of a district superintendent who used state technology moneys to purchase white boards for elementary classrooms.

Concerns

Roblyer, Edwards, and Havriluk (1997) express concern that the increase in number and types of technology resources available leads to dramatic shifts in beliefs about the fundamental goals and strategies of education. Most currently practicing teachers and teacher educators did not learn to teach in student-centered classrooms; therefore, problems are compounded as teachers are expected to learn and to integrate new technological skills at the same time that they are expected to transform their teaching methods. Hatfield (1996) reported that cooperating teachers noticed little integration of hands-on teaching during the student teaching period — even when students had taken an instructional media course. Hence, teachers continued to teach as they had been taught. However, since technology availability varies from school to school in both the quantities of technologies available as well as what type, it seems both unfair and of limited vision to argue that courses in education technology have not resulted in the desired outcomes when technology hardware or software is unavailable in the elementary and secondary schools. The necessity for teacher preparation continues: "Unless the classroom teacher can effectively use educational technology, its potential for facilitating and
enhancing the teaching/learning process will never be realized" (Hunt & Bohlin, 1993, p. 487).

Controversy exists on whether the practice of hiring first year teachers primarily for their technology skills is successful since they may or may not be able to transfer their learning skills into their teaching. In separate studies Marcinkiewicz (1996a) and Grau (1996) reported that first year teachers who are highly skilled users of technology demonstrate computer use and integrate technology more frequently than their counterparts who are not competent users of technology. While Marcinkiewicz argues that preservice teachers' utilization of the computer represents optimal use, neither the preservice nor the practicing teacher integrates the computer very often. Moreover, in just one year of teaching computer use by novice educators approached the low level of use by their experienced counterparts (Marcinkiewicz, 1996b).

"Learning to learn" will help future citizens cope with inevitable changes (Roblyer, Edwards, Havriluk, 1997, p. 55). Technology has both increased the number of decisions that people must make and forced them to become more skilled decisions makers. By emphasizing in training the methods of acquiring, sorting through, and using information, students will be better able to participate in the information society where knowing what questions to ask will be as important as, or more important than, giving the "right answers" (Roblyer, et al., 1997, p.55). As the world learns to value the bits and bytes of information (Negroponte, 1995), it will realize
the necessity of developing knowledge and technological skills as the only sustainable natural resource in the information age (Thurow, 1996).
References


Appendix A

ISTE Guidelines
ISTE Guidelines

1.0 Prerequisite preparation: Professional studies culminating in the computer/technology literacy endorsement must include experiences that provide a foundation for use of computers and related technologies in educational settings.

1.1 Foundations: Professional studies in educating computer and technology provide fundamental concepts and skills that build a foundation for applying computers and other hardware and software in educational settings. All candidates seeking initial endorsements in teacher preparation programs and particularly programs in educational computing and technology require foundations that prepare them to:

1.2 Specialty Content Preparation

Computer/Technology Literacy: Professional studies in educational computing and technology provide concepts and skills that prepare teachers in the specialized and professional content for teaching computer/technology literacy. Masters programs must document the prerequisite preparation of the master's candidates or provide instruction to fulfill the computer/technology literacy guidelines in initial coursework (submit guidelines and matrix for computer/technology literacy).

1.1.1 Demonstrate the ability to operate a computer system in order to successfully utilize software.

1.1.2 Evaluate and use computers and related technologies to support the instructional process.

1.1.3 Apply current instructional principles, research, and appropriate assessment practices to the use of computers and related technologies.

1.1.4 Explore, evaluate and use computer/technology based materials, including applications, educational, software, and associated documentation.

1.1.5 Demonstrate knowledge of uses of computers for problem solving, data collection, information management, communications, presentations, and decision making.
1.1.6 Design and develops student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse student populations.

1.1.7 Evaluate, select and integrate computer/technology based instruction in the curriculum of one's subject area(s) and/or grade levels.

1.1.8 Demonstrate knowledge of multimedia, hypermedia, and telecommunications activities to support instruction.

1.1.9 Demonstrate skill in using productivity tools for professional and personal use, including word processing, database, spreadsheet, and print/graphic utilities.

1.1.10 Demonstrate knowledge of equity, ethical, legal and human issues of computing and technology use as they relate to society and model appropriate behaviors.

1.1.11 Identify resources for staying current in applications of computing and related technologies in education.

1.1.12 Use computer-based technologies to access information to enhance personal and professional productivity.

1.1.13 Apply computers and related technologies to facilitate emerging roles of the learner and the educator.

2.0 Specialty Content Preparation: Professional studies in educational computing and technology (master’s program) provide concepts and skills that prepare teachers in the specialized content needed to teach computer literacy. Candidates seeking initial endorsements in computer literacy require specialty content preparation in these areas: (2.1) general; (2.2) programming and problem solving; (2.3) application tools; (2.5) hardware/software selection, installation and maintenance.
2.1 General: General content preparation in computer literacy extends foundations concepts and skills to provide in-depth knowledge needed to teach about computers and related technologies and their impact and general operation. The program include studies and experiences which prepare candidates to:

2.1.1 Demonstrate knowledge of uses of computers and technology in business, industry, and society.

2.1.2 Demonstrate functional knowledge of terminology associated with educational computing and technology.

2.1.3 Demonstrate knowledge about the historical development and future directions of computing and technology.

2.1.4 Demonstrate knowledge of the ethical, legal, and human issues associated with use of computers, related technologies, and software and model appropriate behaviors.

2.1.5 Demonstrate knowledge of the equity issues associated with use of computers and related technologies and model appropriate behaviors.

2.1.6 Use sources of information about computers and technology for professional development (e.g., journals, associations, seminars, conferences, and on-line services).

2.1.7 Participate in student guidance, career awareness, and student support activities related to computer technology.

2.1.8 Model, encourage, and reinforce appropriate keyboarding skills.

2.2 Programming and Problem Solving: Professional studies in educational computing and technology provide concepts and skills in applying computers and other hardware and software to solve problems. It is recommended that the following skills and concepts be equivalent in depth to at least the level achieved in one three-semester-hour course. Programs require studies of and experiences with programming and problem solving skills and concepts that provide:

2.2.1 Functional knowledge of at least one programming language and the ability to compare
languages commonly used in education (e.g. structured BASIC, Logo, and/or Pascal).

2.2.2 Functional knowledge of structured programming concepts and design of algorithms.

2.2.3 Functional knowledge of program verification and debugging techniques.

2.2.4 Knowledge of applications of programming skills to support and enhance the curriculum and the development of problem-solving skills.

2.2.5 Awareness of other programming, authoring, and problem solving environments.

2.3 Application tools: Professional studies in educational computing and technology provide concepts and skills in using technology-based tools. Programs require studies of and experiences that provide:

2.3.1 Functional knowledge of word processing, desktop publishing, spreadsheets, database management, integrated packages, graphics programs and utility tools.

2.3.2 Knowledge of utilization of applications tools to support and enhance the curriculum and develop problem solving skills.

2.4 Information Access and Delivery Tools: Professional studies in educational computing and technology provide concepts and skills in applying computers and other hardware and software as tools for presentation, research, information access, and communications. Programs require studies of and experience with applications that provide:

2.4.1 Functional knowledge of telecommunications tools and resources.

2.4.2 Functional knowledge of the utilization of telecommunications for information sharing, remote information access and retrieval, broadcast resources, and distance learning.

2.4.3 Functional knowledge of multimedia and hypermedia tools and resources.
2.4.4 Knowledge of application of information access and delivery tools to support and enhance the curriculum and develop problem solving skills.

2.5 Hardware/Software Selection, Installation and Maintenance: Professional studies in educational computing and technology provide concepts and skills in hardware and software selection, installation, and routine maintenance. Programs require:

2.5.1 Knowledge of configuration of computer/technology systems and related peripherals into laboratory, classroom cluster, and other appropriate instructional arrangements.

2.5.2 Knowledge to support development of laboratory policies, procedures, and practices.

2.5.3 Functional knowledge of evaluation, selection, and development of recommendations for purchasing software to support and enhance the curriculum.

2.5.4 Knowledge of procedures for evaluation, selection, and development of recommendations for purchasing computer/technology systems.

2.5.5 Knowledge of procedures for the organization, management, and security of hardware and software.

2.5.6 Functional knowledge of basic troubleshooting and maintenance of hardware and software.

2.5.7 Knowledge of networked systems.

3.0 Professional Preparation: Professional preparation of computer/technology literacy teachers include experiences that combine teaching skills and concepts with knowledge about the use of computers and related technologies.

3.1 Teaching Methodology: Professional studies in educational computing and technology provide knowledge and practice of teaching methodology that applies specifically to the problems and procedures encountered when working with technology. Programs require studies of and experiences with computers, related technologies, and software throughout the
curriculum and methodology relating specifically to instruction about the computer which provide:

3.1.1 Functional knowledge of methods and strategies for teaching general concepts and skills related to computer technology.

3.1.2 Functional knowledge of methods and strategies for teaching programming and problem solving principles and skills.

3.1.3 Functional knowledge of methods and strategies for teaching the use of applications tools.

3.1.4 Functional knowledge of methods and strategies for teaching the use of information access and delivery tools.

3.1.5 Observations and/or teaching experiences in lab and classrooms settings involving computers and related technologies.

3.1.6 Awareness of computer/technology literacy curriculum and the ongoing need to update the curriculum to reflect changes in technology.

3.1.7 Experiences in planning computer/technology literacy teaching activities that reflect the changes in the teacher/learner roles.
Appendix B

ECIT Professional Studies Component:

Domains and Subdomains
Guidelines and Matrix
Basic Programs in
Educational Communications and Information Technologies

Curricula for the basic preparation of personnel in the field of educational communications and information technologies (ECIT) can be grounded in the knowledge base of the field. The domains of the field include design, development, utilization, management, and evaluation. Programs will vary in their concentration of each of the domains.

The Professional Studies Component

The content of basic programs for educational communications and information technologies develops from the five domains and twenty subdomains in the knowledge base as listed below.

Design
- Instructional Systems Design
- Message Design
- Instructional Strategies
- Learner Characteristics

Development
- Print Technologies
- Audiovisual Technologies
- Computer Based Technologies
- Integrated Technologies

Utilization
- Media Utilization
- Diffusion of Innovations
- Implementation and Institutionalization
- Policies and Regulations

Management
- Project Management
- Resource Management
- Delivery System Management
- Information Management

Evaluation
- Problem Analysis
- Criterion-Referenced Measurement
- Formative Evaluation
- Summative Evaluation

Within these five domains and twenty subdomains, the program can be composed of those most appropriate to the intended roles of the graduates.
Appendix C
Matrix for Basic Programs
in Educational Computing and Information Technologies
# Guidelines and Matrix

## Initial Computer/Technology Literacy Endorsement Program

<table>
<thead>
<tr>
<th>Computer/Technology Literacy Endorsement Guidelines</th>
<th>Courses and/or experiences that fulfill the guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 <strong>Prerequisite Preparation:</strong> Professional studies culminating in the computer/technology literacy endorsements must include experiences that provide a foundation for use of computers and related technologies in educational settings.</td>
<td></td>
</tr>
</tbody>
</table>
| 2.0 **Specialty Content Preparation**  
**Computer/Technology Literacy:**  
Professional studies in educational computing and technology provide concepts and skills that prepare teachers in the specialized and professional content for teaching computer/technology literacy. Masters programs must document the prerequisite preparation of the master's candidates or provide instruction to fulfill the computer/technology literacy guidelines in initial coursework (submit guidelines and matrix for computer/technology literacy). | |
| 3.0 **Specialty Content Preparation:**  
Professional studies in educational computing and technology (master's program) provide concepts and skills that prepare teachers in the specialized content needed to teach computer literacy. Candidates seeking initial endorsements in computer literacy require specialty content preparation in these areas: (2.1) general; (2.2) programming and problem solving; (2.3) application tools; (2.4) information access and delivery tools; (2.5) hardware/software selection, installation and maintenance. | |
Appendix D

Advanced ECIT Matrix
Matrix for Advanced Programs in Educational Communications and Informational Technologies

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Courses and/or experiences that fulfill the guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The program in educational communication and information technologies is initiated, developed, and implemented by the faculty members whose own preparation is in this field of specialization.</td>
<td></td>
</tr>
<tr>
<td>2. The program for preparing specialists in educational communications and information technologies clearly identifies the roles their students might take in practice such as management of media programs, product development of various specified media, and instructional program development.</td>
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<tr>
<td>3. The program for preparing personnel in educational communications and information technologies is clearly grounded in the knowledge base for the field of ECIT.</td>
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<tr>
<td>4. The program includes such cognitive, humanistic, behavioral, ethical, and multicultural studies as are appropriate to the individual student's needs in understanding the background of educational communications and information technologies.</td>
<td></td>
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<tr>
<td>5. The program makes available direct and simulated experiences as appropriate to the roles identified in the goal statement.</td>
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<tr>
<td>6. A study of research in educational communications and information technologies is included in the program.</td>
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</tr>
</tbody>
</table>
Matrix for Advanced Programs in Educational Communications and Informational Technologies (continued)

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Courses and/or experiences that fulfill the guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Advanced graduate programs in educational communications and information technologies include the design and conduct of research in the field.</td>
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</tr>
<tr>
<td>8. These AECT guidelines, and others, have been used in forming and/or changing the institution's program in the educational communications and information technologies.</td>
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</tr>
<tr>
<td>9. The program provides opportunities for students to pursue specialized areas in the field of educational communications and information technologies such as educational telecommunications, instructional development, software development, school library-media, educational media research, educational film production, program evaluation, diffusion, and adoption.</td>
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</tr>
<tr>
<td>10. The program has opportunities for students to experience independent approaches to program components.</td>
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</tbody>
</table>
Appendix E

Undergraduate Teacher Education Technology Competencies

at the University of Northern Iowa
## UNDERGRADUATE TEACHER EDUCATION TECHNOLOGY COMPETENCIES

<table>
<thead>
<tr>
<th>Competencies</th>
<th>Awareness</th>
<th>Skill</th>
<th>Instruction</th>
<th>Curriculum Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td></td>
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<tr>
<td>Word Processing</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Database</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Spreadsheet</td>
<td>X</td>
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<tr>
<td>Electronic Mail</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Computer conferencing</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Internet/WWW</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Software Operation</td>
<td>X</td>
<td>X</td>
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<tr>
<td>CD-ROM</td>
<td>X</td>
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<tr>
<td>Software Evaluation</td>
<td>X</td>
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<tr>
<td>HyperCard</td>
<td>X</td>
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<tr>
<td>Multimedia</td>
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<tr>
<td>Desktop Publishing</td>
<td>X</td>
<td>X</td>
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<tr>
<td>One Computer Classroom</td>
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<tr>
<td>Presentation Software</td>
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<tr>
<td>Traditional Media</td>
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<td>Visuals in Education</td>
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<tr>
<td>Education</td>
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<tr>
<td>Transparency Production</td>
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<tr>
<td>Handout Preparation</td>
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<tr>
<td>Mounting Techniques</td>
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<td>Software Evaluation</td>
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<td>Projector Operation</td>
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<td>Educational TV</td>
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<tr>
<td>Interactive Instructional TV</td>
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## UNDERGRADUATE TEACHER EDUCATION TECHNOLOGY COMPETENCIES

<table>
<thead>
<tr>
<th>Competencies</th>
<th>Awareness</th>
<th>Skill</th>
<th>Instruction</th>
<th>Curriculum Integration</th>
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<tr>
<td>Advanced Technologies</td>
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<tr>
<td>Virtual Reality</td>
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<tr>
<td>Emerging Technologies</td>
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<tr>
<td>Other:</td>
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<tr>
<td>Curriculum Issues</td>
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<td>Integrating Media in Teaching</td>
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<td>Emerging Roles of Teacher &amp; Learner</td>
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<td>Legal &amp; Ethical Issues</td>
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<td>Socio-Economic Issues</td>
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<td>Equity Issues</td>
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<tr>
<td>Keyboarding</td>
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Appendix F
Elementary and Secondary Technologies
Infusion Curriculum
at Drake University
# ELEMENTARY EDUCATION CURRICULUM

<table>
<thead>
<tr>
<th>Curriculum Outline</th>
<th>Technology to be Infused &amp; Modeled</th>
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<tbody>
<tr>
<td><strong>First Year:</strong></td>
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</tr>
<tr>
<td>EDUC 001 - Intro to Education (001) - optional 1 cr</td>
<td>Importance of technology, articles, examples</td>
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<td></td>
<td>Examples from classrooms, teacher visit</td>
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<tr>
<td><strong>Second Year:</strong></td>
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<tr>
<td>EDUC 105/294 - * Human Development - Elementary (Elem inclusive of 151) 3 cr</td>
<td>ERIC searches online</td>
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<tr>
<td>SPED 120/220 - Intro to Exceptional Children and Adults 3 cr</td>
<td>Netscape &amp; Internet, WWW</td>
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<tr>
<td>EDUC 107/207 - * Learning and Assessment 3 cr</td>
<td>computer accessories</td>
</tr>
<tr>
<td>EDUC 103/203 - * Foundations of Education (change to 60 hours practicum M-TR) 3 cr</td>
<td>Electronic Gradebook &amp; Databases excel/gradebook, HTML,</td>
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<tr>
<td>EDUC 164/264 - Human Relations 3 cr</td>
<td>Correct use of overhead &amp; Transp., PowerPoint 4.0</td>
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<td></td>
<td>Importance of film, TV, media/MCNS</td>
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<tr>
<td></td>
<td>Admission to Teacher Education Program</td>
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<td><strong>Third Year:</strong></td>
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<tr>
<td>EDUC 125/225 - * Improving the Teaching of Science 3 cr</td>
<td>Utilities/Course Software, CD-ROM</td>
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<tr>
<td>EDUC 126/226 - Improving the Teaching of Mathematics 3 cr</td>
<td>laserdisc</td>
</tr>
<tr>
<td>EDUC 124/224 - Literature of Childhood and Youth 2 cr</td>
<td>&quot;</td>
</tr>
<tr>
<td>*EDUC 122/222 - *Curriculum and Pedagogy 2 cr</td>
<td>types of software</td>
</tr>
<tr>
<td>*EDUC 160260 - * Advanced Technology 2 cr</td>
<td>Multimedia, Video, AEA Resources, 2nd level PowerPoint 4., scanning, digitizing, HyperStudio, Electronic portfolio, HTML, Educational TV, IPB resources</td>
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<tr>
<td>EDUC 127/227 - Improving the Teaching of Lang. Arts 3 cr</td>
<td>Utilities/Course Software, CD-ROM, laserdisc</td>
</tr>
<tr>
<td>EDUC 128/228 - Improving the Teaching of Social Studies 2 cr</td>
<td>&quot;</td>
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<tr>
<td>EDUC 129/229 - Improving the Teaching of Reading 3 cr</td>
<td>&quot;</td>
</tr>
<tr>
<td>EDUC 123/223 - Phys. Ed &amp; Health in the Elementary School 3 cr</td>
<td>&quot;</td>
</tr>
<tr>
<td><strong>Fourth Year:</strong></td>
<td></td>
</tr>
<tr>
<td>EDUC 166/266 - Student Teaching - 11 cr</td>
<td>Requires use of technology in teaching</td>
</tr>
<tr>
<td>EDUC 165/265 - Seminar - 1 cr</td>
<td>Electronic portfolio a possibility</td>
</tr>
</tbody>
</table>
* **Additional Requirements** (Select two of the following):
  MUSIC 015 - General Music in the Elementary School - 3 cr
  ART 083 - Art for Children - 3 cr
  EDUC 123 - Physical Education & Health in the Elem School - 3 cr (see above)

One of the following courses is required by the State of Iowa for licensure:
HIST. 101 or 102
POLITICAL SCIENCE 001

**Teaching Content Area - 24 credit hours**
* This includes a minimum of 24 credit hours of courses in an approved teaching content area. These courses may have been part of the candidate’s undergraduate program. Courses taken as part of the M.S.T. degree must be taken at the graduate level and approved by the advisor. An alternative option is the completion of a formal interdisciplinary program in humanities, language and communication, natural science, or social science. All elementary degrees must contain a concentration area.
SECONDARY EDUCATION CURRICULUM
to be implemented, Fall, 1996

Curriculum Outline

First Year:
EDUC 001 - Intro to Education (001) - optional 1 cr

Second Year:
EDUC 105/106/294 - *Human Development - split Elem/Sec
(Element inclusive of 151) 3 cr
SPED 120/220 - Intro to Special Needs 3 cr
EDUC 107/207 - *Learning and Evaluation 3 cr
EDUC 103/203 - *Foundations (change to 60 hours practicum,
M-TR) 3 cr
Admission to Teacher Education Program

Third Year:
EDUC 164/264 - Human Relations 3 cr
EDUC 160/260 - *Advanced Technology 2 cr
EDUC 132/232 - Secondary Methods

Fourth Year:
EDUC 167/267 - Student Teaching - 11 cr
EDUC 168/268 - Seminar - 1 cr

Technology to be Infused and Modeled

- Importance of technology
- Examples from classrooms
- Specific Prog.
  same as Elem. Ed.

- ERIC search
- Netscape & Internet
- HTML
- Electronic Gradebook & Databases
- Correct use of overhead & Transp.
- Approp. materials

- Importance of film, TV, Educational TV
- Multimedia, Video, AEA Resources - 2nd level Power Point
  4.0, HyperStudio, scanning, digitizing, Electronic
  portfolio, HTML
- Utilities/Subject Software - Types of software
  Print Shop Deluxe, Crossword/Word Maze, PowerPoint
  utility, Internet Bookmark Tour, CD-ROM/laserdisc
  (controlled through HyperStudio)
- Requires use of technology in teaching
- Electronic portfolio a possibility