An investigation of the technology-related courses and experiences in five university undergraduate teacher education programs

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AN INVESTIGATION OF THE TECHNOLOGY-RELATED COURSES AND EXPERIENCES IN FIVE UNIVERSITY UNDERGRADUATE TEACHER EDUCATION PROGRAMS

by
Julie R. Mandes

A Thesis
Submitted in partial fulfillment of the requirements of the Masters of Arts Degree in the Graduate Division of Rowan University
May 1, 1997

Approved by Professor

Date Approved May 1, 1997
Abstract

Julie R. Mandes

An Investigation of the Technology-Related Courses and Experiences in Five University Undergraduate Teacher Education Programs

1997

Dr. Louis Molinari

Master of Arts Degree in Elementary School Teaching

One of the most relevant issues facing schools today, is the incorporation of technology into classroom instruction. The literature reveals that knowledge is the most critical factor which determines the degree to which teachers integrate technology into their instruction. Teachers with high levels of anxiety are less likely to integrate technology into their curricula. Elementary school teachers are not generally comfortable and skilled in the use of instructional technology and are therefore unable to exploit its potential. It was the purpose of this study to define whether or not there is a need for undergraduate teacher education programs to further evaluate their programs to see if they are preparing teachers with the technology understandings they need. This study consists of an investigation of the technology-related courses and experiences in five undergraduate teacher education programs. A Likert-type scale was used to rate the level of technology included in the required education courses, as well as, in the general and electives courses. An overall rating system was developed to measure the strength of technology within the educational framework of the program; as well as the strength of technology within the overall
Abstract

program. The investigation results indicate that there is a strong need to further evaluate
the level of technology involvement in undergraduate teacher education programs.
Mini-Abstract

Julie R. Mandes

An Investigation of the Technology-Related Courses and Experiences in Five University Undergraduate Teacher Education Programs

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Dr. Louis Molinari

Master of Arts Degree in Elementary School Teaching

Much of the related literature indicates that a large number of teachers are anxious about the use of technology in the classroom and do not have adequate knowledge or skills to integrate technology into their lessons. Could it be that preservice professional education courses in the current undergraduate teacher education programs do not give adequate attention to educational technology and its applications in a classroom setting? The research concluded that there is a strong need to further evaluate the level of technology involvement in undergraduate teacher education programs.
Acknowledgements

This document was only made possible due to the great contributions of those around me. First and foremost, I need to thank my husband, Jay who sacrificed greatly during the long hours which I dedicated to my research. I couldn't have gotten through this without his love and support. I would also like to thank my twin sons, Joseph and Michael, for doing without me on many occasions when I had class or was completing my research. I did it all for you guys! I want to provide you with an education someday!

I also want to thank my parents, Ann and Michael Ricca, for instilling within me the importance of education and providing me with every opportunity to further my education. They have helped to form me into a person who is excited about learning and who isn't afraid to accept new and exciting challenges. I need to also thank them for the many hours of loving care which they gave to Joseph and Michael during my studies.

I thank God who has given me the strength and endurance I needed in tough times. He helped me to have the faith to believe in myself and to take the first step towards my Master's degree. He helped me to believe in myself and to understand that the way that I learn is by accepting challenges and making mistakes along the way. I always trust that with prayers and faith, he can help me to achieve even the most impossible of tasks!
Acknowledgements

I want to give special thanks to all of my elementary school teachers who took special care in helping me to develop my writing skills; specifically, my fourth grade teacher, Mrs. Majeski, and my eighth grade teacher, Mrs. Winheld. I hope that I give to my students at least half of what they gave to me. Mrs. Winheld's words of wisdom still ring true: "What are you trying to say? Write it!"

Special thanks also goes to Dr. Daniel Shade, who guided me in my first experiences with educational technology, in the undergraduate program at the University of Delaware. I became so excited about technology during my independent study with him regarding computers in early childhood. He planted a seed which has grown into an excitement for teaching with educational technology.

I especially want to thank Dr. Louis Molinari, who spent much of his time over the past year, meeting with me and listening to my thoughts and concerns regarding the state of technology in education today. He encouraged me and guided me in my writing; and has helped me to develop into a commendable research-writer, critical thinker, and advocate for children. Also, I would like to thank him for being in touch with the needs of my students with his kind donations to me. He has given me the "tools" to bring to life in my own classroom, what I have learned from my research. I am a better teacher because of this, and my students will always benefit because of it.
Acknowledgements

Also, I need to thank my students. This has been my favorite class ever; my first fourth grade class; 1996-1997. They challenged me as a teacher to make learning exciting and real. They made it exciting for me to teach! They were the first students to witness a technology explosion in my classroom. I hope that I have been a model for them of a person who is excited about learning. I hope that by watching me, they have come to understand that learning is a life-long process, and to always believe in themselves. I always say, and I am living proof that, "If you believe it, then you can achieve it". I hope that they will always believe in their abilities and challenge themselves as I will continue to challenge myself. I will never forget them!

Finally, special thanks goes to my student, Nick Fiamingo, for allowing me extra time to explore technology with him. Through tutoring him, he has allowed me to sharpen my skills so that even I am becoming comfortable in the uses of new technologies. I know from my research, that the more comfortable I become in using technology; the more I will use it in my classroom. Thanks to Nick, I will be able to be more innovative in my uses of technology in years to come.

To all, thank you,

Julie R. Mandes

Brigantine, New Jersey - May 1997
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Chapter One

Significance of the Study

"The incorporation of technology, specifically computers, into classroom use is one of the most relevant issues facing schools today" (Larner and Timberlake, 1995). We need to "transform elementary schools to meet the needs of the 21st century" by fully integrating computer technology into the curriculum (Butzin, 1991). It appears that in order to effectively meet the needs of today's students, education needs to be transformed so that technology is a part of every area of learning.

"If technology is to be a natural part of students' instructional lives, their teachers must be competent technology users and incorporate it into their daily lessons" (Mergendoller, et al., 1992; Brennan, 1991). According to Larner and Timberlake, "knowledge is the most critical variable which determines the degree to which teachers integrate computers into their instruction and planning... there is a direct correlation of knowledge to use for all teachers". The more knowledge teachers have of computer technology, the more likely they are to fully incorporate computers into their instruction.

Brennan (1991) states that "elementary school teachers were not generally comfortable and skilled in the use of instructional technology and were therefore unable to exploit its potential for enriching learning experiences." According to Shick (1996), 83% of teachers showed a "lack of knowledge of technology skills in relation to teaching
and learning”. Hence, elementary school teachers are not likely to integrate computers into their instruction because of a lack of knowledge in this area. He found that these teachers rarely used computers to present lessons; there was a low level of computer integration, and there was a mid to high level of teacher anxiety.

“Teachers who have high levels of anxiety are less likely to integrate computer technology into their curricula” (Barker, 1994; Pina and Harris, 1993; Chin & Hortin, 1993; Savenye, et al., 1992 as cited by Larner and Timberlake, 1995). Shick, in 1996, found that “a strong understanding of technological systems will secure that feeling of confidence”. So it seems that if elementary school teachers who currently have mid to high levels of anxiety about computer use, receive more training in computer technology, they will become more confident; and this, in turn, will “lead to improved and integrated applications” (Brennan, 1991). Integration will not occur until teachers gain the knowledge they need (Richardson, 1993 as cited by Shick, 1996). So, some form of teacher training is vital to ensure successful integration of computer technology into the curriculum.

‘Businesses have been building electronic highways while education has been creating an electronic dirt road’ (Peck and Dorricott, 1994 as cited by Shick, 1996). It is “standard practice in business and industry to typically allocate about 50% of funding in a technology project for training employees to use the newly installed equipment” (Mergendoller, et al., 1992). School districts, innately with limited amounts of funding;
often utilize most of their funds towards gaining expensive hardware and software; and place minimal amounts towards teacher training (Shick, 1996). Education needs to fund the building of their electronic highway! School districts need to allocate enough money for teacher training or they need to hire teachers who are already competent computer-users (Richardson, 1993 as cited by Shick, 1996). Brennan, 1991, states that “lack of training for education majors at the college or university level, prohibits new teachers from taking a proactive leadership role regarding the use of computers or acquiring the knowledge necessary for the use of technology in the schools.” This means that either school districts will need to find creative ways of gaining technology at lower costs; so as to afford the training necessary to make this technology utilized and integrated into the curriculum; or colleges and universities will need to evaluate their undergraduate elementary teacher education programs to see if they are effectively preparing preservice teachers to meet the technological needs of today’s students.

Without training in computer technology; “teachers who are active computer users will use computers in ways that they currently believe to be most effective” (Mergendoller, et al., 1992). Bork, 1980; Cole and Griffin, 1987; Gradolf, 1988 as cited by Mergendoller, et al., 1992, state that “with minimum training, the majority of … ‘teachers typically appropriate technology to support existing practice, using technology primarily for drill and practice in basic skills’… for enrichment, or for review and remediation. Fewer use computers to develop higher order thinking skills, enhance creativity or present new concepts.” If nothing is done to provide teachers with training in technology;
new technology will be utilized in traditional ways instead of being integrated into the curriculum. This is of particular concern because it "runs counter to current national policy, particularly in mathematics education, where reformers are advocating a much greater emphasis on the development of students' conceptual understanding through problem-solving, concrete activities, and integration of mathematical concepts across subject areas" (National Council of Teachers of Mathematics, 1989; as cited by Mergendoller, et al., 1992). In order for elementary school teachers to use computer technology to expand and change their instructional goals and practices, they need more than additional technology. "They need training in technology and curriculum" and "Teachers need to see examples of other teachers using technology in innovative ways" (Mergendoller, et al., 1992). Again, this will either need to be accomplished through extensive teacher in-service programs or it will need to be accomplished at the undergraduate elementary teacher education institutions.

It was stated in Mergendoller, et al., 1992, that teachers need to focus on "the intelligent use of technology--i.e., the use of technology as a tool for student learning rather than as a tutor for drill and practice...Intelligent use of technology means going beyond superimposing it on the existing structure...Teachers will need extensive...training if they are to successfully utilize technology in instruction...They will require training in computer operation and training in the integration of computers in classroom instruction...Effective implementation will require that computers become fully integrated into the personal and professional lives of teachers." Brennan (1991) agrees with the need
for teacher "training in the use of computers as an instructional tool to enhance teaching and learning through a combination of presentation of information and practical simulation and application." It appears that teachers need to have enough training so that computer use is second nature to them. Teachers need to be active computer-users in the classroom; using it as a classroom management tool, a presentation mode for lessons, a simulator, and a means of application. Yet, teachers also need to utilize the computer in their personal lives as well. In this way, their skills will be so strong that they can be extended into instruction in creative ways.

Hecker (1993) as quoted by Shick (1996) "feels education has not kept up with the changes brought about by technology. Educators who have been taught without the use of technology find it a difficult task to attempt changes in their teaching styles to include computer integration. No modeling of computer integration was observed during their schooling to become teachers, therefore, their own curricula lacks the integrated strategies that computers have to offer. "Only through modeling of expected teacher behavior can we accomplish the goal of teacher acceptance of technology as a normal, everyday part of the instructional process". Hecker feels that "instruction in using the computer (and related technologies) as a means of delivery should be regular events; modeling good teaching behavior, not something scheduled as part of the syllabus to fit a requirement of the course". We need to teach teachers how to use the computer as a teaching tool to regularly present lessons to the children. This should be done through modeling these behaviors for teachers either during extensive in-service training; or during undergraduate
teacher preparation. In turn, one might be able to extend this to say that elementary school teachers will best teach their students how to utilize technology in modern ways, by modeling such use during everyday classroom instruction.

Shick, 1996 states that “proper training to assist with the application of technology in the presentation of curriculum is essential. . . . With a growing emphasis placed on computer integration into teaching strategies, educator training has grown to be a critical requirement necessary for the development and success of computer technologies integration into the modern educational field.” The training of teachers in computer technology, through extensive in-service programs or during teacher preparation coursework is vital if computer technology is to be successfully incorporated into education in the 21st Century.

One study found that because teachers were improperly trained in computer technology, much of the new hardware remained idle and underused by most classroom teachers (DeBettencourt and Matson, 1994 as cited by Shick, 1995). They also discovered that even though a multitude of integrated computer software is available for all subject areas, it is not being utilized due to improper training for teachers in educational technology. “Lack of computer literacy and technological skills in many colleagues forces these amazing advances to be non-functional.” It seems that no matter how much money school districts invest in computer hardware and software, these resources will not be fully realized until teachers receive enough training to feel comfortable in using them.
Educated people in the 21st century will need “critical thinking and problem-solving skills. Every individual will be affected by the rapid societal and technological changes. Schools must prepare all students for a complex global society”...through an “integrated comprehensive curriculum with emphasis on outcomes for creative thinking, communication, physical and emotional well-being and lifelong learning. These are basic skills essential to live, learn and work effectively, both independently and in groups.” (Kansas State Board of Education, 1993). It seems that if schools are to meet the rapid societal and technological changes and give students even minimal skills necessary to live, learn, and function in the workplace; they need to prepare the students to be critical thinkers and problem-solvers. This is best accomplished through an integrated curriculum. We need to infuse technology into the existing curriculum so that students will be using it to develop higher order thinking skills, to enhance creativity, to research, and to give presentations.

Van Horn (1984) believes that “even before technology is in place it is important to begin educator training in the uses of technology,” as cited by Shick, 1996. Shick also believes that “It is imperative to introduce technology to students in education as early as possible”. It appears that the training of elementary school teachers in the “intelligent use of technology” (Mergendoller, et al., 1992) is vital. This should be done at the undergraduate level of teacher education so that teachers entering the workforce are ready
Preservice Training and Technology

to effectively utilize updated technology as it becomes available to the schools, and to be leaders in the uses of these new technologies (Brennan, 1991).

Glasser, 1975 as quoted by Butzin, 1991 stated that “in a good education there is involvement, relevance, and thinking.” Today’s students live in a world where they are surrounded by “electronic media”, and yet when they go to school, very often the main tools which the teacher uses in her instruction are chalk and paper (Butzin, 1991). He also states that very few students who graduate from public school actually “acquire the knowledge they need to enter the increasingly sophisticated workplace of the Information Age”. Technology is relevant to students. We need to integrate it into their school experiences; modeling it’s effective use in our presentations to them. By utilizing technology in our everyday lessons and teaching students to utilize it for higher order thinking skills; we will not only be developing good thinkers who are prepared for the workplace of the 21st century, but we will also be engaging our students’ attention for better learning.

Shick (1996) cited Peck and Dorricott (1994) stating that technological tools have the power to foster students’ abilities, revolutionize the way they work and think, and give them new access to the world. Computer illiterate educators are not using computer technology properly due to a lack of training. It is believed that once the educator becomes computer literate and properly trained, she will use technology as an integral part of learning. Shick, 1996, states that “it is a necessity for educators to have the knowledge
and confidence level to incorporate modern technology into all areas of classroom curriculum.” We need to empower students to utilize technology by first empowering educators with the knowledge they need to feel comfortable integrating technology into the curriculum.

In the United States, modern technology is strongly utilized in the military, in mathematics and science, for weather forecasting, for special effects in television and theater productions, and in the space program (Shick, 1996). Technology is a real part of our world and is incorporated into everything that we do. “Everyone seems to know that in the real world, all the major problems are interdisciplinary and all the solutions are interdepartmental, interprofessional, interdependent, and international...The trouble is that our whole educational system is geared more to categorizing and analyzing patches of knowledge than to threading them together” (Cleveland, 1986). “Computer integration into the classroom is an essential component of every school’s development and growth.” (Shick, 1996). Our educational system needs to undergo a major transformation in order to prepare the students for a world driven by technology. We need to stop teaching in bits and pieces, and start teaching in whole, relevant ways. Technology needs to be integrated into all subject areas and it needs to be seen more as a way of teaching and learning than as a subject to be taught or as objectives to be met.

There are many movements to reform education to meet the current needs of today’s students, including; “Educating Americans for the 21st Century, 1983; Making the

Harlan Cleveland (1986) stated that if districts continue to teach skills separately without an integrated approach, the government is going to need to impose “Core Curriculum Standards” to force change to occur. “What we need now is a theory of general education that is relevant to life and to work based on the new information resource... a new ‘core curriculum,’ a central idea about what every educated person should know, and have, and try to be.” Over ten years ago, Cleveland predicted the development of such standards; and now they are a reality in New Jersey.

Specifically, it can be seen that technology is incorporated into all areas of New Jersey’s Core Curriculum Content Standards; including, Cross-content workplace readiness, Language arts literacy, Mathematics, Science, Social Studies, and World Languages. The following are examples of how technology is used as a vehicle to integrate the subject areas for elementary school students. Under the area of Cross-content workplace readiness, standard 2, it is stated that “All students will use information, technology, and other tools” (New Jersey State Department of Education,
Specifically, the cumulative progress indicators state that students will "understand how technological systems function; select appropriate tools and technology for specific activities; demonstrate skills needed to effectively access and use technology-based materials through keyboarding, troubleshooting, maintenance, and retrieving and managing information; develop, search, and manipulate databases; access technology-based communication and information systems; identify and locate information on specific topics using both technological (e.g. computer, telephone, satellite) and conventional (e.g. library, media center) resources; use technology and other tools to solve problems, collect data, and make decisions; use technology and other tools, including word processing, spreadsheet and presentation programs, and print or graphic utilities to produce products; use technology to present designs and results of investigations; discuss problems, including ethical decisions, related to the increasing use of technologies (New Jersey State Department of Education, 1996).

Another example of the integration of technology into the Content Standards is in the area of Mathematics. Standard 4.1 states that "All students will develop the ability to pose and solve mathematical problems in mathematics, other disciplines, and everyday experiences." The cumulative progress indicators state that students will "construct and use concrete, pictorial, symbolic, and graphical models to represent problem situations" (New Jersey State Department of Education, 1996). Also, in the area of Language arts literacy it is stated that "All students will view, understand, and use nontextual visual information and representations for critical comparison, analysis, and evaluation."
cumulative progress indicators for this are: "demonstrate the ability to gain information from a variety of media; articulate awareness of different media forms and how these contribute to communication; articulate information conveyed by symbols such as those found in pictorial graphs, map keys, and icons on a computer screen; take notes on visual information from films, presentations, observations, and other visual media, and report that information through speaking, writing, or their own visual representations" (New Jersey State Board of Education, 1996). It becomes obvious that technology is not defined here as a subject to be taught; but instead, as a vehicle or process by which a variety of technologies are utilized during everyday instruction to bring educational methods into the 21st century; and to better meet the educational needs of today's students in this technology-rich world.

"As technology has increased in both personal and professional perspectives a need for teacher training has become mandatory" (Shick, 1996). Shick also cited Richardson (1993) in saying that "any development in technology integration in a classroom will be unnoticed until teachers grasp this knowledge". After a 12 week in-service training program implemented by Shick, teachers' knowledge of computer workstations increased; showed a 20% decrease in anxiety when implementing computer technology into teaching strategies; demonstrated an improvement in utilizing computer presentation skills; showed a 20% or better increase in knowledge and understanding of computer software used in the classroom; including, tutorial and presentation software. If just a 12 week in-service training program can increase the effective use of technology in this way; it seems that
proper training of teachers at the undergraduate level will have an even more powerful affect on the improvement of the use of technology in the classroom. If we are to effectively train students in the use of technology and prepare them for the 21st Century, teacher training is mandatory.

Statement of the Problem

Much of the related literature indicates that a large number of teachers are anxious about the use of technology in the classroom and do not have adequate knowledge or skills to integrate technology into their lessons. Could it be that the preservice professional education courses in the current undergraduate teacher education programs do not give adequate attention to educational technology and its applications in a classroom setting?

Hypothesis

In order to investigate this problem the following hypothesis was generated:

H₁. There will be no significant differences between the technology understandings which researchers state teachers should have to effectively address the needs of today’s students; and the technology understandings which undergraduate teacher education programs offer.
*Purpose of the Study*

It is the purpose of this study to define whether or not there is a need for undergraduate teacher education institutions to further evaluate their programs to see if they are preparing teachers with the skills they need for educational technology.

*Method of the Study*

The study was conducted during the Spring of 1997. The undergraduate program catalogs from 10 area colleges and universities, well-known as teacher education institutions, were obtained by sending e-mail requests, followed up with a letter and phone request. All ten institutions responded. Since many of the programs were similar, a representative group of five was chosen for detailed study. These include: Widener University, University of Delaware, Temple University, West Chester University, and Rowan University.

The undergraduate elementary teacher education program descriptions of the five institutions were analyzed and the specific technology requirements were identified. The involvement of technology in an undergraduate teacher education program was identified by first reviewing the education requirements less the student teaching practicum and field experiences. All Education course requirements were itemized without regard to the number of credit hours of each. Course descriptions were reviewed and Education courses were defined as to the level of technology involvement, by utilizing a Likert-type scale of measurement. If a course was fully dedicated to technology in that technology
was the main focus, it received 3 technology quality points (T.Q.P.). If it was partially

dedicated to technology, in that technology was mentioned and described as a good part

of the course but not as its main focus, the course received 2 T.Q.P. If the course
description or name included technology but did not describe how it would be utilized, the

course received 1 T.Q.P. as having little technology involvement. Finally, if the course
description did not include any mention of technology, the course received a 0 for having

no technology involvement.

In addition, points were then given to each institution for general requirements and
electives courses as follows: If a general course requirement had any technology

involvement; as indicated by any mention of technology in the course description, the

institution received an additional 3 General and Elective Technology Quality Points

(T.Q.P.) for that course. If the institution offered a “suggested” course which had any

form of technology involvement; as indicated by any mention of technology in the course
description; the institution received an additional 2 General and Elective T.Q.P. for that
course. Finally, if any elective was offered as part of completing the program; and the

course description for that elective included any mention of technology, the institution
received an additional 1 General and Elective T.Q.P. for that course.

A “suggested” course was defined as a course which needed to be chosen out of a
given list of specific courses in order to meet a requirement. For example: A list of five

specific courses is provided, and the student is required to choose one out of the five.
This course would then be termed as "suggested". Even though the course descriptions for all general requirements and electives were reviewed; only the general requirements and electives which received any General and Elective T.Q.P. were itemized. This was due to the fact that most of the general requirements and electives received no points; and it would have been cumbersome to list them only to indicate that no technological points were received from them.

When free electives were offered in a program or when a program gave a choice of electives from a multitude of courses in a particular area of study; the review was done in the following manner. Every attempt was made to find a course to meet the elective requirement which included some form of technology. All possible choices were reviewed until one was found which included technology or until all choices were exhausted. In this way, each University was given every possible chance to receive the greatest number of technology quality points.

Limitation of the Study

It should be noted that the design of this study has its limitations. Reviewing the course descriptions may or may not be an effective way of measuring the technology involved in a course. Many courses may include technology, but it may not be listed in the course descriptions. Also, technology may be utilized by the instructor as part of the instructional process; and this may not be noted. Just because the word "technology" was in a course description; doesn't necessarily mean that it is a part of the course that will be
effective in training pre-service teachers to utilize technology in their teaching. Look at the instance of Widener’s elective called, “The Modern City”, which discusses the role of technology in shaping the urban environment. This course handles technology in a general sense and doesn’t focus on educational technology; how teachers can use technology as a tool for learning.
Definitions of Terms

1. Educational Technology - the vehicle or process by which a variety of technologies are utilized during everyday instruction, to accomplish the learning objectives in all subject areas. Such technologies which will be used as a tool for learning may include, but are not limited to the following: personal computer, on-line services, CD ROM, multi-media, LCD projection plate, laserdisc player, scanner, modem, instructional media, video equipment, cameras, television, radio, editing equipment, calculators, telescopes, spectrosopes, and portable planetariums.

2. T.Q.P.- technology quality points

Widener University Undergraduate Bulletin Subject Area Abbreviations:

1. ED- Education
2. SOC- Sociology

University of Delaware Undergraduate Bulletin Subject Area Abbreviations:

1. EDDV- Educational Development
2. EDST- Educational Studies
Definitions of Terms

(Continued)

Temple University Undergraduate Bulletin Subject Area Abbreviations:

1. ED or EDX - Education

West Chester University Undergraduate Catalog Course Prefixes:

1. CSC - Computer Science
2. EDE - Childhood Studies and Reading
3. EDF - Counselor, Secondary, and Professional Education
4. EDM - Instructional Media
5. EDP - Counselor, Secondary, and Professional Education
6. HEA - Health
7. KIN - Kinesiology (formerly Physical Education)
8. LIT - English
9. MAT - Mathematics
10. MUE - Music Education
11. PHY - Physics
12. SCE - Geology and Astronomy
Definitions of Terms

(Continued)

Rowan University’s Undergraduate Catalog Numerical Subject Area Abbreviations:

(Continued)

1. 0601- Communications, general
2. 0701- Computer Science, general
3. 0801- Education, general
4. 0802- Elementary Education/Early Childhood
5. 0830- Reading Education
6. 0837- Health Education
7. 0839- Technology - Art
8. 0925- Industrial Technology
9. 1509- Philosophy
10. 1701- Mathematics, general
11. 1913- Atmospheric Sciences and Meteorology
12. 2205- History
13. 4901- General Liberal Arts and Sciences
Organization of the Thesis

In order to further the investigation, the following organization of study was followed. Chapter one presents the significance of the study along with the statement of the problem, the hypothesis, and the purpose of the study; chapter two reviews the literature; chapter three describes the design or methods used to conduct the study; chapter four analyzes the information gained through the study; and chapter five draws conclusions and makes recommendations based on the study.
Chapter Two

Review of the Literature

Technology should be a part of every subject area, a way of teaching—not a subject to be taught in isolation. Much research discusses the need to fully integrate technology into the curriculum (Butzin, 1991; Lanner and Timberlake, 1995) and into daily lessons (Brennan, 1991; Mergendoller, et al., 1992; Shick, 1996). A resource document developed by the Kansas State Board of Education (1993), to assist in moving schools towards an “outcome-based integrated curriculum,” indicates that such a curriculum would help develop students’ critical thinking and problem-solving skills. It seems that if we integrate technology into the curriculum, this will help students to develop higher-order thinking skills. Mergendoller cited many researchers who agree that teachers need to use computers to develop higher-order thinking skills, enhance creativity, or present new concepts (Bork, 1980; Cole and Griffin, 1987; Gradolf, 1988). This use is termed by Mergendoller as the “intelligent use of technology”. He and the researchers agree that the computer should be utilized as a tool for student learning rather than a provider of drill and practice. It is also believed that computers should be utilized by teachers as an instructional tool; to present information, for practical simulation, and for application (Brennan, 1991). In order for teachers to develop the skills they need to integrate
technology into the curriculum, Mergendoller believes that teachers need to be trained not only in technology, but also in curriculum.

Mergendoller specifically looks at Utah teachers' use of technology. He summarizes that "the restricted use of technology by Utah teachers appears to be closely related to their lack of training...with minimum training teachers can use computer technology as they would a worksheet for drill and practice activities or a typewriter...Teachers receiving training were more likely to use computers in sophisticated ways and to increase their focus on higher order thinking skills and conceptual understanding." "Teachers typically appropriate technology to support existing practice, using technology primarily for drill and practice in basic skills" (Eork, 1980; Cole and Griffin, 1987; Gradolf, 1988; as quoted by Mergendoller, et al., 1992 and Brennan, 1991).

Mergendoller also states that "The majority of computer users report using computers for drill and practice, for enrichment, or for review and remediation. Fewer use computers to develop higher order thinking skills, enhance creativity or present new concepts."

Shick's study in 1996, of sixth grade teachers in four different schools had similar findings. Teachers rarely used computers to present lessons. There was a mid to high level of teacher anxiety about utilizing the computer. One of the main goals of the Educational Technology Initiative of which Mergendoller et al., (1992) speaks, is to "provide staff development and support to teachers in integrating technology into the
curriculum, instruction, assessment and classroom management.” This study reinforces the need for teacher training in educational technology.

Lerner and Timberlake (1995), specifically studied six most important variables in determining the degree to which teachers integrate computers into their instruction and planning. These included: knowledge, anxiety, personal attitudes, professional attitudes, school support, and school resources/set-up. They found that knowledge was the most critical variable in determining the extent to which teachers integrate computers into the curriculum. The level of anxiety had the strongest correlation with computer use for limited knowledge teachers. So it appears that the more knowledge a teacher has regarding technology, the more likely she will be to fully integrate computers into the curriculum. Also, if a teacher is defined as having a limited knowledge of computers; the more anxious she is about using the computer, the less likely she is to use it.

Brennan, 1991 described a program designed to increase elementary school teachers’ comfort and skill in the use of computer-related technology to establish effective integration of technology. “This program was also designed to develop alternative modes of utilizing the computer in instruction and increase interactive vs. passive modes of instruction.” According to Brennan, teachers need to be able to integrate technology into the existing curriculum, prescribe specific activities based on student’s individual needs, communicate effectively with the lab attendant, have a working knowledge of the hardware and knowledge of operational procedures of both hardware and software.
Shick (1996) believes that teachers need to be trained in software selection, as well.
Teachers need to have a strong foundation in educational technology and a lot of personal experience in utilizing this technology (Brennan, 1991). Teachers themselves should be competent technology-users (Brennan, 1991; Mergendoller, et al., 1992; Shick, 1996). Mergendoller feels that this can be best accomplished by fully integrating computers into the personal and professional lives of teachers. In order to utilize technology effectively during instruction, he also believes that teachers need extensive training in computer operation and in the integration of computers into classroom instruction.

Brennan explains that Goodson (1986), Kulic (1984), and Scott and Barber (1988) agree that "personnel must receive significant training about how to effectively integrate computers as a part of the instructional process. Less than ten hours of specific versus generic applications will not contribute to program effectiveness or successful implementation, and can be considered a contributing cause of ineffective applications."

This particular research defines some of the technological skills teachers need to have. It supports the idea that increased knowledge means increased confidence and thus, increased use of the computer (Brennan, 1991; Lerner and Timberlake, 1995; Shick, 1996). It also indicates, however, that less than 10 hours of training will have minimal effect on teachers' use of technology. In a study by Shick (1996), 83% of teachers showed a "lack of knowledge of technology skills in relation to teaching and learning". The integration of technology in education is vital; and yet, it will not occur until teachers receive the proper training.
In the State of New Jersey, Core Curriculum Content Standards were approved by the Department of Education in 1996. Technology is integrated into each subject area. The importance of integrating technology into all areas of learning is even recognized and now required by the State of New Jersey. Now more than ever, teachers need to receive significant training in educational technology. In reviewing the standards, the following specific technology understandings were identified. These may shed some light on specific areas of need regarding the training of preservice teachers. Teachers are expected to teach students the following: how to select appropriate tools and technology for specific activities; keyboarding; how to trouble-shoot, maintain, retrieve, and manage information; how to develop, search, and manipulate databases; how to access technology-based communication and information systems; how to identify and locate information on specific topics using both technology and library/media resources; how to use technology and other tools to solve problems, collect data, and make decisions; how to use technology and other tools including the word processor, spreadsheet, and presentation programs, and print or graphic utilities to produce products; how to use technology to present designs and results of investigations; how to discuss problems, including ethical decisions, related to the increasing use of technologies; how to create graphs using the computer; how to gain information from a variety of media; and to understand information conveyed by symbols; such as, icons on a computer screen.

The aforementioned study by Shick (1996) investigated the readiness of elementary school teachers to integrate computers into the curriculum. He surveyed sixth
grade teachers at a target school in Florida, and three other nearby schools with similar demographic profiles. This revealed high levels of anxiety and low levels of computer use being integrated into the curriculum. He then implemented a 12-week training program for the teachers at the target school. By the end of the 12 weeks, teachers were less anxious, they utilized the computer more often for presenting lessons, and they had become familiar with presentation software, such as, Microsoft's Powerpoint, word processing, and various computer tutorials. This study seems to suggest that 12 weeks of in-service training in technology can be beneficial by increasing the comfort level of the teacher regarding technology, and increasing the amount of time she utilizes the computer to present her lessons. This training seems to increase the teacher's understanding of the use of presentation software.

If training in the uses of technology increases comfort, use, and knowledge of in-service teachers, could it be that such training could greatly benefit pre-service teachers by preparing them in advance for use of the technological "teaching tools" which are yet to come. Shick (1996) supports the idea that educator training needs to occur even before the technology is in place. In this way, teachers will be ready to use updated technology as it becomes available, and they will be able to lead others in its use. Mergendoller, et al., (1992) defines specifically, some of the newer technologies that currently exist at the elementary level or are just beginning to reach some elementary schools. These include: use of a file server for network communications, CD ROM, multimedia, LCD projection plate, laserdisc player, scanner, and the modem. While these tools have great potential,
Mergendoller found and Brennan (1991) also states that "most teachers require training and support to use them." At a bare minimum, we need to start training preservice teachers in the use of these technologies. We also need to teach them how to instruct students in the uses of such technologies (Shick, 1996). Teachers will also need thorough training in the use of high quality software and technology support materials (Brennan, 1991). They will need to be trained in how to use tutorial programs, produce and organize materials and data, and how to complete research through the use of electronic data bases and communication (Mergendoller, et al., 1992). They will also need to be trained to utilize the large variety of integrated software which is now becoming available, and classroom management software; such as, that for grading, lesson presentation, and parental communication.

Mergendoller et al., (1992) and Shick, (1996) have found that although technology is a large financial investment for most districts, and many updated technologies are now becoming available; the lack of computer literacy and technological skills in many colleagues forces these amazing advances to be nonfunctional." Butzin, 1991 believes that technology remains to be an illusive goal for most teachers. "Lack of classroom equipment in sufficient quantity, lack of training, coupled with limited time and expertise to integrate software into the instructional program cause computers to remain an expensive distraction in the back of the classroom" Mergendoller, et al., 1992, states that the potential of technology is not being attained, especially at the elementary level.
"Teachers are using the technology in traditional ways and are not using the wide variety of technological tools or experimenting with instructional presentation mediums."

We need to maximize the educational return on this investment. Mergendollar states that "If computer technology is to really make a difference in the instructional life of most teachers, then attention to teacher training and support is needed." This research supports that the training of teachers in the use of educational technology is vital.

Brennan (1991) supports the belief that training in educational technology needs to occur at the college or university level for preservice teachers. Hecker (1993) as cited by Shick (1996) takes this one step further in defining how this training should occur. He states that preservice educators need to be taught with the use of technology as an integrated part of the curriculum. In this way, expected teacher behavior is modeled as a normal, everyday part of the instructional process. Mergendoller, et al., 1992, also believes that teachers need to see examples of other teachers using technology in innovative ways in order to learn the skills best. Along the same lines, teachers should then be models to students of effective technology use.

Richardson, (1993) as cited by Shick (1996) believes that education needs to fund the technological training of teachers or hire teachers that are already competent technology-users. This brings us to the dilemma. Funding in education is limited, so most of the funds go toward the access of expensive hardware and software (Shick, 1996). There is not enough funding left to properly train teachers in the use of technology.
School districts will need to find creative ways to gain the costly hardware and software so as to afford the necessary training of teachers in educational technology. If teachers do not receive this proper training, this will force the amazing technological advances to go untouched in the schools. If districts do not spend money on the training of teachers, they will need to attempt to hire new teachers who are competent technology-users. The research states that if they do this, these teachers can then act as leaders in the uses of the new technologies.

According to Brennan, 1991, the "lack of training for education majors at the college or university level prohibits new teachers from taking a proactive leadership role regarding the use of computers or acquiring the knowledge necessary for the use of technology in the schools." This means that either school districts will need to find creative ways of gaining technology at lower costs; so as to afford the training necessary to make this technology utilized and integrated into the curriculum; or colleges and universities will need to evaluate their undergraduate elementary teacher education programs, to see if they are effectively preparing teachers to be to meet the technological needs of today's students.

This brings us to the main focus of this research. We need to look at the technology understandings which the research states teachers need to have in order to teach students effectively. We also need to focus on what technology understandings the research deems necessary for the students to gain. We then need to look closely at the
programs offered at the undergraduate teacher preparation institutions to see if they are providing the proper and necessary training in educational technology to preservice teachers.
A list of technology understandings which the research deems as necessary for teachers to have in this increasingly technological world has been compiled. It has been categorized so as to be a guide or resource for Universities and researchers to use in the future; when studying and evaluating undergraduate teacher education programs. The categories follow, with a brief description of the skills included, next to each.

Categories of Educational Technology Understandings

1. **Computer Operation/Knowledge of Hardware**: This includes a knowledge of operational procedures of hardware; the use of a computer lab; the use of a fileserver for network communications; the use of such new technologies as CD ROM, LCD projection plate, laserdisc player, scanner, and a modem; print and graphic utilities; and keyboarding. Teachers will not only need to learn about the hardware; but they will need to learn appropriate teaching methods using the hardware.

2. **Integration of Technology into the Curriculum**: This includes learning to utilize all sorts of technology tools to further the goals of the curriculum. Teachers will need to know how to utilize technology as an integral part of learning---for presenting, practical simulation and application. Teachers will need to view technology as a way of teaching and learning instead of a subject to be taught in isolation. They will need a strong background in curriculum; understanding the theory of why it is important to teach in a whole, meaningful, and relevant fashion---rather than to teach isolated skills. They will
need to know how to select the appropriate tools and technology for specific activities; how to utilize a variety of presentation software; how to utilize the computer for problem-solving, collecting data, and making decisions; and know the effective methods to use to teach the students to do the same. Teachers will need to learn appropriate teaching methods to instruct students to utilize such tools in researching and giving presentations across the subject areas. This will in turn help students to develop higher order thinking skills and will enhance their creativity. Teachers need to be competent in the use of, and be able to teach students to utilize the following technologies as tools for learning: word processing and spreadsheet programs; learning how to develop, search, and manipulate databases; learning to utilize communication and information systems; learning how to gain information from a variety of media; and learning how to create graphs.

3. **Use of Technology as a Classroom Management Tool:** This includes use for grading, lesson planning; lesson presentations; parental communications; creating tests; and utilizing the computer as a mode of implementing assessment.

4. **Educational Software Review and Selection:** This includes understanding the criteria involved in selecting software for the ‘intelligent use of technology’.

5. **Modeling of the Effective Use of Educational Technology and Practice in Utilizing It:** This includes teachers having their teachers model the effective use of technology in their instruction as a normal, everyday part of the instructional process. It also includes enough time and experience during the teacher’s coursework, to utilize the same technology in these innovative, integrative ways so as to cause the teacher to become a competent technology user.
Chapter Three

Design of the Study

A review of the literature was conducted to discover what the experts think teachers need to know regarding technology, and what understandings they need to have in order to teach children by utilizing technology. Categories of technology understandings deemed necessary requirements for a teacher were then developed by looking at the specific understandings listed in the literature. These categories include: Computer Operation/Knowledge of Hardware, Integration of Technology into the Curriculum, Use of Technology as a Classroom Management Tool, Educational Software Review and Selection, Modeling of the Effective Use of Educational Technology and Practice in Utilizing It.

Description of the Sample

The undergraduate program catalogs from 10 area colleges and universities, well-known as teacher education institutions, were obtained by sending e-mail requests, followed up with a letter and phone request. All ten institutions responded. Since many of the programs were similar, a representative group of five was chosen for detailed study. These include: Widener University, University of Delaware, Temple University, West Chester University, and Rowan University.
**Design and Rating Procedures**

The undergraduate elementary teacher education program descriptions of the five institutions were analyzed and the specific technology requirements were identified. The involvement of technology in an undergraduate teacher education program was identified by first reviewing the education requirements less the student teaching practicum and field experiences. All Education course requirements were itemized without regard to the number of credit hours of each. Course descriptions were reviewed and Education courses were defined as to the level of technology involvement, by utilizing a Likert-type scale of measurement. If a course was fully dedicated to technology in that technology was the main focus, it received 3 technology quality points (T.Q.P.). If it was partially dedicated to technology, in that technology was mentioned and described as a good part of the course but not as its main focus, the course received 2 T.Q.P. If the course description or name included technology but did not describe how it would be utilized, the course received 1 T.Q.P. as having little technology involvement. Finally, if the course description did not include any mention of technology, the course received a 0 for having no technology involvement.

In addition, points were then given to each institution for general requirements and electives courses as follows: If a general course requirement had any technology involvement; as indicated by any mention of technology in the course description, the institution received an additional 3 General and Elective Technology Quality Points (T.Q.P.) for that course. If the institution offered a “suggested” course which had any
form of technology involvement; as indicated by any mention of technology in the course description; the institution received an additional 2 General and Elective T.Q.P. for that course. Finally, if any elective was offered as part of completing the program, and the course description for that elective included any mention of technology, the institution received an additional 1 General and Elective T.Q.P. for that course.

A "suggested" course was defined as a course which needed to be chosen out of a given list of specific courses in order to meet a requirement. For example: A list of five specific courses is provided, and the student is required to choose one out of the five. This course would then be termed as "suggested". Even though the course descriptions for all general requirements and electives were reviewed; only the general requirements and electives which received any General and Elective T.Q.P. were itemized. This was due to the fact that most of the general requirements and electives received no points; and it would have been cumbersome to list them only to indicate that no technological points were received from them.

When free electives were offered in a program or when a program gave a choice of electives from a multitude of courses in a particular area of study; the review was done in the following manner. Every attempt was made to find a course to meet the elective requirement which included some form of technology. All possible choices were reviewed until one was found which included technology or until all choices were exhausted. In this
way, each University was given every possible chance to receive the greatest number of technology quality points.

Rowan's program was unique in comparison to other university programs because not only a major course of study needed to be chosen by students; but also a coordinate major. To conduct the study on Rowan's program, in addition to the course catalog, general education models for the nineteen coordinate majors were obtained from the Elementary Education Department at Rowan University since the program catalog was not detailed enough. General Requirements were not listed in the program catalog, and it was determined that in order to follow a program and study its involvement of technology, it would be necessary to choose one coordinate major out of the possible 19; and evaluate the model for that particular program. The choice of a coordinate major would dictate what the program requirements would be.

In order to conduct a fair evaluation of Rowan's program, it was decided that the coordinate major chosen for study should be the most popular one. In this way, the results of the study would be most representative of those who are education majors at Rowan. After conferring with the undergraduate education department at Rowan, it was found that Psychology is the coordinate major most representative of the students with an elementary education major. Out of the 678 students enrolled in the elementary education program as of the Spring of 1997, the coordinate major of Psychology has the most students enrolled; 172. This means that about twenty-five percent of the students enrolled
in the elementary education major are following the Psychology coordinate major program. Sociology is the second most popular coordinate major, with 135 students enrolled; about twenty percent of all elementary education majors. English was the third most chosen coordinate major with thirteen percent or 85 students enrolled; Mathematics was fourth, with nine percent or 61 students; and History was fifth, with eight percent or 51 students enrolled. Computer Science is offered as a coordinate major, but less than one percent; only 2 out of the 678 students are enrolled it. This might be due to the fact that most education majors are females, and computer science tends to be a major predominately chosen by males.

In studying Rowan's program, Psychology was chosen as the coordinate major to be evaluated in detail. Since it is the most popular coordinate major according to the undergraduate education department, it would be most representative of those who are elementary education majors at Rowan. Although the sociology major was almost equally as popular, it was not evaluated because in examining the course requirements for each, they were very similar and so the evaluation would be comparable. It was also decided that all required courses for the coordinate major would be counted as general and elective courses in the rating.

In evaluating the undergraduate teacher education programs of all five universities, scoring procedures were developed to create a means of arriving at an Educational
Technology Number and a Program Technology Number for each institution. The Educational Technology Number would measure the force of technology in the educational foundation of the program; and the Program Technology Number would measure the force of technology in the overall program.
Chapter Four

Analysis of the Data

Overall Scoring Procedures

Course descriptions were reviewed and the level of technology involvement in the Education courses was defined. A Likert-type scale was used in the following manner. If a course was fully dedicated to technology, in that technology was the main focus, it received 3 technology quality points (T.Q.P.). If it was partially dedicated to technology, in that technology was mentioned and described as a good part of the course but not as its main focus, the course received 2 T.Q.P. If the course description or name included technology but did not describe how it would be utilized, the course received 1 T.Q.P. as having little technology involvement. Finally, if the course description did not include any mention of technology; the course received a 0 for having no technology involvement.

After itemizing all Education course requirements; a Possible Educational Technology Quality Point number was computed by counting the total number of Education course requirements in the program and multiplying the number by 3, the greatest possible score which each course could receive if it had total technology involvement. An Actual Educational Technology Quality Points Score was then computed for the institution by adding up all points received from the evaluation of each
education course using the Likert-type scale. To calculate the Educational Technology Number, which measures the force of technology within the educational foundation of the program, the Actual Educational Technology Quality Points were compared to the Possible Educational Technology Quality Points.

In addition, points were then given to each institution for general requirements and electives courses as follows: If a general course required for a program had any technology involvement; as indicated by any mention of technology in the course description; the institution received an additional 3 General and Elective T.Q.P. for that course. If the institution offered a "suggested" course which had any form of technology involvement; as indicated by any mention of technology in the course description; the institution received an additional 2 General and Elective T.Q.P. for that course. Finally, if any elective was offered as part of completing the program; and the course description for that elective included any mention of technology; the institution received an additional 1 General and Elective T.Q.P. for that course. Only the general requirements and suggested electives which received any General and Elective Technology Quality Points were itemized. The total General and Elective T.Q.P. were added to the Actual Educational T.Q.P. the institution received for education coursework. The resulting score was defined as the Total Technology Quality Points. To calculate a Program Technology Number which indicates the force of technology within the overall program; the Total Technology Quality Points were compared to the Total Program Technology Quality Points. (The Total Program T.Q.P. was calculated by combining the Possible Educational T.Q.P. and
the General and Elective T.Q.P.) The score of the program is designated as the institution's Program Technology Number, and will measure the force of technology within the overall program.

**Individual Analysis of the Universities**

**Widener University**

Table One and Chart One which follow, describe Widener University's Education Course Listing and T.Q.P. Rating, and the Breakdown of Technology Quality Points for the University. Out of the nine required education courses in Widener University's program for certification in Elementary Education, only three had any involvement of technology. Two of them had little technological involvement; they only mentioned technology in the course catalog, but were not specific about its role in the courses. Technology was strongly emphasized, but not the main focus of one course, entitled: "Implementing the Elementary Curriculum". Out of their general requirements and electives, only one made mention of technology; "The Modern City".

Since Widener had a total of nine required education courses, it could have received a Possible Educational T.Q.P. of twenty-seven. The Actual Educational T.Q.P. was four. This resulted in an Educational Technology Number of 15. The total possible number of T.Q.P the program could have received was twenty-eight. It received a total of five. This resulted in a Program Technology Number of 18.
Table #1: Widener University’s Education Course Listing and T.O.P. Rating
(Widener University Undergraduate Bulletin, 1996-1997)
Curriculum: Certification in Elementary Education

Required Education Courses:

<table>
<thead>
<tr>
<th>Scale of Courses Dedicated to Technology</th>
<th>Points Assigned</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>3</td>
<td>Technology is course's main focus.</td>
</tr>
<tr>
<td>Partial</td>
<td>2</td>
<td>Technology is strongly emphasized, but not the main focus.</td>
</tr>
<tr>
<td>Little</td>
<td>1</td>
<td>Technology is mentioned in course title or description.</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>Technology is not included.</td>
</tr>
</tbody>
</table>

Technology Quality Points

1. ED 101 Introduction to Teaching 0
2. ED 201 Educational Psychology 0
3. ED 250 Introduction to Special Education 0
4. ED 324 Implementing the Elementary Curriculum 2
5. ED 316 Reading and Language Arts I 0
6. ED 306 Social Studies Instruction 1
7. ED 318 Mathematics for Children 1
8. ED 321 Reading and Language Arts II 0
9. ED 323 Children’s Literature 0

Actual Educational Technology Quality Points: 4

General and Elective Courses:

<table>
<thead>
<tr>
<th>General Course Rating Scale for Courses with Any Mention of Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Required Course</td>
</tr>
</tbody>
</table>

1. SOC 321 The Modern City 1

Total General and Elective T.O.P.: 1

Widener University’s Total Technology Quality Points 5
**Chart #1: Widener University’s Breakdown of Technology Quality Points**

<table>
<thead>
<tr>
<th>Possible Educational T.Q.P.</th>
<th>27</th>
<th>Actual Educational T.Q.P.</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Program T.Q.P.</td>
<td>28</td>
<td>General and Elective T.Q.P.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total T.Q.P.</td>
<td>5</td>
</tr>
</tbody>
</table>

**Educational Technology Number =**

\[
\text{Percentage Achieved} = \frac{\text{Actual Educational T.Q.P.}}{\text{Possible Educational T.Q.P.}} \times 100
\]

Percentage Achieved = 15

**Program Technology Number =**

\[
\text{Percentage Achieved} = \frac{\text{Total T.Q.P.}}{\text{Total Program T.Q.P.}} \times 100
\]

Percentage Achieved = 18
University of Delaware

Table Two and Chart Two which follow, describe the University of Delaware’s Education Course Listing and T.Q.P. Rating, and the Breakdown of Technology Quality Points for the University. Out of the eight required education courses in the University of Delaware’s bachelor of science degree program in elementary teacher education, there were four courses which were fully dedicated to technology. These courses were: “Educational Technology I: Productivity Tools”, “Educational Technology II: Professional Tools”, “Educational Technology III: Literacy and Language Arts Lab” or “Special Education Technology”, and “Educational Technology IV: Science, Social Studies, and Math Lab”. This means that a total of half of the required education courses were fully dedicated to technology. These courses were all in fact one credit courses; but this does not affect the results of our study. This is because each education course, no matter how many credit hours, had the possibility of receiving a total of three technology quality points.

Since the University of Delaware had a total of eight required education courses, it could have received a Possible Educational T.Q.P. of twenty-four. The Actual Educational T.Q.P. was twelve. This resulted in an Educational Technology Number of 50. The strength of technology in the education coursework was so great, that the fact that the University of Delaware received no technology quality points from general and electives courses, still resulted in a strong Program Technology Number. The total possible number of T.Q.P. the program could have received was twenty-four. It received a total of twelve. This resulted in a Program Technology Number of 50.
Table #2: University of Delaware's Education Course Listing and T.O-P. Rating

(University of Delaware’s Undergraduate Catalog, 1996-1997)
Bachelor of Science in Education Degree Program in Elementary Teacher Education

Required Education Courses:

<table>
<thead>
<tr>
<th>Scale of Courses Dedicated to Technology</th>
<th>Points Assigned</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>3</td>
<td>Technology is course's main focus.</td>
</tr>
<tr>
<td>Partial</td>
<td>2</td>
<td>Technology is strongly emphasized, but not the main focus.</td>
</tr>
<tr>
<td>Little</td>
<td>1</td>
<td>Technology is mentioned in course title or description.</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>Technology is not included.</td>
</tr>
</tbody>
</table>

Technology Quality Points:

1. EDST 240 or 247 Professional Issues: Philosophical or Historical Perspectives 0
2. EDST 258 Cultural Diversity, Schooling, and the Teacher 0
3. EDST 390 Instructional Strategies and Reflective Practice 0
4. EDST 461 Measurement Theory and Techniques for Classroom Teachers 0
5. EDDV 186 Educational Technology I: Productivity Tools 3
6. EDDV 286 Educational Technology II: Professional Tools 3
7. EDDV 386 Educational Technology III: Literacy and Language Arts Lab or EDST 386 Special Education Technology 3
8. EDDV 387 Educational Technology IV: Science, Social Studies, and Math Lab 3

Actual Educational Technology Quality Points: 12

General and Elective Courses:

General Course Rating Scale for Courses with Any Mention of Technology

<table>
<thead>
<tr>
<th>General Course Rating</th>
<th>Required Course</th>
<th>Suggested Course</th>
<th>Elective Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Required Course</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Total General and Elective T.Q.P. 0

University of Delaware's Total Technology Quality Points 12
### Chart #2: University of Delaware's Breakdown of Technology Quality Points

<table>
<thead>
<tr>
<th>Possible Educational T.O.P.</th>
<th>24</th>
<th>Actual Educational T.O.P.</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Program T.O.P.</td>
<td>24</td>
<td>General and Elective T.O.P.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total T.Q.P.</td>
<td>12</td>
</tr>
</tbody>
</table>

**Educational Technology Number =** \[
\frac{\text{Actual Educational T.O.P.}}{\text{Possible Educational T.O.P.}}
\]

Percentage Achieved = 50

**Program Technology Number =** \[
\frac{\text{Total T.Q.P.}}{\text{Total Program T.Q.P.}}
\]

Percentage Achieved = 50
Temple University

Table Three and Chart Three which follow, describe Temple University's Education Course Listing and T.Q.P. Rating, and the Breakdown of Technology Quality Points for the University. Out of the seven required education courses in Temple University's Elementary and Early Childhood Program, only one; "Computer-based Instruction", involved technology, and that was fully dedicated to technology. Four electives courses had some form of technology involvement.

Since Temple had a total of seven required education courses, it could have received a Possible Educational T.Q.P. of twenty-one. The Actual Educational T.Q.P. was three. This resulted in an Educational Technology Number of 14. The total possible number of T.Q.P. the program could have received was twenty-five. It received a total of seven. This resulted in a Program Technology Number of 28.
### Table #3: Temple University's Education Course Listing and T.O.P. Rating


**Elementary and Early Childhood Education**

**Required Education Courses:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Points Assigned</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>3</td>
<td>Technology is course’s main focus.</td>
</tr>
<tr>
<td>Partial</td>
<td>2</td>
<td>Technology is strongly emphasized, but not the main focus.</td>
</tr>
<tr>
<td>Little</td>
<td>1</td>
<td>Technology is mentioned in course title or description.</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>Technology is not included.</td>
</tr>
</tbody>
</table>

#### Technology Quality Points:

1. ED0111 Crucial Teaching Strategies 0
2. ED0121 Lifespan Human Development 0
3. ED0151 Multicultural/Multigroup Relations 0
4. ED0152 Teaching Exceptional Children 0
5. ED0153 Assessment and Evaluation of Learners 0
6. ED0240 Computer-Based Instruction 3
7. EDX060 Education, Schooling, and the Individual in US Society 0

*Actual Educational Technology Quality Points: 3*

#### General and Elective Courses:

<table>
<thead>
<tr>
<th>General Course Rating Scale for Courses with Any Mention of Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Required Course</td>
</tr>
</tbody>
</table>

1. 0227 Mathematical Computer Programming I 1
2. C055 Computers and Applications 1
3. 0010 Introduction to Management Information Systems 1
4. 0335 Advanced Problems in Production 1

*Total General and Elective T.O.P.: 4*

Temple University’s Total Technology Quality Points 7
Chart #3: Temple University's Breakdown of Technology Quality Points

<table>
<thead>
<tr>
<th>Possible Educational T.Q.P.</th>
<th>21</th>
<th>Actual Educational T.Q.P.</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Program T.Q.P.</td>
<td>25</td>
<td>General and Elective T.Q.P.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total T.Q.P.</td>
<td>7</td>
</tr>
</tbody>
</table>

**Educational Technology Number** = \[
\frac{\text{Actual Educational T.Q.P.}}{\text{Possible Educational T.Q.P.}}
\]

Percentage Achieved = 14

**Program Technology Number** = \[
\frac{\text{Total T.Q.P.}}{\text{Total Program T.Q.P.}}
\]

Percentage Achieved = 28
West Chester University

Table Four and Chart Four which follow, describe West Chester University’s Education Course Listing and T.Q.P. Rating, and the Breakdown of Technology Quality Points for the University. West Chester University’s Bachelor of Science in Education program for Elementary Education required 18 education courses. Out of the 18 courses, only two had any involvement of technology. These both had partial involvement of technology; technology was strongly emphasized but was not the major focus. These included: “Introduction to Instructional Communications” and “Teaching Social Studies in the Elementary School”. Out of the general and elective coursework, two suggested courses as well as four elective courses included technology.

Since West Chester University had a total of eighteen required education courses, it could have received a Possible Educational T.Q.P. of fifty-four. The Actual Educational T.Q.P. was four. This resulted in an Educational Technology Number of 7. The total possible number of T.Q.P. the program could have received was sixty-two. It received a total of twelve. This resulted in a Program Technology Number of 19.
Table #4: West Chester University’s Education Course Listing and T.O.P. Rating

(West Chester University Undergraduate Catalog, 1996-1997)
Bachelor of Science in Education—Elementary Education (Curriculum K-6)

Required Education Courses:

<table>
<thead>
<tr>
<th>Description</th>
<th>Points Assigned</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>3</td>
<td>Technology is course's main focus.</td>
</tr>
<tr>
<td>Partial</td>
<td>2</td>
<td>Technology is strongly emphasized, but not the main focus.</td>
</tr>
<tr>
<td>Little</td>
<td>1</td>
<td>Technology is mentioned in course title or description.</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>Technology is not included.</td>
</tr>
</tbody>
</table>

Technology Quality Points

1. EDF 100 School and Society 0
2. EDM 300 Introduction to Instructional Communications 2
3. EDP 250 Educational Psychology 0
4. EDP 351 Evaluation and Measurement 0
5. EDE 251 Child Development and Behavior 0
6. EDE 310 Communication Skills in the Elementary School 0
7. EDE 311 Introduction to Reading Instruction 0
8. EDE 332 Teaching Social Studies in the Elementary School 2
9. EDE 352 Self and Group Processes in the Classroom 0
10. EDE 401 Creativity in the Classroom 0
11. EDE 406 Classroom Management 0
12. HEA 301 Health for the Elementary Grades 0
13. KIN 200 Elementary School Physical Education 0
14. LIT 395 Children’s Literature 0
15. MAT 102 Mathematics for Elementary Teachers II 0
16. MAT 351 Teaching Mathematics in Elementary Schools I 0
17. MUE 231 Music for the Classroom Teacher 0
18. SCE 310 Science for the Elementary Grades 0

Actual Educational Technology Quality Points: 4
Table #4: West Chester University's Education Course Listing and T.Q.P. Rating Continued
(West Chester University Undergraduate Catalog, 1996-1997)
Bachelor of Science in Education---Elementary Education (Curriculum K-6)

**General and Elective Courses:**

<table>
<thead>
<tr>
<th>General Course Rating Scale for Courses with Any Mention of Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Required Course</td>
</tr>
</tbody>
</table>

1. CSC101 Introduction to Computers 2
2. PHY170 Physics I 2
3. ART113 Computer Art I 1
4. CSC110 Fundamentals of Computer Science 1
5. CSC115 Introduction to Computer Programming 1
6. CSC141 Introduction to Computer Science 1

Total General and Elective T.Q.P.: 8

West Chester University's Total Technology Quality Points: 12
Chart #4: West Chester University's Breakdown of Technology Quality Points:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Technology</td>
<td>54</td>
<td>4</td>
<td>82</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Program Technology Number</td>
<td>82</td>
<td>8</td>
<td>62</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

Educational Technology Number = \[
\frac{\text{Actual Educational T.Q.P.}}{\text{Possible Educational T.Q.P.}}
\]

Percentage Achieved = 7

Program Technology Number = \[
\frac{\text{Total T.Q.P.}}{\text{Total Program T.Q.P.}}
\]

Percentage Achieved = 19
Finally, Table Five and Chart Five which follow, describe Rowan University's Education Course Listing and T.Q.P. Rating, and the Breakdown of Technology Quality Points for the University. There was no involvement of technology in any of the five required education courses, in Rowan University's program for Elementary Education with a coordinate major of Psychology. Out of their general requirements and electives, there were nine courses which involved technology: one was a general requirement, "Computer Literacy"; and there were three suggested electives and five other electives.

Since Rowan University had a total of five required education courses, it could have received a Possible Educational T.Q.P. of fifteen. The Actual Educational T.Q.P. was zero, since there was no involvement of technology in any of the required education courses. This resulted in an Educational Technology Number of 0. The total possible number of T.Q.P. the program could have received was twenty-nine. It received a total of fourteen; due to the large amount of technology involvement in the general and elective courses. This resulted in a Program Technology Number of 48.
Table #5: Rowan University's Education Course Listing and T.O.P. Rating

(Rowan University Undergraduate Catalog, 1996-1997)
Elementary Education Major with Psychology Coordinate Major

Required Education Courses:

<table>
<thead>
<tr>
<th>Scale of Courses Dedicated to Technology</th>
<th>Description</th>
<th>Points Assigned</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>3</td>
<td>Technology is course's main focus.</td>
<td></td>
</tr>
<tr>
<td>Partial</td>
<td>2</td>
<td>Technology is strongly emphasized, but not the main focus.</td>
<td></td>
</tr>
<tr>
<td>Little</td>
<td>1</td>
<td>Technology is mentioned in course title or description.</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>Technology is not included.</td>
<td></td>
</tr>
</tbody>
</table>

Technology Quality Points

1. 0801.101 Teaching as a Profession   0
2. 0830.281 Foundations of Reading     0
3. 0802.350 Educational Studies II: Problems of Practice 0
4. 0837.209 Health Education for Elementary School Teachers 0
5. 2205.321 US History                 0

Actual Educational Technology Quality Points: 0
Table #5: Rowan University’s Education Course Listing and T.Q.P. Rating

Continued

(Rowan University Undergraduate Catalog, 1996-1997)
Elementary Education Major with Psychology Coordinate Major

**General and Elective Courses:**

<table>
<thead>
<tr>
<th>General Course Rating Scale for Courses with Any Mention of Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

1. 1701.202 Introduction to Geometry 2
2. 1701.122 Pre-calculus Mathematics 2
3. 0701.100 Computer Literacy 3
4. 1913.101 Meteorology 2
5. 0925.100 Man and Technology 1
6. 4901.265 Computers and Society 1
7. 0601.205 Mass Media and Influence 1
8. 1509.393 Contemporary Moral Problems 1
9. 0839.330 General Photography 1

**Total General and Elective T.Q.P.:** 14

**Rowan University’s Total Technology Quality Points:** 14
Chart #5: Rowan University’s Breakdown of Technology Quality Points

<table>
<thead>
<tr>
<th>Possible Educational T.Q.P.</th>
<th>15</th>
<th>Actual Educational T.Q.P.</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Program T.Q.P.</td>
<td>29</td>
<td>General and Elective T.Q.P.</td>
<td>14</td>
</tr>
<tr>
<td>Total T.Q.P.</td>
<td></td>
<td>Total T.Q.P.</td>
<td>14</td>
</tr>
</tbody>
</table>

Educational Technology Number = \[
\text{Actual Educational T.Q.P} / \text{Possible Educational T.Q.P.}\]

Percentage Achieved = 0

Program Technology Number = \[
\text{Total T.Q.P.} / \text{Total Program T.Q.P.}\]

Percentage Achieved = 48
Overall Review

Table Six and Figure #1 follow. Table Six is a compilation of the technology ratings for all of the Universities while Figure #1 focuses on the Program Technology Numbers and Educational Technology Numbers for each; comparing them visually. Table Six and Figure #1 rank the Universities in descending order by their Educational Technology Numbers; since it is this number which shows the strength of technology within the educational foundation of each program. This is the most important rating in this study because it seems to measure how well the Universities are preparing pre-service teachers with the educational technology understandings they should have to effectively address the needs of today's students.
TABLE #6: FIVE AREA UNIVERSITIES' TECHNOLOGY RATINGS

<table>
<thead>
<tr>
<th>Universities</th>
<th>Actual T.Q.P.</th>
<th>General and Elective T.Q.P.</th>
<th>Possible Educational T.Q.P.</th>
<th>Total Educational T.Q.P.</th>
<th>Program Technology Number</th>
<th>Educational Technology Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Delaware</td>
<td>12</td>
<td>0</td>
<td>12</td>
<td>24</td>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>Widener</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>27</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Temple</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>21</td>
<td>25</td>
<td>14</td>
</tr>
<tr>
<td>West Chester</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>54</td>
<td>62</td>
<td>19</td>
</tr>
<tr>
<td>Rowan</td>
<td>0</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>28</td>
<td>48</td>
</tr>
</tbody>
</table>

Figure #1

Comparison of Technology Ratings by University
Conclusions and Recommendations

Summary of the Problem

In order to meet the needs of today's students in this highly technological world, education needs to undergo a major transformation; technology needs to be integrated into every area of learning. In order for this to occur, teachers need to be trained in the use of technology so that they are competent technology-users. The research states that the more knowledgeable a teacher is in the area of technology, the more likely she is to utilize it in her classroom. Also, limited knowledge teachers who are anxious about using the computer tend not to use it; but, when trained, they become more comfortable, and they will utilize it more.

It seems that teachers who are currently in the workforce are not prepared to meet the technological needs of today's students. They have limited knowledge of educational technology. If they utilize the available technologies at all, they utilize computers for drill and practice activities; rather than, to develop higher-order thinking skills through integration of technology into all areas of learning. Understanding this as the current status of technology in education, this research focused on examining the undergraduate teacher education programs of five area Universities. It concentrated on evaluating whether there is a significant difference between the technology understandings defined in
research as necessary for teachers to have to effectively meet the needs of today's students, and the understandings which these institutions are requiring teachers to learn. It is the purpose of this study to define whether there is a need for undergraduate teacher education institutions to further evaluate their programs to see if they are preparing teachers with the skills they require for educational technology.

**Comparison of Technology Ratings**

After reviewing the course catalogs from five area universities' undergraduate teacher education programs, and rating the courses as to the level of technology involvement in each, the following overall evaluations can be made. The following is a comparison of the Universities' Educational Technology Numbers: which measured the force of technology within the educational foundation of each program. (See Table #6 and Figure #1).

Out of all of the Universities studied, the University of Delaware had the strongest Educational Technology Number, 50. This is because out of the eight required education courses in the University of Delaware's Bachelor of Science Degree Program in Elementary Teacher Education, there were four courses which were fully dedicated to technology. The University of Delaware is the only institution out of all which were studied, which required a comprehensive study of educational technology. They required students to take four education-related technology courses. This means that a total of half of the required education courses were fully dedicated to educational technology. These
courses were: “Educational Technology I: Productivity Tools”, “Educational Technology II: Professional Tools”, “Educational Technology III: Literacy and Language Arts Lab” or “Special Education Technology”, and “Educational Technology IV: Science, Social Studies, and Math Lab”. From the names of these courses, it is evident that they focus specifically on developing teachers’ understandings of technology in relation to education. This seems to show a clear understanding of the importance of teacher training in educational technology, on the part of the University of Delaware.

The University of Delaware was rated as number one out of the five universities regarding the strength of technology within the education coursework, as well as, in the strength of technology within the overall program. The strength of technology in the education coursework was so great, that the fact that the University of Delaware received no technology quality points from general and electives courses, still resulted in a strong Program Technology Number. The total possible number of T.Q.P. the program could have received was twenty-four. It received a total of twelve. This resulted in a Program Technology Number of 50. The University of Delaware’s Educational Technology Number was so strong that it was 32 points above Widener University’s score of 15. Widener was rated as second in its strength of educational technology. (See Table 6 and Figure #1).

Although, Widener University’s program was rated as second highest in the strength of technology within its required education courses, there remains to be a large
gap between the preparation of students in the understandings of educational technology at the University of Delaware and that of students at Widener. Students in Widener's program had one required course entitled, "Implementing the Elementary Curriculum", which had only partial technology involvement; technology was strongly emphasized, but was not the main focus of the course. Two other required education courses had little technology involvement; technology was mentioned in the course description; but it was not specified how it would be used. These courses included "Social Studies Instruction" and "Mathematics for Children". In addition to the required education courses, Widener only had one elective course which involved technology; "The Modern City". This course covered the "role of technology in shaping the urban environment". This is a perfect example of how the technology understandings included in genera and electives courses are not as valuable to preservice teachers as those included in the required education courses. This is because the technology understandings in the general courses are not focused on education, while those involved in the education coursework are directly related to educational technology; which is what the research says teachers need to be prepared with.

It can then be concluded that the Educational Technology Number is more important than the overall Program Technology Number, because the Educational Technology Number measures the force of technology within the education courses. This technology would be more specific to education. It would include educational technology
understandings; specific training on how to utilize technology as a tool for teaching and learning, and specific information on how to integrate technology into all areas of learning.

Widener’s overall program technology number was the lowest out of the five institutions. This seems to indicate that the force of technology in its overall program was the weakest out of the five Universities evaluated. Widener’s Educational Technology Number of 15, although it is rated as the second highest out of the five Universities studied, shows a weak involvement of technology in the education foundation. Since this was the second highest rating for Educational Technology received out of the five universities studied; concerns certainly exist regarding the level of educational technology involvement in the undergraduate teacher education programs.

Temple University was rated as having the third highest Educational Technology Number; 14. It is comparable to Widener’s rating of 15. Out of the seven required education courses in Temple University’s Elementary and Early Childhood Program, only one; computer-based instruction, involved technology; and that was fully dedicated to technology. Its Program Technology Number was third highest out of the five programs. This is because four electives had some involvement of technology. (See Table Three and Chart Three.) Certainly, requiring that teachers take only one education course which is fully dedicated to technology is not providing teachers with a strong foundation in educational technology! Out of the general and elective courses, Temple had four electives which included some form of technology.
It should be noted, that not only is the technology included in the general and electives courses not specific to educational technology; but electives are in and of themselves courses which students may or may not choose to take. Certainly, if it is believed that teachers need to have a strong foundation in educational technology; we should not be leaving the building of such a foundation to chance. The training of teachers in technology should not depend on their choosing of the “right” electives. Universities who rely heavily on teachers obtaining their technology training through general and elective courses need to seriously reevaluate this procedure! The courses related to educational technology need to be requirements, not electives!

West Chester’s Educational Technology Number is 7, the second lowest out of the five Universities. This seems to indicate that out of the five universities studied, the force of technology within the education framework is one of the weakest at West Chester. One might also note that out of the five Universities, West Chester had the highest number of required education courses; 18, and this certainly could “water down” the strength of technology within the coursework. (This is because this research utilizes the following rating system. The number of required education courses is multiplied by 3; the total possible number of points the institution could receive if all courses included full technology. This score is utilized in a comparison with the total number of T.Q.P. that the university receives for its education courses.) Out of the 18 courses, only two had any involvement of technology. These both had partial involvement of technology; technology was strongly emphasized but was not the major focus. These included: “Introduction to
Instructional Communications" and "Teaching Social Studies in the Elementary School". Out of the general and elective coursework, two suggested courses as well as four elective courses included technology. West Chester was also rated as fourth lowest out of the five universities in the technological strength of its overall program; with a Program Technology Number of 19.

West Chester's Educational Technology Number is exactly half that of Temple. One would expect that the amount of technology included in the education coursework at West Chester would be half that of Temple. West Chester had two partially dedicated courses versus Temple's one fully dedicated course. West Chester had two suggested and four elective courses which included technology versus Temple's four electives courses. It appears that the programs are just about comparable in the amount of technology actually in the coursework; and yet, when measuring the Educational Technology Number, one has to take into account the amount of coursework which includes technology in comparison to the amount of coursework which could have included technology. Both programs are weak in the amount of educational technology understandings included in the educational foundation of the programs.

Finally, Rowan University's program for Elementary Education with a coordinate major of Psychology was evaluated. In this program, which is a representative program for the typical Rowan student, there is no involvement of technology in any of the five required education courses. Since Rowan University had a total of five required education
Preservice Training and Technology

courses, it could have received a Possible Educational T.Q.P. of fifteen. The Actual Educational T.Q.P. was zero, since there was no involvement of technology in any of the required education courses. This resulted in an Educational Technology Number of 0.

This lack of involvement of technology in the education courses remained constant when the descriptions of the programs for all of the other coordinate majors were perused. This is because there is little deviation in the required education courses throughout the various majors. When the courses were different, they still did not include technology. No matter what coordinate major an elementary education student at Rowan chooses to follow, there will be no educational technology included in the required education courses for the major; the Educational Technology Number will remain to be “0”.

Out of the general requirements and electives for Rowan’s major in Elementary School Teaching with a coordinate major of Psychology, there were nine courses which involved technology. One course was a general requirement, “Computer Literacy,” and there were three suggested electives and five other electives. Out of the remaining five, three were suggested courses, and two were electives. The total possible number of T.Q.P. the program could have received was twenty-nine. It received a total of fourteen, due to the large amount of technology involvement in the general and elective courses. This resulted in a Program Technology Number of 48.
This is almost as high as the University of Delaware's Program Technology Number of 50 which rates the strength of technology in the overall program. All that this really says is that students taking the Elementary Education Major with a coordinate major in Psychology are required to take only one general course which includes technology, "Computer Literacy". All other courses which a student might take which include technology are optional; one student may choose to take all or none of those courses.

Although the overall program technology number is 48, which seems to be quite strong; one should be quite careful of making judgments on the program based solely on that number. Since most of the courses which caused the program number to be so high are suggested or electives courses; it could be very possible that many students won't even take any of those courses. In that case, the strength of technology in a particular student's overall program would be weak.

Rowan University's elementary education program is unique because students need to choose a coordinate major program out of 19 possible coordinate majors. In following the program, I chose to follow Psychology for the overall study and comparison of Rowan with the other institutions. This is because twenty-five percent of the students who are enrolled in the elementary education program, are also enrolled in this coordinate major. The Psychology major was most representative of students in the program. Although the Sociology major was almost equally as popular; it was not evaluated because
in examining the course requirements for each; they were very similar and so the evaluation would be comparable.

It was decided for comparison purposes within Rowan's program; the mathematics and computer science coordinate majors would be informally evaluated. These two were chosen since these programs would be expected to include more technology than most, and it would be interesting to compare how the force of technology rated within these coordinate majors in comparison to its rating in the Psychology coordinate major program.

The mathematics coordinate major includes only 9 percent of the overall students currently enrolled in elementary education. This particular program evaluation resulted in a Program Technology Number of 64. Also, less than one percent of the total students are currently enrolled in the computer science program. This program evaluation resulted in a Program Technology Number of 72. Yet, as mentioned earlier, the Educational Technology Numbers for both of these programs would be 0 because the education requirements do not include any technology! So, even if someone enrolled in a coordinate major that one would expect to include more technology; one would encounter that technology in the general requirements and electives, but not in the education requirements. Although, at Rowan University, the education major has 19 variations on the program of study due to the 19 coordinate majors; one thing does not vary, the educational technology number for all of the coordinate majors is "0", there is no involvement of educational technology.
Conclusions and Implications

The general hypothesis stated that there would be no significant difference between the technology understandings which researchers state that teachers need to have, to effectively address the needs of today's students; and the those understandings which undergraduate teacher education programs are requiring teachers to learn. From the evidence accumulated, it appears from this study that there is a significant difference between the technology understandings which researchers state that teachers need to have, to effectively address the needs of today's students; and the technology understandings which undergraduate teacher education programs are requiring teachers to learn. Therefore, the hypothesis must be challenged. There is a strong need for undergraduate teacher education institutions to further evaluate their programs to see if they are preparing teachers with the skills they need for educational technology.

It is an alarming thought when one realizes that in all of the Universities which were evaluated, except for the University of Delaware, educational technology understandings for preservice teachers are not being taught because they are not being included and required in sufficient quantity in the education coursework. Out of the five universities studied, Rowan University had the only required general elective which included technology. All of the others had technology included in suggested or elective
courses. Do we want it to be a choice for preservice teachers to decide whether or not they want to take courses which include technology, or do we need to make it a requirement that they do so?

The research clearly states that in order to effectively meet the needs of today's students in this increasingly technological world, we need to have teachers who are competent technology-users. Brennan (1991) states that the "lack of training for education majors at the college or university level, prohibits new teachers from taking a proactive leadership role regarding the use of technology in the schools". Since Van Horn (1984) has noted that "even before technology is in place it is important to begin educator training in the uses of technology", is it not vital that we start training preservice teachers now in the uses of upcoming technologies? Shouldn't the forum for this training be required education courses so that we are sure that teachers will get the training they need and that it will be training in educational technology; in technology which can be applied specifically to teaching. The risks of not further evaluating teacher education programs are great! If teachers do not have the knowledge they need regarding technology; school districts will spend great amounts of money on obtaining new hardware and software, and these amazing advances will remain idle in the back of the classrooms!

Elementary school teachers today need to integrate technology into all subject areas; using technology as a tool for learning to help students to achieve the objectives of learning in every subject area. In order for this to occur, teachers need to be competent
technology-users. The research states that most teachers today do not integrate technology into all subject areas. Many utilize it in traditional ways; for drill and practice of basic skills. Many teachers remain uncomfortable in using technology; and so new technology remains idle in classrooms. School districts, innately with limited funding, spend most of their funds on gaining expensive new technologies; and very little in comparison on the training of teachers. Why do most teachers not have enough skill in utilizing educational technology today? Are undergraduate teacher education institutions providing the necessary training of teachers in educational technology so that they graduate as competent technology users? Are these graduates ready to be leaders in their schools in the use of new technologies? This research seems to indicate problems may exist in the level of technology training which pre-service teachers receive. It certainly does indicate the need for further study of the involvement of technology in teacher education programs.

**Recommendations for Future Study**

There are many teachers who lack skills in educational technology and many districts are not and can not afford to provide enough on-going quality training in the uses of educational technology. Future studies should focus on creative in-service programs for teachers in instructional technology. Since most districts funds are limited, this makes it hard for them to provide enough in-service training to adequately train teachers in educational technology. Future studies should focus on whether or not there is a need for
graduate programs in educational technology. Rowan University is currently investigating this.

Other studies should further evaluate the involvement of technology in undergraduate teacher education programs. The following questions might be posed about each undergraduate teacher education program: What percentage of the overall required coursework has a minor to integral involvement of technology? How many credit hours of required study involve even a minor amount of technology training? Are there specific courses dedicated to teaching instructional technology or is this integrated throughout the other coursework? What percentage of overall training involves instructing teachers in the integration of technology into the curriculum? What percentage of overall training involves the training of teachers to utilize presentation programs in everyday lessons? Does the training prepare teachers to meet the Core Curriculum Standards? When examining electives, what percentage includes some form of technology?

These questions need to be thought about by the undergraduate teacher education institutions when reviewing their programs. They may want to focus on the categories of technology understandings which the review of the literature indicated as necessary for educators in today's increasingly technological world. Maybe these categories can be a starting point for the institutions in their development of programs which better prepare teachers to integrate technology into all areas of learning. It should be remembered that
only by empowering educators with the knowledge they need to feel comfortable
integrating technology into the curriculum; will we be able to empower students to utilize
technology as a tool for learning.
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