

**Technology-Assisted-Reflection: A Study of Pre-service
Teacher Education in Middle School Language Arts and Social
Studies and Secondary English Education and Social Studies**

By

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Abstract

Hsiang, Yung-Lai Michelle. Technology-Assisted-Reflection:
A Study of Pre-service Teacher Education in Middle School
Language Arts and Social Studies and Secondary English
Education and Social Studies, (Under the direction of Dr.
Ellen Storey Vasu and Dr. Alan J. Reiman)

The purpose of this quasi-experimental research was to examine a new approach to information delivery and communication within Teacher Education courses. Advanced technologies in the Internet, Listserv, E-mail, NetForum and electronic forms were integrated, and the learning was guided by the clinical analysis/reflection and structured self-evaluation in a differentiated environment to promote individual development in both cognition and ethics.

A cluster sample of sixty-eight pre-service teachers enrolled in the Introduction to Teaching Humanities and Social Sciences course in the Spring of 1999 at the North Carolina State University. Both pretest and posttest were conducted using Defining Issues Test by James Rest for the evaluation of moral growth of the students and Computing

Concerns Questionnaire by Jean Martin for the concerns of the students in computing.

The qualitative conclusion reached by the researcher suggested students have improved in both quantity and quality of their work more than previous semesters. The quantitative data showed a trend of decrease in students' concerns with regard to computing through Technology-Assisted-Reflection. Despite the statistically insignificant result, study indicated moral development of our pre-service teachers at the Stage 4 of moral development, which is within the norm of the national standard for undergraduate students.

Biography

Yung-Lai Michelle Hsiang was born in Yilan, Republic of China on May 28, 1958, the daughter of Shao-Hong Hsiang and Show-Chin Yang Hsiang. She graduated from PingTong Girls' High School in 1976 and completed a Bachelor of Art in Teacher Education and a Master of Education from University of North Carolina in Charlotte in 1986.

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Chapter 1

Introduction

General

Background of the Problem

Our society cannot advance without exchanging information. As computer technology advances, it has brought about changes in many aspects of human existence related to how people conduct themselves in their lives and professions (Martin, 1989). Teaching tools have also advanced from chalk, blackboards, TVs, VCRs, and overhead projectors, to computers. Burns and Bozeman's meta analysis (1981) concluded that Computer-Assisted-Instruction in the form of drill, practice and tutorials was superior to traditional instruction. Kulik, Bangert and Williams' (1983) study showed that students using Computer-Assisted-Instruction outperformed those who received traditional instruction. Furthermore, meta analyses (Kulik, 1983, Kulik & Shwalb, 1985; Kulik & Kulik, 1986, 1987, 1991) indicated that computer based learning is effective in areas of improving students' achievement at all levels of schooling, the most to the least in respective sequence from elementary, to secondary and finally to college. In addition, these same meta analyses show evidence of Computer-Assisted-Instruction improving students' attitudes toward subject matter, instruction, and computer technology, as well as saving instructional time. In 1994, the United States led the world in the number of computers installed in its schools. At that time, ninety-nine percent of all elementary schools and secondary schools in the U.S. were equipped with computers, and 93% of the students used computers during their school years. More recently, Internet applications, multimedia and the World Wide Web have been adapted in K-12 classrooms in the United States (Pool &

Blanchard & Hale, 1995, Williams, 1996; Sherry & Lawyer-Brook, 1997). In 1996, more than sixty million computers were connected to the Internet and over half of these were in the United States (Ilandoli & Norris, 1997). In 1997, 72% of the schools in the USA had online access and the computer-to-student ratio in the United States increased from 1:50 in 1985, to 1:20 in 1990, and to 1:9 in 1997 (NCATE, 1997). This ratio is still increasing. Technology is becoming accessible to most segments of the United States population, and 177 countries in the world are connected to the Internet (Cipoletti, 1997, Graphic, Visualization, & Usability's (GVU) Center, 1997; Research Spectrum, 1997; Ilandoli & Norris, 1997).

Major changes in the training of teachers must occur so that teachers can integrate computer technology into the curriculum areas in which they teach, demonstrate an idea using various methods, bring new ideas to students, and motivate them to maximize learning. Students and their teachers need to have the skills to seek out and use information that is accessed through use of the technology. If we do not act upon the deficiencies that exist in our teachers' training in technology integration, the prosperity of future generations may be affected.

Another concern in teacher education is the inability of programs to overcome the powerful influence of the pre-service teachers' own personal schooling, i.e. prospective teachers came to the teaching profession with preconceptions of what teaching was all about (Carter, 1990; Feiman-Nemser, 1990; Zeichner & Gore, 1990; Evertson, 1990, Tyson, 1994). This problem requires more powerful pedagogies to break the hold of pre-service teachers' prior conceptions.

Successful teachers are both effective and responsible. This means that teachers not only have an understanding of curriculum and instruction, but also they can interact with students and parents/caregivers in respectful ways. Thus, teacher education programs need to give equal weight to both good teaching models and the moral dimensions of teaching. The connections to students are direct in that the teacher and schools hope to develop in students not only knowledge and skills, but values and sensibilities as well. A reflective and ethically responsible approach is needed in pre-service teacher education to prepare students to be able to manage a complex classroom experience and to reflect and analyze various classroom situations (William & Niles, 1987; Schon, 1991; Nelson & Smith, 1995). Teacher education programs should be tailored to meet each individual student's learning and developmental needs. Programs should also provide each student with a learning environment that includes advanced technology, so that students can be trained to use technology in their classrooms. This intervention is designed to impact both clinical analysis/reflection skills, and pre-service teacher's moral/ethical development, in addition to providing adequate technology teacher training at the pre-service level. These problem areas in teacher education will be discussed in the sections that follow.

Education and Technology

One reason that college students showed the smallest achievement gain due to computer-based learning may be explained by the limited number of research studies in this area. Another reason is the training procedures used by the majority of colleges in improving and enhancing the technical skills of their students. Using teacher education as an example, the 1998 report from the SouthEast and Islands Regional Technology Consortium, funded by the U.S. Department of Education, stated that only

25.2% of administrators gave support and encouragement for the use of the technology in teacher education programs. One of the major issues for teacher education related to computers is the structure under which education is offered. Todd (1993) indicated that teacher preparation programs were faced with providing computer experiences by faculty who themselves often have limited computing experience and insufficient resources. Collis (1994) found that in general, computer-related courses were conducted by persons without an academic background in teacher education, and furthermore, teacher education has not effectively prepared future teachers to use technologies as pedagogical tools (POET, 1997). The solution offered was only to fit computer technology into the organization and the content area of method courses rather than to add new courses to the teacher education curriculum (Collis, 1994), or to change the curriculum to reflect the impact of computer technology (Fisher, 1994). The gap in the knowledge of technology between the current teaching force and future needs has been stated by the Office of Technology Assessment:

"Technology is not central to the teacher preparation experience in most colleges of education. Consequently, most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice. Most technology instruction in college of education is teaching about technology as a separate subject, not teaching with technology across the curriculum (OTA, 1995. P. 165)."

Colon, Willis, Willis and Austin (1995) reported that in a nationwide survey of recent graduates, the majority did not feel they were well prepared to use technology in their teaching. Technology was also seldom considered in the placement of student teachers, and only a small percentage of student teachers were

required to teach one lesson using technology. Strudler, Quinn, McKinney, and Jones (1995) found low ratings for working with computers during their student teaching experiences. Teacher education curricula need to model appropriate uses of technology, and only then should teachers be expected to develop a good understanding of the potential of technology in the teaching profession (Lambdin, 1996). The 1998 report of SouthEast and Islands Regional Technology Consortium indicates that only 58.8% of colleges that responded to the surveys have a technology plan in their teacher education programs, and 23.9% stated that their states have allocated funding from the state legislature for the technology effort. Computer technology is a relatively new technical invention. Many of our inservice teachers were not trained to use it when they were students. In the meantime, the popularity of the Internet increases. It is crucial to provide relevant and meaningful technology-based learning tools to our teachers, so that computer technology can be fairly evaluated by all teachers and implemented in their curricula. The practical reason for having better technology integration in teacher education general mainstream courses is to evenly distribute the resources and to provide relevant and meaningful learning experiences for pre-service teachers to model. These experiences can reinforce academic content, enhance higher-order of thinking skills, and build character. In addition, pre-service teachers as students can adopt and adapt their experiences in their own future teaching.

Pre-service Teacher and Teacher Education

There is growing alarm with respect to the overall effectiveness of teacher education programs (Hansen, 1993). Prospective teachers come to the teaching profession with preconceptions of what teaching is all about (Carter, 1990; Feiman-Nemser, 1990; Zeichner & Gore, 1990). Traditional teaching

methods tend to be direct, unidirectional, and rigid. Many researchers believe that teacher education is a weak intervention incapable of overcoming the powerful influence of the teachers' own personal schooling or the impact of experience on the job (Feiman-Nemser, 1990; Evertson, 1990, Tyson, 1994). For example, in one research study (Tyson, 1994), student teachers were simply required to memorize content to demonstrate their learning and the effectiveness of their teaching. As a result of their student teaching experience, they would become authoritarian, less flexible, less empathic with students, and more rigid in their classroom performance. Part of the problem, of course, is the brevity of most teacher education programs. Typically they are expected to "rear" competent and mature teachers in an extraordinarily brief period of time - junior and senior school years. Such expectations may be unreasonable. However, there is a great need for teacher education programs to include more specially designed analysis and reflective activities and assignments (i.e. Technology-Assisted-Reflection and structured self-evaluation in journal writing). The short-term goal is to elicit pre-service teachers' reflective and analytical thinking ability. The long-term goal is to improve instruction for the benefit of our future generations as reflective, analytical and life-long learners.

Reflection and Teacher Education

Why is it so important to educate thoughtful, analytical and reflective teachers? Educators, including Dewey (1910), have advocated a more reflective and ethically responsive approach to teacher education. Dewey suggested that pre-service teachers should be encouraged to become thoughtful and alert students of education rather than proficient craftsmen (Dewey, 1904, 1910). Recent trends in teacher education suggest that reflective and ethically responsive approaches are important to the success of

teacher education programs (Schon, 1991; William & Niles, 1987b; Nelson & Smith, 1995).

Studies have found that new experiences like student teaching without clinical analysis/reflection hardly made any impact on the cognitive developmental stage of the pre-service teachers (Sprinthall & Reiman & Thies-Sprinthall, 1993; Oser, Dick & Patry, 1992; Sprinthall, Hall & Gerler, 1992; Sprinthall & Scott 1989; Conrad & Hedin, 1981).

When student teachers were given opportunities to think through the consequences of their actions for others, the results of these studies confirmed that instruction alone was sufficient only for learning rudimentary skills. As Reiman (1999) stated "definition of reflective practice is one that describes a process of problem solving, reconstruction of meaning, and subsequent reflective judgments while persons are engaged in significant new activity " (p.598). Based on these types of reflective thinking elements, learning and cognitive development can occur.

A reflective and ethically responsible curriculum requires that pre-service teachers are able to understand and internalize the process of reflective thinking. To succeed, pre-service teachers will need some encouragement and assistance to look into reasons behind the theory and practice, and the implications for their decisions and behaviors for educating qualified teachers. It is common in teacher education programs for students to be required to maintain a self-reflection journal (Raymond & Santos, 1995) or clinical analysis/reflection and structured self-evaluation journals (Reiman, 1999); this provides a record for the evaluation of progress and gives student a chance to practice meta cognitive processes (Piburn & Middleton, 1997) and allow pre-service teachers to demonstrate a capacity to analyze the

process of what they are doing and to reconstruct their professional and personal knowledge schemes while continuously making alternatives or judgments to adapt their actions to best matches the needs of individual students (Reiman, 1999). In addition to these reflective components, social issues and discussions were added to this study as characteristics of reflective practice to promote pre-service student cognitive and moral development through the analysis of the social problems in the areas that related to students and classrooms.

However, studies by Thomas, Clift and Sugimoto (1996) and Piburn and Middleton (1997) found that journal writing is distasteful to instructors who too often found few noteworthy results, therefore turned away from writing journals as a classroom activity. As an alternative, some educators have adopted electronic journals as a means to facilitate reflection. The investigator wanted to explore this area in a clinical analysis and structured self-evaluation journal writing environment using Technology-Assisted-Reflection to evaluate the effect of promoting cognitive and ethical development.

Will it be too late for teacher education programs to promote growth and ethical development for college students? We cannot stop wondering about the effect of promoting the conceptual and ethical growth of college students. This will be discussed in the next session.

Conceptual/Ethical Growth and Education

Researchers have shown that teachers' conceptual and moral levels are positively related to their teaching ability. Higher stages of cognitive development predict performance in complex tasks (Sprinthall & Reiman & Thies-Sprinthall, 1993; Miller, 1981; Holloway & Wampold, 1986). Teachers who possess a more

complex conceptual level have a greater ability to "read and flex" with pupils, to take the perspective of others, and to think and seek alternative solutions (O'Keefe & Johnston, 1989; Van Manen, 1991). Thoma (1994) compared the effect size of interventions on different age/educational levels and found that treatment effects were more powerful for adults (.61), followed by college students (.28), senior high school students (.23), and junior high school students (.22). Kohlberg (1969) and Rest (1986) also reported that most adults function at the midpoint of their moral scales, as well between stage 3 (social conformity) and stage 4 (law and duty). Standard academic instruction has a marginal effect upon moral stage (Rest, 1986) and conceptual development (Schmidt and Davidson, 1983; Sprinthall, Reiman & Thies-Sprinthall, 1993). These studies suggest that a successful educational intervention can take place later in life, therefore, the conceptual and ethical development of college students could possibly be enhanced through an appropriate intervention in a teacher education program.

Guided clinical analysis and reflective thinking have been major emphases in the course of ECI205 - Introduction to Teaching Humanities and Social Sciences at North Carolina State University. During their course work, student teachers write structured self-evaluation journals, and maintain field notes of their clinical analysis/reflections of activities, theories, current issues and classroom practices. The techniques, which elicit and enhance pre-service teachers' reflective thinking, are very important to the overall effectiveness of the program and studies have been conducted which have empirically shown that pre-service teacher instructional skills and conceptual/ethics development are promoted through careful guided and differentiated clinical analysis/reflection (Reiman & Parramore, 1993; Watson, 1994). Watson (1994) studied the curriculum in 1994. The purpose of her study was to investigate the effects of the intensive written

clinical analysis and differentiated reflection model on pre-service teachers' concerns, conceptual development, and moral development. As such, it mirrors the proposed treatment of this study except that it did not include Technology-Assisted-Reflection interaction. As well, no social issues were introduced to the students in the prior study. The quasi-experimental study showed significant positive gains in all three domains, concerns, conceptual (.10), and moral development (.10). The alpha was set at .10 due to the exploratory nature of the intervention. Similarly, the Reiman and Parramore study (1993) examined the role of new field experiences and intensive differentiated reflection on pre-service teachers. Cognitive-developmental theory served as the guiding framework for this quasi-experimental study. Once again, pre-service teachers showed significant gains in moral development. Non-significant gains were measured for conceptual level. Concerns of students were not assessed. These two studies showed important effects for students in pre-service teacher education, and served as an important backdrop for the present study.

Some of the techniques that have been adopted by instructors in ECI205 to elicit clinical analysis/reflection of pre-service teachers, are classroom participation, group discussion, clinical analysis/reflection of classroom practice of journal writing, and structured self-evaluation. However, the potential of word processing software has not been explored. Through the use of word processing, clinical analysis/reflection in journal writing and structured self-evaluation could be adapted from thinking on paper, to thinking on the monitor or keyboard. There is considerable published evidence (Zinser, 1983; Murray, 1985; Stillman, 1985) that expert writers are able to reflect on their composition processes at the keyboard. These same authors have inquired into the way in which word processing might change the nature of the process. The report of SouthEast and Islands Regional Technology Consortium (1998) indicated that 93.2% of faculty members use word

processing to deliver instruction in their teaching methods courses. Unfortunately, the high percentage of word processing use tends to be more oriented toward productivity than learning and instructional tasks. The goal of this intervention is to employ technology assisted clinical analysis/reflection in journal writing and structured self-evaluation to help the pre-service teachers learn new ideas, new knowledge, beliefs and values, and develop ethically.

Through the intervention, it is hoped that students can develop higher-order thinking skills and become better critical thinkers and reflective teachers throughout their profession. The emergence of new technologies, such as telecommunications, Listserv, E-mail and electronic forms via Internet, have presented new challenges and opportunities to teacher education programs.

Universities need to take the leading role in using technology to prepare teachers who in turn will prepare our students to be successful in the future. A challenge for teacher education faculty is to understand the complexity in the world, but still take the responsibility to educate qualified teachers to be able to think reflectively and model this in their teaching. With developments in technology, it is time for us to take a new look at integrating technology into our teacher education programs. However, questions remain with respect to the possibility of promoting conceptual and ethical growth through the use of technology and in-depth clinical analysis/reflection.

Technology, Reflection, and Teacher Education

Traditional

When the chalkboard was introduced to the classroom in the 1800s, many teachers ignored it. Training manuals with step-by-step instructions had to be prepared for teachers to follow. In

the early 1900s, students could view three-dimensional photographs. Visual images in filmstrip projectors, overhead projectors and motion pictures were introduced into classrooms in the 1910s. Television was introduced as a possible method of handling teacher shortages caused by the baby boom in 1950s (Ryan & Cooper, 1998.) When microcomputers became affordable in 1980s, instructional software was limited to mainly drill and practice programs in Computer-Assisted-Instruction (CAI). Meta studies (Kulik, 1983; Kulik & Shwalb, 1985; Kulik & Kulik, 1986, 1987, 1991) indicated that using computers was effective in areas of: improving students' achievement at all levels of schooling; improving students' achievement from the most to least in respective sequence from elementary, secondary and then college levels; improving students' attitudes toward subject matter, instruction, and computer technology; and saving instructional time. In 1990s the use of technology in the classroom is gaining increased attention as the price of computers goes down and the popularity of computers goes up.

Technology in the Information Age

By 1996, over thirty million computers were connected to the Internet in the United States (Ilandoli & Norris, 1997). The Secretary of Education, Dr. Riley, in his "State of American Education" address (February 1997) advocated the importance of using Internet technology for education. Many studies have explored the use of computer-mediated communication, such as E-mail, electronic forms, and Listserv through the Internet. In these applications students can participate and share experiences, in a one-to-many dialogue or discussion format 24 hours a day. This is different from the traditional environment in which students interact with instructors or peers in regular classes. In traditional communication, conversations after class

are communicated through telephone calls or during instructors' office hours.

The Internet

The Internet has been widely described as being representative of democratic principles because of its availability, ease of use, and the ways in which it levels the field of communication (McEwan, 1996). Technology has also changed the communication process and the relationships between students, instructors and their learning environments. Fey (1993) found that an electronic environment where responses were shared with greater ease, led students to more powerful learning than a traditional classroom. Hirokawa and Garside (1995) suggested that students might be more inclined to respond to class materials through this medium, and more student-faculty interactions would be evidenced than through office visits. It might also minimize or remove some of the potential restraints, such as physical or personality distractions that negatively affect face-to-face communication (Crawford, 1994).

Pedias and Horton (1996) have tried to implement technology into Teacher Education. They suggested that future teachers need to learn the use of technology in a new, innovative and meaningful way to maximize learning. However, the innovative method mentioned above was limited to multimedia and presentation software development, such as Power Point and Astound.

Electronic Forms

Processing data through the Internet is interactive in nature. To process data, HyperText Markup Language (HTML) is used to compose a webpage for setting the questions and defining the area for answers. Next, a script is needed to collect and direct

the typed data to E-mail account(s). For this study, Perl scripts were used to develop programs that processed students' typed information. It is an interpreted programming language. It is very useful for manipulating text data. Any text editor (e.g. SimpleText, BBEdit, MS Word, and EditIt) can be used to prepare a text file containing the program source. Source files should be compiled and stored in the binary directory of the HTTP server, otherwise, an error will occur and typed data will not be transmitted. Using electronic forms written through Perl scripts for educational research is limited.

Electronic-mail (E-mail)

Four characteristics of electronic mail that make it useful for communication and survey research (Sproull, 1986; Thach, 1995) are: (1) Speed - messages can be transmitted in seconds to any location in the world, depending on the scope of the network; (2) Asynchronous Communication - messages can be sent, read and replied to at the convenience of the user, people can take their time to think about their response and answer when ready; (3) No Intermediaries - the message is generally only read by the receiver; (4) Ephemerality - messages appear on the screen and can easily be deleted with no trace of a hard copy. Using E-mail in educational settings validates student voices, and engages students in self-disclosure that emphasizes differences.

E-mail can be used for enhancing educational experiences (Varricchio, 1992; Poling, 1994; Garside, 1994). When E-mail is used, some communication barriers tend to disappear (Stahlhut & Hawkes, 1994). Johns' (1994) survey of student attitudes regarding electronic interaction with faculty confirmed that E-mail was an acceptable alternative to face-to-face communication. The total number of E-mails generated has been rising since technology started being used in classrooms (McIntyre, 1995),

although there is no direct evidence that E-mail provides an effective method of clinical analysis/reflection, some researchers agree that electronic journals and tele-communication can be used as a means to facilitate reflection (Thomas, Clift and Sugimoto, 1996; Audet, Hickman & Dobrynina, 1996).

Listserv

Listserv originated with an electronic mail service called BITNET, which uses a computer program to maintain electronic mailing lists. Users can subscribe to any electronic mail address to receive and send messages. The responses that are sent to the Listserv are delivered to all of the members who belong to the service. Some studies have been done using Listserv (Burke 1994; Beacham & Kester, 1994), but in these studies, there was no evaluation of the effectiveness of using this technology to assist clinical analysis/reflection for pre-service teachers.

National Trend

In the United States, the national trend toward improving the ability of teachers to use technology in the classroom is evident. In the report Preparing for the 21st Century Classroom Teacher by The Task Force of National Council for Accreditation of Teacher Education (NCATE), three broad categories of recommendations concerning the use of technology in teacher preparation were developed:

1. stimulating effective use of technology in teacher preparation;
2. improving the accreditation process; and
3. improving NCATE's operations through technology.

The report points out the importance of technical skills and knowledge that the new professional teacher needs to acquire during pre-service teacher preparation. The International Society for Technology in Education (ISTE) also promotes appropriate uses of technology to support and improve teaching and learning. The Secretary of Education, Dr. Riley, in his "State of American Education" address (February 1997) advocated the importance of using Internet technology for education. He stated "we simply can't leave any child behind in this information age." Preparing new teachers to use technology effectively began to receive attention in several states in the US. In the State of North Carolina, the Board of Education has adopted a position calling for formal assessment, revision and improvement of the technology competencies for educators, and establishment of assessments. The recent requirement from the North Carolina Department of Public Instruction (NCDPI) (<http://www.dpi.state.nc.us/>) is for the new licensures to produce a technology portfolio before graduation from the teacher education program. In addition, at the middle school level, the Computer Skills Competency Test is now administered to all eighth grade students. Beginning with the high school class of 2001, all students will be required to pass this examination in order to receive their high school diplomas. These actions demonstrate the determination of administrators to integrate technology into K-12 education in the United States. The commitment from federal, state and private organizations toward integrating technology into education is evident.

It is clear that managing a complex classroom experience requires higher order interactions, human ability, and the complexity of a high conceptual level. These dispositions determine how deeply a person can perceive, reflect, and analyze a situation. The current vogue in teacher education is to focus on developing reflective practitioners (Sprinthall, Reiman & Thies-Sprinthall, 1993; Cruickshank & Metcalf, 1990; Schon, 1987;

Zeichner & Liston, 1987). However, programs may fail if interventions are not tailored to each individual student's learning and developmental needs. In addition, for students and faculty, this requires a learning environment that includes Internet technology; access to the world through E-mail and Listserv; and the ability to access text, graphics and software online. Thus, it may become the responsibility of teacher education programs to appropriately and effectively integrate these resources into the curricula.

If pre-service teachers can become knowledgeable and skilled in using the vast resources that today's technology offers, then Teacher Education programs must provide adequate teacher training at the pre-service level. They can then build confidence in themselves to apply technology to classroom instruction (Hirschbuhl & Bishop, 1996; Pedias, et al. 1996). Universities should provide a reasonable foundation at the pre-service level so that prospective teachers can learn about and evaluate the use of instructional technologies. Also, pre-service teachers need to gain competence in "how to apply" technology to teaching and learning activities that take place in classrooms.

Research Questions

This study represents an effort to integrate existing technologies into the course in ECI205 - Introduction into Teaching in Humanities and Social Sciences for pre-service teachers in Middle School Language Art and Social Studies and Secondary English Education and Social Studies covering students' field notes, journals, and online discussions. Students will use technology to assist their process of clinical analysis/reflection and structured self-evaluation throughout a semester. By providing reflective thinking opportunities, pre-service teachers can consider and acknowledge multiple

perspectives through Internet discussion. The ability to take more than one viewpoint into account when making decisions might facilitate the development of reflective judgment that stimulates critical reflection (King & Kitchener, 1990) and may be a milestone of "wisdom in practice" (Arlin, 1993). Such an intervention essentially raises several questions for the study:

1. Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in cognitive development than the Control Groups that used a traditional teaching method?
2. Did students with minors in the Experimental Group have greater gains in cognitive development than students with minors in the Control Groups that used a traditional teaching method?
3. Did students with post-bachelor degrees in the Experimental Group have greater gains in cognitive development than students with post-bachelor degree in the Control Groups that used a traditional teaching method?
4. Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in moral development than the Control Groups who used the traditional teaching method?
5. Did students with minors in the Experimental Group have greater gains in moral development than students with minors in the Control Groups that used a traditional teaching method?
6. Did students with post-bachelor degrees in the Experimental Group have greater gains in moral development than students with post-bachelor degrees in the Control Groups that used a traditional teaching method?
7. Did the various levels of stages of concern in the Experimental Group of Technology-Assisted-Reflection differ from the levels in the Control Groups that used the traditional teaching method?

Summary

The responsibility of educators is to provide pre-service teachers with an information rich environment that reflects the real world. It is our hope to maximize students' motivation and enhance their cognitive and moral development through the use of technology. The next chapter is a review of the literature, which will give theoretical support in the areas of conceptual, moral development and concerns for the use of technology.

Human development is a complex and slow process. Higher stages of cognitive development predict performance in complex tasks. Teachers' conceptual and moral levels are positively related to their teaching ability, to take the perspective of others and to think about alternative solutions (O'Keefe & Johnston, 1989; Van Manen, 1991). Hence, it is essential to elicit pre-service teachers' cognitive and moral growth through their coursework, as well as through providing a supportive environment and qualified instructors. Chapter 2 contains a literature review and a discussion of theories that were adapted to support the study.

Chapter 2

Review of Literature

This researcher is interested in examining whether technology can be used as a medium to promote clinical analysis/reflection, cognitive and ethical development through an instructional impetus using Technology-Assisted-Reflection. Most effective learning takes place when knowledge is part of an activity that the learner is experiencing in real life, while creating meaningful outcomes. The role of education is to facilitate those natural inclinations through interactions between biological endowment and the environment.

Reflective teaching is adopted to the pre-service teaching program under the assumption that clinical analysis/reflection leads to more effective practice and might lead to more ethical and critical approaches to one's professional work (Oser, Dick & Patry, 1992; Van Manen, 1991). However, a review of the literature indicates that the goal of developing more reflective teachers who act effectively and responsibly is unrealized due to the lack of theory and of testing (Copeland & Birmingham, 1993). Therefore, the identification of relevant theory and the creation and testing of interventions that can appropriately guide the development of reflection are important. This chapter will present a review of research in seven broad areas: (1) cognitive development, (2) social cognition, (3) person-environment interaction, (4) learning and development during the college years, (5) role-taking and clinical analysis/reflection studies in teacher education, (6) concerns theory: computing concerns, (7) and technostress. Theories of Piaget, Vygotsky, Hunt, Perry and King and Kitchener will be discussed to reinforce those guiding principles for cognitive development in the intervention. The five testable conditions, which frame the clinical

analysis/reflective model in growth, are summarized. Theories of Kohlberg and Rest will be used to evaluate moral development and enhance students' moral stage. It is important to draw on developmental theorists to develop and support an intervention in Technology-Assisted-Reflection. This review provides a developmental focus and theoretical framework upon which the study is based.

Will integrating technology into pre-service teacher education promote a qualitative change in students' cognitive and moral development, and concerns for technology adaptation? The research aims to have answers to this question.

Cognitive Development

Cognitive developmental theory is framed by a number of theoretical assumptions. One of these assumptions is that development occurs across a series of partially independent domains. Growth occurs in an invariant sequence from a less complex to a more complex state. Each stage of growth is built upon the preceding stage, therefore, higher stages lead to more complex behavior. A number of theorists and researchers have extended this theory and tested the assumptions. For example, Robbie Case, a Neo-Piagetian, has confirmed the overall developmental assumptions in a provocative set of studies (Case, 1992). While Piaget's theory does not have a direct relationship with this research, other researchers influenced by Piaget and his contributions are noted. Several theories are now summarized.

Jean Piaget

Piaget's stages of cognitive development were a result of the influences of innate factors that included physical structures, maturation, and invariant functions in adaptation and

accommodation. Development inevitably proceeded because of the influence of these innate factors. The nature of the physical world, social world, and disequilibrium prompts the cognitive system to change, to adjust, and to reestablish the equilibrium to reach a higher level of cognitive development. A child can profit from the experience only when the child is ready for it. The child must be able to assimilate the experience into current cognitive structures and accommodate the structure to the experience in order to reach cognitive development, as Piaget called equilibrium.

The driving force for development from Piaget's point of view is maturation. He did not emphasize a changing society or changing physical environment as possible sources of disequilibrium. He tended to see an active organism in a passive environment. A child is actively engaged in the learning process through a complex and ongoing series of interactions, first with physical experience and later with logical mathematical experience (Mann, 1992). Development promotes learning. In brief, development leads learning. Based on clinical observation, Piaget described development as a sequence of distinct stages, each of which would entail important changes in the way a child's thinks, feels and behaves.

One influential notion was Piaget's view that children actively construct their own knowledge. Piaget's view of the direction of cognitive development is that it is goal-directed, unidirectional, and that regression from later to earlier stages does not occur. His theory does not give a good explanation of development for children more than 15 years old. Despite criticisms of Piaget's theory, he influenced the field of developmental psychology to focus on cognition. According to Piaget the stages of development from birth to 15 years of age are: Sensorimotor period (roughly birth - 2 yr.), Preoperational

period (roughly 2 to 7 yr.), Concrete operational period (roughly 7 - 11 yr.), and Formal operational period (roughly 11-15 yr.) With respect to clinical analysis/reflection, the adolescent's thinking is transformed through "powers of reflection - i.e., thoughts which deal critically with his own thinking" (Inhelder & Piaget, 1958, p. 340). The ability to reflect also allows the adolescent to understand "multiple perspectives" and to gain "objectivity which implies both differentiation and coordination of the points of view which have been differentiated" (Inhelder & Piaget, 1958, P. 346).

Social Cognition and Contextualism

In contrast with Piaget, Vygotsky (1978) stated that biological and cultural forces coincided and mingled with one another to affect cognitive development. He chose to concentrate on the environmental or social forces, such as parental guidance, teacher instruction and language. The activities use psychological tools (language systems, counting systems, writing, conventional signs and works of art) and technical tools (axes or plows) and emphasize collaborative activities between child and environment, people use psychological tools to control thought or behavior and use technical tools to control nature. His social/historical theory of cognitive development states that children and adolescents actively construct meaning from social experiences. He emphasized the collaboration of peoples' ideas in the process of interacting in a variety of social and physical contexts.

Adults "build bridges" between children's present ability and new skills. The concept of the zone of proximal development (ZPD) explains what the child is initially able to do together with adults and peers, and what they are able to do independently later. It is a process of the development of a person from a

level of assisted learning to a level of independent performance. Zellerman, Salomon, Globerson, and Givon (1991) defined it as "the zone between what students can already accomplish on their own and what they can accomplish with appropriate help" (p. 376). This type of usage often maximizes the potential for enriching intellectual performance (Salomon, 1991). When adapting the concept of ZPD to computer-based writing, he relates ZPD to "what student writers can accomplish on their own versus what they can accomplish with the assistance of computers" (p. 422). Students develop related skills later, and write without electronic prompting.

Quality of instruction marches ahead of development and leads it. According to Vygotsky (1962), effective instruction can further development. Quality of instruction depends on the instructor's attention to sensitive periods that exists in all subjects. Instruction is an active involvement of all participants and an instructor should bridge the gap between the students' current skill levels and their potential skill level (Driscoll, 1994 & Davydov, 1995). Therefore, instructional technologists must be aware of where their students are in their development (Vygotsky, 1962) within which instruction is more feasible and productive.

Vygotsky's theory is included in the literature review to stress the importance of ZPD while delivering instruction, so that new knowledge will be just beyond students' current preferred system of learning and development. Even though computer programs can be designed to help students reach their potential in their ZPD in many ways, various technologies and methods including guided clinical analysis/reflection and role taking will be adapted to instruction as catalysts for cognitive and moral development for this research. As Tharpe & Gallimore (1988) indicated, when creating a ZPD for instruction there must

be a joint activity that creates a context for the student and teacher to interact so that instructional strategies may be used to enhance learning. The telecommunication in E-mail, Listserv, and NetForum can bridge the social interaction between peers and teachers. This is important because teachers can model the appropriate solution, assist in finding the solution, and monitor the student's progress closely through Technology-Assisted-Reflection. Instruction can then be collaboration between teacher and students, the role of the teacher is to guide, direct and encourage students' activity to promote development.

Language enhances cognition and permits new forms of thinking. Dialogue plays a decisive role in the formation of thought processes (Luria & Yudovich, 1959; Reiman, 1997). Vygotsky recognized that the structure of conversation relates to the structure of thoughts and reasoning. Thought may be a form of unconscious concept, before it is expressed through language. Language is a tool for organizing thinking because it bears the concepts (Moll, 1990). Vygotsky believed that language and thought began independently, then partially merged. He stated: "The relation between thought and word is a living process; thought is born through words. A word devoid of thought is a dead thing and a thought unembodied in words remains a shadow" (Vygotsky, 1986, p.255). Collaboration and dialogue among students lead to mental activity during individual private thoughts. Human beings use language to represent reality. Written clinical analysis/reflective journal writing and structured self-evaluation can be used to elicit and promote growth of cognition and ethics. Vygotsky's principle of language mediating thought directly links to clinical analysis/reflection and the pedagogy of clinical analysis/reflection in journals. Structured self-evaluation can frame language and reflective thinking in new ways, and promote deeper understanding in students (Reiman, 1997). Providing effective means and activities to enhance

students' cognitive development and competence in various domains is crucial in education. It is crucial for teacher education programs to provide various opportunities for promoting the growth of pre-service teachers. The following chart demonstrates a general outline of Piaget and Vygotskys' theories. Table 2.1 displays some major differences between Piaget and Vygotsky as follows:

Table 2.1

Major differences between Piaget and Vygotsky

Piaget	Vygotsky
Driving force - internal (Maturation)	Driving force - external (Social world)
Development leads to growth	Environment leads to growth

Either physical maturation or change in the environment can lead to development. It is also important to look into the learner's characteristics. How such development may be promoted is discussed in the next section.

Person-Environment Interaction

David Hunt's theory of person-environment interaction is based upon Kurt Lewin's (1935) classic formula, $B = f(P, E)$, where behavior (**B**) is a function of the Person (**P**) and the Environment (**E**). Hunt focuses on how educators can stimulate the conceptual development of their students by means of various characteristics of learners and the different environment or intervention. As Dewey (1944, p. 19) noted: "We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference."

Hunt's Conceptual Matching Model (1971) further considers the differential effectiveness of a person's Conceptual Level (CL) and their environment. Hunt believed that students learned best when instruction matches a student's conceptual level (such as, High structure for low CL students and low structure for high CL students). In order to understand the nature of changes, one must consider the educational program in relation to the kind of student. The most effective teachers are those who can assess their students' needs on a continual basis and adjust their teaching methods accordingly (Hunt, 1971, 1981). There are three Conceptual Levels categorized by Hunt.

Low CL students:

They prefer a more structured educational approach based on an external standard. They are concrete thinkers but are incapable of generating their own concepts.

Moderate CL students:

They can have a better tolerance of uncertainties and are more willing to search for answers when solving problems. The ability to generate concepts increases at this stage.

High CL students:

They prefer an unstructured, flexible educational approach. They have high tolerance for ambiguity. They are abstract thinkers, self-regulating, autonomous, and prefer a low structure where they can discover and generate new concepts and knowledge by themselves. They have a greater degree of internal thought and are capable of taking different perspectives.

Hunt's matching model also indicates that the intervention should stimulate one stage above or gradually mismatch a student's current conceptual level to produce the greatest change. Hunt argued that the ultimate aim of an intervention was to increase conceptual level with its associated adaptive capability and flexibility, because "the world will change in ways we can't now foresee" and we should not educate a pupil "for the world he is going to live in." (p. 79), and we should develop a disposition of adaptation and flexibility toward the world's changing dynamics.

The theories from Piaget, Vygotsky and Hunt are discussed in the literature review, because Hunt's match-mismatch model is related to Piaget's cognitive developmental process of equilibrium and disequilibrium and also Vygotsky's zone of proximal development. Matching means "starting where the learner is." Mismatching implies providing additional challenges (Reiman, 1997). For example, when guided clinical analysis/reflection is used in clinical analysis or journal writing, instructors must skillfully match and mismatch in accordance with a student's current preferred system of learning. When a situation is presented with challenges to a student's current developmental stage, the student is in a state of disequilibrium. If the challenge is a level higher than the student's current developmental stage within the ZPD, the student will reach the state of equilibrium, that is the stage in which the student can function without the assistance of teachers or peers.

The theorist, William Perry, studied the cognitive development of college students. Since the target group of this research is college students and the indication of cognitive growth in college students, it is important to study and understand Perry's research.

Cognitive Development for College Students

William Perry

Perry conducted research in order to understand how college students respond to the pluralistic intellectual and social environments of the university in the early 1950s at Harvard University. He used 97 open-ended interview questions to encourage students to express what was salient in their experience in their own words, and to avoid dictating the structure of the response. Based on these interviews, a scheme of intellectual and ethical development that included a sequence of nine positions was outlined and clustered into four sequential categories: dualism, multiplicity, relativism and commitment. Not until the final version of Perry's study was being completed (Perry, 1970, pp. 204-206), did he and his group become aware of the contemporaneous research of Hunt or Piaget. Perry described cognitive development in terms of "positions" rather than "stages," as a way to indicate the "central tendency" of an individual's thinking, while recognizing that students employ "a range of cognitive structures" and frequently apply different cognitive structures in different areas of their lives (1970, pp. 47-48). The positions appear to represent an invariant sequence of hierarchically integrated structures and his contribution is the description of a much more detailed account of the process of cognitive development of college students. Perry's four major categories of Cognitive Development for College Students are listed below:

Dualism

Experiences are categorized as dualistic, absolutist, right and wrong view of the world (Hofer & Pintrich, 1997). Teachers are represented as authority figures whose job is to transmit facts to students. Dualistic students pay less

attention to theory and abstract concepts. They believe that a direct correlation should exist between the amount of time they spend studying and their grade (Mann, 1992).

Multiplicity

As students shift to this level, there is the beginning recognition of diversity and uncertainty. Students view the presentation of alternative problem-solving approaches or conflicting interpretations as the authority figure's methods for enhancing the learning process (Mann, 1992). Students tend to think that every person has a right to his or her own opinion and all views are equally valid.

Relativism

This level represents another qualitative shift or change of perception about self. Self is an active maker of meaning. Knowledge is perceived as relative, contingent and contextual. Individuals also begin to realize that there is a need to choose and affirm their own commitments (Hofer & Pintrich, 1997). They tolerate a variety of beliefs and opinions and evaluate different views using logic, reason, or other types of evidence (Mann, 1992).

Commitment

As the most complex level uncovered by Perry, individuals make and affirm commitments to values, careers, relationships and personal identity. Although it is proposed as a part of Perry's model, it is not commonly found among college students (Hofer & Pintrich, 1997).

Piaget's concepts of assimilation and accommodation were adopted by Perry in explaining college students' epistemological change from one position to another (Mann, 1992). As college students experience the pluralistic environment around them, their interactions with diverse opinions of peers, instructors and alternative approaches that are generated through the curriculum challenge their dualistic perceptions. As students try to resolve the conflict resulting from new experiences that challenge their old ways of thinking (assimilation), they gradually transform these same structures (accommodation) (Perry, 1970, p. 42). Perry was the first to suggest that how college students made meaning of their educational experiences was not a reflection of personality, but an evolving developmental process (Hofer & Pintrich, 1997).

Since Perry reported his findings, many researchers have tried to design programs or models that foster the development of college students in accordance with the general developmental scheme set forth by Perry and his colleagues, such as the Reflective Judgement Interview (RJI) by King and Kitchener (1994, 1981). The RJI was designed to investigate the thinking and reasoning process using ill-structured problems. Because King and Kitchener's work includes strong construct validity as well as longitudinal and cross-sectional data, it is singled out for review and their concept will be adapted in the qualitative portion of this study.

King and Kitchener

The review of Kitchener and King is extensive due to its importance to the construct validity of the proposed intervention. The work by King and Kitchener (1994) was based upon the research of Perry (1970) and the ideas of Dewey (1933), especially Dewey's astute observation that uncertainty was a

characteristic of the search for knowledge (King & Kitchener, 1994). Similar to Kurt Lewin's (1935) classic formula, $B = f(P, E)$, where (**B**) is a function of the Person (**P**) and the Environment (**E**), the development of reflective judgement is the outcome of an interaction between the individual's conceptual skills and environment that promotes or inhibits the acquisition of skills (King & Kitchener, 1994). Its mechanisms of developmental changes are Piagetian; the assumption about knowledge is that it develops through the assimilation and accommodation of existing cognitive structure as the individual interacts with the new environment (Hofer & Pintrich, 1997). King and Kitchener claimed that the stages in their Reflective Judgement Model (RJM) are organized according to cognitive-developmental assumptions. Each stage represents a distinct level of reasoning, growth in an invariant sequence, and the prior stage appears to lay the groundwork for movement to the subsequent stage.

Adapting the work by Fischer (1980) in explaining how development occurs between stages, the Reflective Judgment Model (RJM) suggests that there is a gradual process in development. There are both optimal and functional levels of development for individuals. The difference between them is the individual's development range (Lamborn & Fischer, 1988). The Reflective Judgment Interview (RJI) uses interviews of individuals to determine reflective judgement reasoning. King and Kitchener noted that the interview clarifies the functional level of reasoning, furthermore, the questioning prompts for the interviewee were developed as a means of tapping the interviewee's optimal level of cognition (Kitchener et al, 1993, Hofer & Pintrich, 1997). Table 2.2. contains the Reflective Judgment Interview (RJI) Questioning probes:

Table 2.2.

Reflective Judgment Interview Questioning Probes

Questions	Purpose of questions
What do you think about the statement?	To share the initial reaction to the problem presented from the interviewee.
How did you come to hold that point of view?	To find out how the respondent arrived at the point of view, and whether and how it has evolved from other positions on the issue.
On what do you base that point of view?	To find out about the basis of the interviewee's point of view. This will provide information about the concept of the justification of the interviewee.
Can you ever know for sure that your position on the issue is correct? How or Why not?	To find out the assumptions concerning the certainty of knowledge about the interviewee.
When two people differ about matters such as this, is it the case that one opinion is right and one is wrong?	To find out how the respondent assesses the adequacy of alternative interpretations; To see if the interviewee holds a dichotomous either/or view of the issue; To allow the interviewee to give criteria by which she or he evaluates the adequacy of arguments.
How is it possible that people have such different points of view about this subject?	To elicit comments about the interviewee's understanding of differences in perspectives and opinions
How is it possible that experts in the field disagree about this subject?	To elicit comments about the interviewee's understanding of how he or she uses the point of view of an expert or authority in making decisions about controversial issues.

King and Kitchener's RJI (1994) suggested that more abrupt developmental spurts might be observed when the environmental

context supports high-level performance (such as providing an opportunity for practice, and guided clinical analysis/reflection) but that more continuous development is observed when the environment is not as supportive (Kitchener, Lynch, Fischer and Wood, 1993). This has important implications for college students who cannot understand or comprehend concepts beyond the optimal level, and it is very important for educators to understand that students need practice and feedback about their learning. Students probably would not learn as much as educators planned for them without these provisions. It is also essential that teachers consider each student's developmental range, their current stage (functional level), and the more advanced stage (optimal level) at which they might be able to function with sustained support, challenge, and guided clinical analysis/reflection.

The RJI was developed in the late 1970s. It consists of seven different qualitative stages that describe how individuals perceive and reason about problems. The focus for each of the RJI stages is on both the individual's conception of the nature of the knowledge and the process of justification for knowledge. The model has three general levels identified as pre-reflective, quasi-reflective and reflective (Hofer & Pintrich, 1997; King & Kitchener 1994) (See Table 2.3).

Kitchener and King (1994) further defined that reflective thinking relates to the structure of problems on which thinking is focused. Kitchener and King's (1994) focus was not on well-structured problems, but rather in the ill-structured domain. From ill-structured problems, students can learn to construct and defend reasonable solutions for the problem. The solving of a well-structured problem in which students simply learn to reason to correct a solution is not a higher-order of thinking process. Examples of ill-structured problems within the RJI framework

include how the pyramids were built, the safety of chemical additives in food, the objectivity of news reporting and the issues of creation and evolution. Table 2.3 represents the Stages of the Reflective Judgment Interview (RJI).

Table 2.3.

Stages of the Reflective Judgment Interview (RJI)

Name of Levels	Stages	General Outline
Pre-reflective	1	Individual can not perceive that problem(s) may exist without correct answer.
	2	
	3	
Stage 1:		
Knowledge is simple, concrete and absolute and needs no justification. There is a one-on-one correspondence between what one sees and believes.		
Stage 2:		
Knowledge is obtained by authority figures or in direct observation. This stage is similar to Perry's dualism.		
Stage 3:		
Recognition of temporary uncertainty that authority may not have the truth and it allows for judgements based on personal opinion.		
Quasi-reflective	4	One starts realizing that one cannot know with certainty.
	5	

Stage 4:

The nature and justification of knowledge are perceived as abstraction and not well differentiated. Individuals in this stage think that each person is entitled to her or his own opinion. This stage is similar to Perry's multiplicity.

Stage 5:

"What is known is always limited by the perception of the knower" (King & Kitchener, 1994, p. 62). Individuals are capable of relating two abstractions and can relate evidence and arguments to knowing, however, the ability to coordinate these into a well-reasoned argument is not present yet. This stage is similar to Perry's relativism.

Reflective	6 7	Knowledge is actively constructed and must be understood contextually. Judgements are opened for reevaluation.
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Stage 6:

Knowledge is uncertain and contextual, but at this stage, it is possible for individual to coordinate knowing and justification to draw conclusions across perspectives. Authority figures can be critically evaluated.

Stage 7:

Thinking is marked by the use of critical inquiry and probabilistic justification to guide knowledge construction. Individuals are able to determine that some judgements are more reasonable or valid than others are, but with an awareness that all conclusion may be reevaluated.

It is important for pre-service teachers to engage in reflective/analytical thinking and make reflective judgements while in school, therefore, it is the responsibility of educators in higher education to facilitate and promote pre-service teachers' thinking processes (LaBoskey, 1994; King & Kitchener, 1994). Few educators have affirmed the role of clinical analysis/reflection on ill-structured problems. For example, Brookfield (1987, p.13) stated that critical clinical analysis/reflection was intended to help pre-service teachers

develop the habit of mind in which "change is regarded as the fundamental reality. Forms and structures are perceived as temporary. Relationships are held to involve developmental transformations and openness is welcomed." Shulman (1986) stated that the "wisdom of practice" in the teaching profession was to exercise good judgement in the presence of enormously complex and ill-structured problem situations. Harrington (1992) stated that unless teachers become critically reflective it is unlikely that they will become effective life-long learners committed to an ongoing critique of educational systems. Teachers must be capable, willing, and committed to questioning systems, not only as they are, but also as they could be. Teachers need to become active contributing members of a democratic society who are able to provide an equitable and quality education for all students (Bowers, 1987; Brookfield, 1987; Harrington, 1992; Mezirow, 1991). Griffin (1987) in a seminal study of teacher education pointed out that not only should programs be collaborative and developmental, but also analytical and reflective. Likewise, Arlin (1993) studied the post-formal operational stage of adults and found that "wisdom of practice" traits for adults included good judgment about difficult and uncertain matters of life. Teacher education programs should take the responsibility to educate student teachers as just, caring, critical and analytical thinkers and citizens, so that they can become not only life-long learners, but active and contributing members of this increasingly technologically oriented democratic society (Harrington, 1992).

What is the cognitive stage of college students in RJI? King & Kitchener (1994) indicated that first year college students have typically scored just above 3.5 on the RJI. A study by Kitchener, Lynch, Fisher and Wood (1993) indicated that the functional level of college students is between stage 3 and 4 with a possibility of

only half a stage of cognitive development in a four-year college study.

Eight ill-structured social issues in educational settings were designed with the questioning prompts for the study (See Appendix K). The eight issues chosen were in areas of safety, gender, crime, technology, hate crime, environment, race and the classrooms. These were chosen to expose students to the types of issues that could be encountered by every classroom teacher. Can these social issue curricula promote students' cognitive and moral growth? A study by Kitchener and King (1985) stated that the average scores on discipline-specific problems have been almost identical to the scores earned by the same participants on the standard RJI problems (p. 118), in addition Hayes (1981) compared scores on two standard RJI problems with scores on problems familiar to education students and found no substantial differences among them. King & Kitchener (1994, p. 25) stated the correlation between individuals' responses to different problems are generally moderate to high, and familiarity with content has only minimally affected Reflective Judgment scores. It was suggested that RJI taps students' underlying assumptions about knowledge, not the assumptions they hold about a specific discipline. Therefore, we integrated the eight social issues in educational settings into the curriculum for the study. It is our hope to promote clinical analysis/reflection of our pre-service teachers and to elicit their cognitive and ethical development through the use of technology.

Due to the short-term intervention and the slow growth in human cognitive development, the results from the social issues were used for qualitative analyses only.

Moral Development

A person's stage of moral development is related to his or her moral behavior. It is the individual who determines right and wrong (Kohlberg, 1965). Kohlberg posited a progression through an invariant sequence of six stages (Pressley, 1995 & Rest, 1986). (See Table 2.4). Based on Kohlberg's theory of moral reasoning, Rest developed the "Defining Issues Test" (DIT). It uses the six stages from Kohlberg, and can be group administered and scored by computer. There are six moral dilemmas (Appendix E), each dilemma contains 12 items. Individuals evaluate each item and rate it on its importance. Then individuals rank items as the Most, Second, Third and Fourth most important. Each of the 12 issues has a predefined scale based on the rank given by individuals. The four most important items are assigned a score of 4, 3, 2, or 1. Scores are then added and multiplied by .6 to get a percentage score. The percentage score is used for comparison to other group averages to identify an individual's moral stage. The assumptions are that people define the most important issue of each dilemma in different ways, and that the selection of items indicates an individual's moral development. Table 2.4 represents the Six Moral Stages by Kohlberg.

Table 2.4.

Six Moral Stages by Kohlberg

Name of Stage	Stages	General Outline
Pre conventional Morality	1, 2	Thinking is not acceptable to most adults.

Stage 1: Obedience: "You do what you're told." Being good is being obedient to the demands of superior others.

Stage 2: Instrumental Egoism and Simple Exchange: "let's make a deal." Individuals are self-centered beings. Cooperation becomes the simple exchange for favors. Fairness is coming through with your side of bargain.

Conventional Morality	3, 4	Most typically observed in adults' thought.
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Stage 3: Interpersonal Concordance: "Be considerate, nice and kind, and you'll get along with people." Human interaction involves loyalty, gratitude and mutual caring, reciprocal for each other, the ability to take other people's point of view. Cooperation is reserved for allies and friends.

Stage 4: Law and Duty to Social Order: "Everyone in society is obligated and protected by the law." Cooperation is the scheme for the society. Society can be governed by diverse systems of law. The principles determine, regulate and criticize the law and role systems that a society might have.

Post-conventional Morality (Principled Level)	5, 6	Can be reached by some adults, but not all.
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Stage 5: Societal consensus: "You are obligated by whatever arrangements are agreed to by due process procedures."

Stage 6: Non arbitrary social cooperation: "How rational and impartial people would organize cooperation is moral."

Kohlberg was still working on stage 6 at the time of his death. However, he thought that stage 6 occurred so rarely that it was better to not score anybody for inter-judge reliability. These stages are combined as principle stage.

There have been over 1000 studies conducted in four different countries using the DIT. Approximately 50 new DIT studies are generated every year. The predisposed DIT was moderately correlated with other developmental variables by Perry and Hunt (Rest, 1986). Based on a ten-year longitudinal study of

the DIT reported by Rest (1986), moral judgment can be increased with age and education. Education is the most powerful predictor of moral development. McNeel found that college experience was very effective in promoting DIT gains. One reason is that the college environment is stimulating and reinforcing to an individual's development (Rest, 1986). A ten year longitudinal study of 102 subjects with varying amounts of college experience found that students who had 4 years or more of college continued to an increase in DIT scores, followed by groups with 2 or 3 years of college, and then no college or less than 2 years (Rest, 1979). Studies also looked into DIT scores and college majors (i.e. between Arts & Sciences students and Engineering students) (Rest, 1986). The results were inconclusive, because different curricula might not account for the impact of moral judgment, however, the difference between students who have only majors and students who have both majors and minors within the same curriculum was not discussed.

What is the relationship between moral reasoning and behavior in college students? McNamee (1997) believed that the higher the students' moral stages were, the more the students act in principled ways. Rest and Naenaez (1994) found the higher the Principle-score (P-score) in teacher's moral reasoning and discipline, the more tolerant and democratic teachers become. The higher the P-score in teacher's moral reasoning and relationship with students, the higher the P-score in teacher's moral reasoning and understanding of educational concepts. The higher the P-score in teacher's moral reasoning and teaching performance, the more reflective and interactive teachers become. In the relationship between developmental stage and behavior for teachers in complex situations, Miller (1981) discovered that at higher conceptual levels teachers were more effective in teaching strategies, more empathic, and more willing to innovate.

Therefore, it is important to enhance pre-service teachers' moral and cognitive growth.

How can Technology-Assisted-Reflection promote moral reasoning? Studies using the DIT have shown an increase in moral judgment when students were exposed to experimental procedures in discussing moral dilemmas, but the DIT has shown no increase when no dilemmas or social issues were introduced. Simply talking about the theory or philosophy of ethics appears to make little difference (Thoma,1994). An intervention studied by Mischel & Mischel (1976) used undergraduates aged from 17 to 44 with 73 enrolled in sections of the ethics course and 28 enrolled in sections of logic course. He found that DIT scores for the students in the ethics course who analyzed moral situations increased more on the DIT than for students in the logic course who emphasized formal thoughts and abstract symbols.

Jones (1997) stated that a "teachable moment is simply an occasion in working with technical content when an ethics or value can be introduced and fit the technical details like a glove." Ethics and values have been successfully integrated into various courses, such as in business, technology, English, and the social sciences. Educators should infuse educational issues of ethics and values in the use of technology, especially when these issues arise naturally from course content or current issues. How can we integrate "teachable moments" into teacher education? Head (1994) suggested using ethical dilemmas that involve high enough "stakes" and access to deep developmental structures, while also being as true-to-life as possible.

This study developed eight social issues (See Appendix K) in the areas of safety, gender, crime, technology, hate crime, race, and the classroom to expose students to the issues that could be encountered by every classroom teacher. These issues had

two parts; one contained the problem situation and the other contained scenarios in educational settings. These social issues were designed to tap into students' deep thinking/analytical structures in the ill-structured problems format. The ill-structured problem format leads to no fixed or correct answers to the problems, but helps to promote students' thinking/analytical processes to a higher level. In addition, these social issues in educational settings were to familiarize pre-service teachers with social issues that they might be facing in their future classrooms.

The study also used the Internet to conduct group discussions of these issues as well as individual clinical analysis/reflection of these issues on paper. Conducting democratic discussions that were not authoritarian or dictatorial could potentially promote empathy and elicit views with multiple perspectives among students and the instructor. Human beings can grow in a positive and supportive environment. It is necessary for teacher education to provide every opportunity to promote pre-service teachers' understanding in various aspects of morality and moral actions.

The terms "morality" and "ethics" are used interchangeably in the study. As Rest and Narvaez (1994) stated "Various authors have proposed distinctions, but there does not seem to be one, generally accepted distinction." (p. xi)

To effectively elicit students' cognitive and moral growth, role taking and clinical analysis/reflection are two important methods. They will be discussed below.

Role taking and Reflection Studies in Teacher Education

In the George Herbert Mead (1934) concept, social role taking could promote human moral/ethical development. More recently, investigators have applied and tested Mead's theory by examining how deliberate interventions could positively affect moral and conceptual stage reasoning (Sprinthall, 1980; Sprinthall, Reiman & Thies-Sprinthall, 1993). Role taking experiences involve any human complex helping experience, which require the assumption of new responsibilities and intellectual growth elicited from the experience. Examples of new roles include teaching assistant, tutoring, and mentoring roles. In studies with young children, Selman (1980) found that role taking could be a bridge, and a necessary condition leading to conceptual and moral stage growth.

Clinical Analysis/Reflection is also very important to cognitive-developmental stage growth (Reiman, 1988). It assists an individual in making meaning from an experience and can take the form of journal writing and discussion on the role-taking experience in promoting the cognitive growth. As the research suggests, when a new experience involves "helping others and taking the perspective of others," it becomes a very powerful, complex, and growth-promoting activity. It can promote learning and development across a variety of professions, as well as a variety of interpersonal and intrapersonal domains (Oja & Sprinthall, 1978; Peace, 1992; Reiman & Thies-Sprinthall, 1993, Sprinthall, Reiman & Thies-Sprinthall, 1996; Oja & Reiman, 1998). Sprinthall and Thies-Sprinthall posited five conditions in 1983 for promoting cognitive development, and these conditions have been stated and tested (Thies-Sprinthall, 1984; Reiman, 1988; Reiman & Parramore, 1993). They are described below.

1. Role-Taking:

It requires selecting a helping experience in a real world context, such as pre-service teachers take the assistant/observer roles in classroom observations.

2. Guided Clinical Analysis/Reflection:

Clinical analysis/reflection on the role taking experience occurs in reading, journal writing, and discussion. Without clinical analysis/reflection, the new experience is like listening to a lecture, having little impact on cognitive-developmental stage growth. Clinical analysis/reflection also requires educating; therefore, it is important to provide guided clinical analysis/reflection to pre-service teachers in the process of their learning and development. (Conrad & Hedin, 1981; Sprinthall & Scott, 1989; Sprinthall, Hall & Gerler, 1992; Sprinthall, Reiman & Thies-Sprinthall, 1993).

3. Balance:

It is essential for the new role and clinical analysis/reflection to remain in balance or praxis. Usually, this means that the helping experience is supported by clinical analysis/reflection and structured self-evaluation in journals, discussions, and weekly guided clinical analysis/reflections (Sprinthall, Reiman & Thies-Sprinthall, 1993; Reiman, 1997).

4. Continuity:

It is a learning truism that spaced practice is superior to a massed one. The research has suggested that when the goal is to promote cognitive, moral, and ego development, a continuous interplay of role taking and clinical analysis/reflection is needed (Sprinthall & Thies-Sprinthall, 1983; Reiman, 1997). In general, a longer period of intervention, such as a

semester or two, would reveal more growth in different domains of interpersonal/intrapersonal understanding.

5. Support and Challenge:

Both support (encouragement) and challenge (new learning) must be provided for adult learning. New learning should be matched with the current preferred mental and learning system of adults. The instruction and pedagogy have to match, and only gradually, constructively, mismatch a learner to provide challenging information and promote growth. The pedagogy of matching and mismatching instruction is complex, and must be carefully implemented and differentiated according to the individual learner's needs.

Hedin (1979) used a differentiated instructional curriculum (in role taking, clinical analysis/reflection of experience) for high school pupils (n=21) based upon their developmental level. Changes in pupils' ego and moral development were statistically significant in her differentiated intervention. Thies-Sprinthall (1980) found that the lower the stage of the cooperating teacher, the more rigid the teaching would be in a classroom and the more incompetent the supervision. Reiman (1988) explored a framework for differentiating clinical analysis/reflection according to the current problem-solving system of adult mentor teachers. His research clarified how clinical analysis/reflection should be dialogic and differentiated. Appendix A displays the Reiman framework for differentiating clinical analysis/reflection. As one can see, it provides a type of interactive lesson plan for guiding clinical analysis/reflection. Appendix B portrays the overall factors of differentiation of structure that could be applied to technology and clinical analysis/reflection.

A study by Lind (1996) with a sample of 271 German undergraduate students confirmed the potential of promoting moral

development through role taking and guided clinical analysis/reflection. Using the Moral Judgment Competence test as the assessment, Lind discovered that role taking and guided clinical analysis/reflection were important conditions for moral development (Reiman, 1997).

Guided clinical analysis and reflective thinking are a major emphasis in the course ECI - 205 Introduction into Teaching of Humanities and Social Sciences for pre-service teachers in Middle School Language Arts and Social Studies and Secondary English Education and Social Studies at North Carolina State University. Student teachers use either videotapes or audiotapes to assess, analyze, and reflect on what they hear and see in group discussions, field notes, or structured self-evaluation in journals with their instructors and/or peers. However, the new technologies, such as telecommunications using the Internet, E-mail, and discussion groups are now widely available to students and faculty on campus. Due to new technology integration requirements by the North Carolina Department of Public Instruction, it seems appropriate to integrate these advanced technologies into this introduction into teaching course. Our goal for this research is to help the pre-service teachers engage in reflective and analytical thinking through the use of the Internet, so that not only can they gain new knowledge, beliefs and values, but also help students develop more positive attitudes and skills in technology integration. These pre-service teachers will become better critical and analytical thinkers as reflective teachers throughout their profession. Seven questions to be answered by this research are:

1. Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in cognitive development than the Control Groups that used a traditional teaching method?

2. Did students with minors in the Experimental Group have greater gains in cognitive development than students with minors in the Control Groups that used a traditional teaching method?
3. Did students with post-bachelor degrees in the Experimental Group have greater gains in cognitive development than students with post-bachelor degree in the Control Groups that used a traditional teaching method?
4. Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in moral development than the Control Groups who used the traditional teaching method?
5. Did students with minors in the Experimental Group have greater gains in moral development than students with minors in the Control Groups that used a traditional teaching method?
6. Did students with post-bachelor degrees in the Experimental Group have greater gains in moral development than students with post-bachelor degrees in the Control Groups that used a traditional teaching method?
7. Did the various levels of stages of concern in the Experimental Group of Technology-Assisted-Reflection differ from the levels in the Control Groups that used the traditional teaching method?

Concern Theory in Computing

The importance of concern theory is that it provides a method to assess and categorize the various perspectives that teachers can have. Frances Fuller (1969) defined "concerns" to include motivation, perceptions, attitudes, feelings and mental gymnastics indulged in by a person when confronted with a new process or product. Fuller used small groups of prospective teachers in an introductory education class, and student teaching seminars. Fuller reevaluated the findings of other researchers in the hope of discovering what pre-service teachers were concerned

about and whether their concerns could be conceptualized in some useful way.

Fuller found that there was consistency in the studies despite the fact that diverse populations were surveyed over a period of 36 years in the different studies. She posited that pre-service teachers are largely preoccupied with self concerns and believed there was a developmental conceptualization of teacher concerns. She suggested three phases of concern: a pre-teacher phase (non-concern), an early teaching phase (concern with self) and a late teaching phase (concern with pupils). In the first phase, students did not appear to know what their concerns were. The concerns were anticipatory or apprehensive, but seldom specific to teaching. In the second phase, the paramount concerns dealt with self, questions concerning how to handle the job, ability to control a class, knowledge of subject matter, how much administrative support to expect, the ability to contend with evaluation, and working relationships. There was also a need to understand the parameters of the task. The third phase was evidenced by concern with pupil progress and evaluation of one's own contribution to that progress. There seemed to be a sequential concerns stage movement from self, to task, and to impact. As pre-service teachers become concerned about managing the task of teaching; with more experience, they become concerned about impact on students. Fuller developed the Teacher Concerns Statement (1972) as an open-ended assessment to determine concerns based upon the question "When you think about your teaching, what are you concerned about?"

In 1987, Hall & Hord developed the Concerns Based Adoption Model (CBAM) for use in staff development for preparation of educational change. The four main components of CBAM Model are the Stages of Concern, Levels of Use, Innovation Configurations, and Intervention Taxonomy. Levels of Use focuses on the behaviors

that are or are not taking place in relation to the innovation; Innovation Configurations focuses the attention in the innovation itself; Intervention Taxonomy emphasized the changes facilitator made to the intervention.

This study will concentrate only on Stages of Concern. It represents the affective dimension of change and how it is perceived by the individual. People must be personally comfortable with using a technology (innovation), before they can be concerned with implementation and impact. Concerns have a direct effect on performance, and lower level concerns must be alleviated before higher level concerns can emerge (Hall & Loucks, 1978). Stages of Concerns about an innovation examine how people feel about the innovation.

The Stages of Concerns about an innovation questionnaire consists of 35 items, each on a 8-point Likert scale that measures the levels of intensity of concerns for an innovation. It was developed as an instrument to diagnose concerns so that the concerns could be addressed. It was not intended that an individual be labeled or judged on the basis of responses (Todd, 1993). There are seven stages of concerns:

0 Awareness	little concern or involvement with the innovation
1 Information	a general desire to know more about the innovation
2 Personal	concern about how the innovation will affect self
3 Management	concern about time management
4 Consequence	concern about how the change will affect the students

- 5 Collaboration concern about cooperating and coordinating the change with others to improve the outcome
- 6 Refocusing concern about finding new ways to make use of innovation

New and experienced users show a sharp indication of management concerns. Consequence and collaboration concerns may increase under the appropriate support and facilitative interventions.

Internal validity was examined using Cronbach's alpha procedure on a large sample of data (n=830) supplied by teachers involved with team teaching, and professors who expressed their concern about the innovation. A sub sample of teachers (n=132) participated in a test-retest of questionnaire over a two-week period. Alpha coefficients ranged from .64 to .83, and test-retest correlation ranged from .65 to .86. This indicated that the instrument had internal consistency and stability for each of the seven stages (Hall, George & Rutherford, 1979).

The Stages of Concerns can be used to show changes in users over time. Non users of an innovation are high in intensity on Stages 0,1,2. New and inexperienced users show a sharp elevation of management concerns. Experienced users are more likely to have reduced Informational, Personal and Management concerns; and if the appropriate support and facilitative interventions have been taken, consequence and collaboration concerns may start to predominate. Finally, refocusing users, by virtue of experience, show very low Stage 0-2 concerns, low management concerns, and intense Stage 6 concerns. The Stages of Concerns Questionnaire has been used in university and K-12 educational settings (Hall & Hord, 1987).

Jean Buddington Martin studied the application of the CBAM model in a diversity of situations throughout the world. She found researchers extended the Stages of Concerns Questionnaire by replacing the word innovation with microcomputer in the questionnaire given to undergraduate college students (Martin, 1989), but these questionnaires were not administered to educators. In 1989 she found a pattern in the respondents' concerns about the use of technology after administering a series of interviews with some of her computing students. After further examination and refinement, a thirty-two item questionnaire was developed from a original 222 usable responses in concerns. It was categorized into the following stages:

0 Contextual	the use of computer in society
1 Informational	the function and use of computers
2 Personal	implications for the individual
3 Management	resources and steps required to complete a computing task
4S Consequences (self)	the effect the individual's expertise with computers has on himself/herself
4O Consequences (other)	the effect the individual's expertise with computers has on other people
5 Collaboration	the coordination and cooperation with others to have increased positive effects of use
6 Refocusing	alternatives to the proposed or existing use of computers or a particular aspect of computing

See Appendix C for a more detailed description of Martin's Stages of Concerns about Computing (Martin, 1989). Martin was able to validate six stages of concerns from her original list of eight. These stages include Contextual, Informational, Personal, Consequence-Self, Collaboration and Refocusing.

The transition of using technology in teaching for some teachers stimulates change, but it also produces more anxiety and hostile feelings than educational gain (Bly, 1993, Vasu & Atkins, 1997). When integrating technology into the curriculum, it is important to stress that computer practices should be related to theoretical principles of teaching and learning. Berger and Carlson (1988) developed a model for pre-service teachers that advocated integrating computer components within the existing curriculum. Pre-service teachers need to have a way to model how computer technology could be integrated into the existing curriculum. They would need to be taught by education faculty who is comfortable integrating these technologies.

Berger and Carlson provided an explicit link between computer and curricular content. They identified knowledge for teachers as including general knowledge of computers, type of computer use, varieties of software use, and knowledge of the basic concepts of teaching and learning. It was important for teachers in their study to develop favorable attitudes toward using computers. There were three steps for the computer use model. The first is to determine content objectives. The second is to select a computer tool to facilitate the objective. The third step is application of the technology as an instructional strategy to complete the task. Instructors can apply this model when approaching uses of educational computing. Education students would process as it was modeled for them. They could then apply this model in their own teaching. It is a good practice to facilitate future teachers' use of technology in their classrooms by modeling its use in teacher education classes, and provide opportunities for them to become acquainted with and apply its uses. Research has shown the calming effects of experience with computers on anxiety levels (Fann, Lynn & Murranka, 1989; Kay, 1990; Summers, 1990).

Rudden & Mallery (1996) studied the effect of instruction in the use of the Internet and prior computer experience on the concerns pre-service teachers have about the use of technology in teaching. Subjects were 53 pre-service teachers in elementary education. Participants were surveyed using the Stages of Concerns toward an Innovation (Hall, George, & Rutherford, 1979) to determine the levels of prior experience, pre and post treatment levels of concerns. In Rudden & Mallerys' study, a one-sample *t*-test was performed to determine any significant changes. The results indicated that short term instruction in the use of the Internet can affect a positive change in the way pre-service teachers view the technology as a resource for planning and teaching. Prior experience in the use of computers and the Internet was a factor in the changes of stages of concern. It revealed an increase in all stages of concerns, with the greatest gain shown in consequence, collaboration and refocusing. Pre-service teachers with limited prior experience revealed an increase in personal, management, consequence, collaboration, and refocusing. Pre-service teachers with no prior experience revealed an increase in consequence and refocusing concerns. There were notable decreases in awareness-related concerns. The result of Rudden & Mallerys' study is inconclusive based on the literature review by Hall, George, and Rutherford (1979). Higher stages of concern in consequence, collaboration and refocusing should show a trend with a decrease in lower stages of concerns in awareness, personal, informational and management when prior experience could be considered a positive factor for the innovation, however the study (Rudden et. al, 1996) was not persuasive.

Wells & Anderson (1997) examined the effects of Internet instruction on the attitude of learners toward a new innovation before, during, and after instruction for one semester.

Participants were surveyed using the Stages of Concerns toward an Innovation (Hall, George, & Rutherford, 1979). The first four stages (Awareness, Personal, Informational and Management) in the stages of concerns were categorized as internally focused as it related to how the innovation might affect the individual (e.g. "I am interested in the Internet"). The last three stages of concerns (Consequence, Collaboration and Refocusing) were categorized as externally focused as it related to learners' adoption and diffusion of the innovation (e.g. "I see how the Internet would affect my students"). Subjects were 20 graduate students registered in an Internet-based course in which E-mail, telnet, ftp skills, and browsing the Internet were taught. One-way ANOVA with repeated measures was conducted. The overall trend showed a decline in the self concerns regarding the innovation. As the computer experiences increased, so did the concerns related to how the self might be used in their learning environment. However, the expected result of internal concerns steadily dropping and instruction task and concerns rising could not be demonstrated due to the design of the course and the teaching approach.

Vasu & Atkins (1997) examined teachers' concerns in three middle schools (n=155) in a quasi-experimental study, their knowledge and actual use of technology in their teaching, and the relationship of three variables to the technology availability in their schools. Their quantitative data found that teachers with more technology training adapted more skills to the classrooms and were at higher stages of concern. Attending more hours in technology training did not completely ensure acquisition of computer technology, or use of technology in the classroom. Teachers who have computers at home might not use computers for instructional planning, especially if they are at lower levels of concern.

Takacs, Reed, Wells, & Dombrowski (1999) studied the effects of a multimedia institute on teachers' attitudes toward the Internet and hypermedia to determine whether the teachers-developers' learning styles and prior computer-related experiences affected their attitudes. Subjects were 13 teachers attending a three-week multimedia institute on how to develop online instructional units to be used in their classrooms. The study (Takacs et al, 1999) focused on determining how the teacher-developers' learning styles, prior computer experiences and the multimedia institute affected their attitudes toward hypermedia and the Internet. Learning styles were determined by Kolb's learning style inventory (1985); prior computer experiences were collected by responses to a demographic instrument; Hall, George & Rutherford (1979) developed the Stages of Concern (SoC) instrument that was used to evaluate their attitudes. The results revealed a significant statistical effect in pretest to posttest Internet attitudes in refocusing. Teachers were able to take the information they had acquired and relate it to other situations through refocusing and transferring knowledge; this could be the result of prior experience in the Internet. Teachers also displayed a decrease of awareness, informational and management in attitude towards hypermedia. This probably resulted because teachers as they were trained in using hypermedia, had less concern about using the technology. Teachers also had more hypermedia-related concern changes. This could be the result of teachers coming in with less experience in hypermedia. There was no effect of learning styles on Internet and hypermedia attitudes. This could be the result of low student-to-instructor ratio. Instruction should meet the needs of each individual student. This research provided some possible factors that affect attitudes toward the development of online applications.

However, in regards to the research, a question that remains unanswered is whether or not Technology-Assisted-Reflection would affect pre-service teachers' stages of concerns.

Literature Review in Technology

While the technical difficulties of integrating technology into the curriculum present major obstacles, integration has been successful in some educational settings. Most of the time, it was integrated based upon a weak theoretical background or few guidelines to support the curriculum. As the popularity of the Internet increases and accessing becomes easier, the number of advanced technologies generated by students, such as E-mails and Listserv, have greatly increased. Research has shown that student and faculty relationships have been strengthened through E-mail, especially for students who do not like to interact directly with the instructor. Bruning (1995) studied the main benefit of using E-mail and Listserv communication tools among a class of college students. Students monitored their discussion group, contributed to discussion, and reported to the instructor by E-mail every other week. The report covered and summarized the content from their group discussion. Students used the Internet to gather materials for class, and also learned and practiced some Internet etiquette. Findings were that student and faculty relationships were strengthened through E-mail. About 50-60% of the E-mail interactions dealt with interpersonal communication including academic and non-academic content. Students felt comfortable "discussing" the negative aspects of the course. E-mail also facilitated their in-class discussions.

In the Wu's study (1997), Listservs were also integrated to involve all members of the class, which provided a means for members of the class and the instructor to open up an interactive and bi-directional dialogue with no limitation in distance. The

writing process changed from private and isolated activities to collaborative and interactive ones through the use of listserv. The teacher-student relationship became interdependent and reflective. This brought more understanding to teachers of what is going on in students' minds during the writing process besides drafts and finished products. Teachers dealt with frustration more directly and effectively. However, in this less rule-governed virtual environment, students were free of bounds of grammar, syntax, or style and performed more like speakers than writers.

Burke (1994) integrated Listserv in an 8-week staff and faculty development seminar at Fairmont State College. Topics covered a broad array of Internet tools and protocols (e.g. Listserv, E-mail, Gopher, World Wide Web, Telnet, FTP). Lessons were sent as E-mail messages via a Listserv that also served as a forum for group discussion. Electronic copies of each lesson were sent to participants for them to read online and/or to print out. Listserv was more flexible and convenient than face-to-face communication. This type of computer-mediated-communication united the participants from various locations on and off campus by materials, rather than by time. As a result, 95 participants stayed the entire duration of the seminar and more than 70 completed the entire seminar. Telephone calls were heavy in the beginning of the seminar due to the additional assistance required by participants as they learned to use their modems and communication software, however, fuller explanations of materials or questions were provided through the Listserv. The advantages of using computer-mediated-communication through Listserv were the ability to teach large groups of people; the ability to reach all students simultaneously regardless of distance; easier communication between instructor and students; and flexibility resulting from the elimination of time constraints. The disadvantages were participants must have E-mail accounts,

participants must exercise patience to read and respond to postings, particularly if there is a large group involved; participants must spend a lot of time in front of computer screens as an unavoidable aspect of computer-mediated-communication.

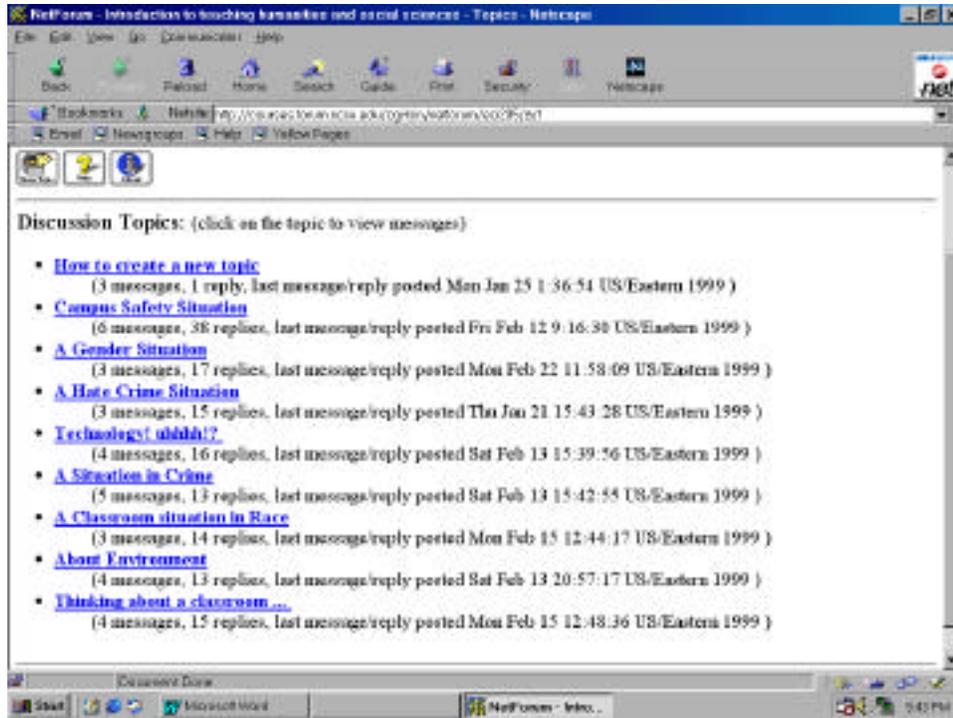
Poling (1994) stressed the importance of E-mail by recommending an institution-wide E-mail workshop required by all students to promote communication through the Internet. Piburn & Middleton (1997) at Teacher Education for Arizona Mathematics and Science (TEAMS) adapted "Reflective Practitioner" as their guiding metaphor. Subjects for the study had degrees in mathematics, science, or technology-related fields and were preparing to enter their student teaching. The TEAMS program was designed to encourage reflection, and required students to maintain a journal that recorded their observations, feelings, and needs as their experience in the program unfolded. Journals were collected weekly, read and responded to by one instructor, and returned to the students. However, alternatives in Listserv had to be integrated to allow communication between students and teacher, because some students did not like journal writing and even resisted completing them. As a result, there were 300 recorded messages by students and the instructor on the Listserv, but only two students continued written journals. The average message length was about 15 lines of text. Piburn & Middleton then analyzed Listserv based upon a modified set of categories by the work of Thomas, Clift & Sugimoto (1996). These categories attempt to parse the subject of conversations into five general foci: as non-academic, procedural, technical, content, and pedagogy. A chi-square test revealed significant differences between the types of messages sent by faculty and students. For example, faculty messages focused more on procedural and less on non-academic content, whereas the most reflection for the longest period of time by students centered around content and pedagogy.

Students participated more frequently than faculty, the ratio of teacher to student contributions on the Listserv was 3:7. Students wrote approximately twice as many E-mails as teachers. This is different from a traditional classroom in which teachers usually talk more than students. Communication through Listserv is a more public format than journals, Listserv conversations often take abrupt turns and changes in topic and focus, whereas, journals often follow a single thread to a conclusion in a private format. As a result, the Piburn and Middleton's study also found that students were more free to make criticism without fear of retribution in journals than Listserv. Journals are vehicles for building trust between teacher and student. Electronic conversations permit more student participation, students do not have to wait for teachers, their postings will be read by multiple readers, and their writings have a purpose. The purposes are: to find out an answer to an important question, to help a colleague in need, and to determine if their feelings and fears are warranted. Communication between students increased and was encouraged in Listserv (Audet, Hickman & Dobrynina, 1996). The length of each posting in Listserv is shorter than a journal entry, but the content displayed a greater depth. It suggested that Listserv might be preferable to journals as devices to encourage communication and introspection.

There are three types of online communication tools among students and instructors on the NC State campus; E-mail, Listserv, and NetForum. Many researchers have already used E-mail and Listserv, whereas fewer use NetForum. The basic function of these three software applications is the same. The primary difference between NetForum, E-mail and Listserv is that NetForum (see Figure 2.1) is a web-based communication tool whereas E-mail and Listserv are not.

Figure 2.1

Main page of NetForum for Class Discussion of Experimental Group



Conversation using NetForum can be grouped by topics. A reply can be addressed to the specific topic with the date and time listed. Upon completion of a reply to the topic, a "submit" button allows users to post the mail dynamically, ready for review and response by all participants. All mail is threaded and presented as a World Wide Web document that can be accessed through the Internet with a valid Uniform Resource Locator (URL). The well-organized layout of topics with time and date listed is an advantage for users since they can respond to a topic without worrying that the conversation is over. The built-in anonymous function allows students to discuss more openly any pressing issues. As the administrator, the instructor can monitor the list to update and remove any improper messages at any given time. Information in the areas of theory, pedagogy, technology and

issues can be added by both instructor and students as the semester goes by, and topics may be added to reflect the evolving issues statewide, nationwide and world-wide by both instructor and students. Therefore, NetForum was used for the study in conjunction with group discussions of social issues in the Experimental Group.

A successful integration of technology into the curriculum in teacher education requires careful thought based upon the results of the literature reviews. The advanced technology in using E-mail, Listserv, NetForum and the Internet to conduct conversations and submit assignments is in a format of "information free", so that pre-service teachers are required to fill in the blanks as they progress through coursework, reflect and analyze their thoughts and feelings through the use of these technologies. This study will not only integrate telecommunication tools into a traditional teacher education course, it will further investigate the effect on students' cognitive and moral development. "Teaching is the profession that shapes American's future." (Haselkorn, 1994). To date, no research has examined pre-service teacher learning and cognitive development through Technology-Assisted-Reflection. Thus, research in this area is warranted.

Technostress

Computer technology has been adopted and widely used in the business world in the 1980s and 1990s in an effort to promote productivity and service for large corporations in banking and service oriented fields. Because many businesses have spent billions of dollars on computer technology, the computer industry has had an unprecedented boom. Commitment to the technology continues to grow without much reservation. Despite the fact that

not all computer systems are cost-effective and easy to maintain, there still are employers and managers who feel that computers will accomplish any task without giving much thought to efficiency and safety. In fact, thousands of workers have been injured and their injuries may be related to mismanagement of the technology. In recent years, as employees started suffering from problems in repetitive strain injuries, backaches, headaches and eye strains, the health costs have risen. It appears that technology may pose a veiled threat to humanity. Relying solely on technology could eliminate human interaction according to some researchers (Weil and Rosen, 1998; Young, 1998; Ryan & Cooper, 1998; Emurian, 1989).

As well, people who have worked in technology-related fields have encountered the so-called technostress problem. Dr. Craig Brod, a psychologist in Oakland, California, coined the term "technostress" to describe the type of stress unique to computer users (Mapartlin, 1990), such as Carpal Tunnel Syndrome and visual symptoms, which occur in 75-90% of Video Display Terminal (VDT) workers. Two-thirds of the complaints have been related to vision problems while one-third has been due to environmental factors (Anshel, 1997; Thornton, 1997; Young, 1996; Ubelacker, 1998). According to Dr. Robert Markison, associate professor of medicine at the University of California at San Francisco, typing and cursor movements on computer keyboards possibly cause stress in delicate muscles, tendons, ligaments and other soft tissues of fingers, hands, wrists and arms. The Department of Labor stated that the repetitive strain injuries were the number one job related illness in the country based on a study by Young (1998). The reported cases of job-related repetitive strain injuries increased by 800 percent with many experts blaming computers (Young, 1996).

As the popularity of the Internet increases and the price of computers decreases, computers are an increasingly prevalent part of our daily routines. In the 1990s, U.S. federal and state government officials promoted computer technology as one of the top items on their agendas. However, there is a need for everyone to be aware of the hazard of repetitive strain injury to the hands and arms resulting from the use of computers (Atencio, 1996; Anshel, 1997). Lack of adequate rest and breaks and using excessive force almost guarantee trouble. As business and education continue to prosper in computer-related fields, it is important for educators to pay attention to the side-effects brought by computer technologies (Cash, 1997). It is also important for educators to learn from the problems in other fields related to computers while promoting the integration of computer technology into K-12 curriculum. To maintain humanity in a technological world and to have healthy and concerned citizens should be major goal of promoting the technology. As these computer-related injuries at the workplace arise, it should send an alarm to educators.

Summary

As technology evolves, the technological requirements for both in-service and pre-service teachers increase. Teacher education programs should not only teach pre-service teachers technological knowledge for short term training, but also for an unforeseeable future. It is essential to enhance pre-service teachers' cognitive and moral development while their students engage in learning. Therefore, it is important for the university supervisor to know the theories of Piaget, Vygotsky, Perry, Hunt, King and Kitchener, Kohlberg and Rest; the five elements of promoting human growth and development (role taking, guided-reflection, balance, continuity, support and challenge); and the

advanced technologies of the Internet, Listserv, NetForum and E-mail.

These types of technologies do not set any parameters or sequences for students to follow. Students have the flexibility to conduct their own research, or collaborate with other classmates or communicate with their teachers privately. Students can engage in learning environments that are active and dynamic. If Computer-Assisted instruction (CAI) increases student achievement and attitude where students are engaged in a controlled learning environment, can Technology-Assisted-Reflection promote development in cognition or ethics as well as increase students' comfortable level with the technology in a more open environment? This study will address this question.

Chapter 3

Methodology

The purpose of this research study was to investigate the following: (1) Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in cognitive development than the Control Groups that used a traditional teaching method? (2) Did students with minors in the Experimental Group have greater gains in cognitive development than students with minors in the Control Groups that used a traditional teaching method? (3) Did students with post-bachelor degrees in the Experimental Group have greater gains in cognitive development than students with post-bachelor degree in the Control Groups that used a traditional teaching method? (4) Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in moral development than the Control Groups who used the traditional teaching method? (5) Did students with minors in the Experimental Group have greater gains in moral development than students with minors in the Control Groups that used a traditional teaching method? (6) Did students with post-bachelor degrees in the Experimental Group have greater gains in moral development than students with post-bachelor degrees in the Control Groups that used a traditional teaching method? (7) Did the various levels of stages of concern in the Experimental Group of Technology-Assisted-Reflection differ from the levels in the Control Groups that used the traditional teaching method?

If it is established that a relationship exists among these factors, it would be useful to integrate Technology-Assisted-Reflection into pre-service teacher education programs.

This chapter describes the design used in the study and presents information concerning the methodology, including: research design; target population; subjects and sampling

procedures; assessment instruments; dependent, independent, and control variables; research questions; hypotheses; procedures for implementation; and statistical analysis.

Research Design

This study employs both quantitative and qualitative components with descriptive and statistical research designs using a quasi-experimental pretest/posttest control-group design (see Table 3.1). The purpose of selecting this design was to maximize the likelihood that measured differences between the experimental and Control Groups would reflect the actual differences. When conducted properly, this type of research design can control the following threats to internal validity: maturation, history, instrumentation, testing, differential selection, statistical regression, experimental mortality, and selection-maturation interaction (Gall, Borg & Gall, 1996; Branoff, 1998).

Table 3.1
Research Design

	Pretest			Treatment	Posttest		
Experimental Group (E)	O ₁₁	O ₂₁	O ₃₁	X	O ₁₂	O ₂₂	O ₃₂
Control Group I (C _I)	O ₁₁	O ₂₁	O ₃₁		O ₁₂	O ₂₂	O ₃₂
Control Group II (C _{II})	O ₁₁	O ₂₁	O ₃₁		O ₁₂	O ₂₂	O ₃₂

E, C_I, C_{II}: Each group consists of a cluster sample of research participants. Each group was formed by selecting a naturally occurring group of individuals in a class. Three clusters were selected.

O₁₁: Stages of Concerns about Computing Pretest.

O₁₂: Stages of Concerns about Computing Posttest.

O₂₁: Defining Issues Test Pretest.

O₂₂: Defining Issues Test Posttest.

O₃₁: Demographic Profile Pretest.

O₃₂: Demographic Profile Posttest.

X: Technology-Assisted-Reflection added to the Experimental Group. This consisted of introducing a curriculum of eight social issues, using a NetForum, E-mail, Listserv and electronic forms.

The statistical part of the study involved one-sample *t*-tests to find the mean scores of the difference between the pretest and posttest, and to identify whether there was a significant difference from pretest to posttest on the cognitive and moral development for the experimental and the Control Groups. In addition, a factorial analysis of variance design was planned to allow the analysis of more than one independent variable and their interaction (with minor and without minor, with post-bachelor and without post-bachelor degree). The descriptive part of the study (description of scores on a single variable) involved characterizing the samples from three groups on the measures of the Defining Issues Test and the Computing Concerns Questionnaire scores (means, medians, standard deviations) to indicate the average score and the variability of the scores for the sample, and frequencies for categorical data. According to Gall, Borg and Gall (1996), the purpose of descriptive research is to investigate and present detailed information and characteristics of a sample or population. Observational and survey methods are frequently used to collect descriptive data.

A qualitative component of this research involved interviewing and observing a random sample of students in the experimental and Control Groups, as well as collecting data from

the open-ended questionnaires, E-mails, NetForum, informal interviews, and observations throughout the semester.

Target Population

Gall, Borg and Gall (1996) defined the target population as a population typically very large in number and geographically dispersed. The geographically dispersed group could be represented by the experimentally accessible population, usually local and relatively small. The twenty pre-service teachers in the Experimental Group, registered in ECI 205 - Introduction to Teaching Humanities and Social Sciences, were chosen for this study because of the licensure requirement of passing a computer competency portfolio assessment in North Carolina. Pre-service teachers have experienced anxiety and panic over the new requirement. Instructors have also experienced concerns for lack of resources and the means for integrating technology into the existing curriculum. For this study, the target population consists of pre-service teachers in teacher education programs throughout the United States similar in nature to the one described below.

Subjects and Sampling Procedure

The sample chosen for this study represented a non-random cluster sample. Gall, Borg and Gall (1996) defined a cluster sample as a group of research participants that is formed by selecting naturally occurring groups of individuals. Because this study lacks random assignment, it is considered quasi-experimental (Campbell & Stanley, 1963).

The three groups selected are referred to as the Experimental Group (E), Control Group I (C_I), and Control Group II (C_{II}). There were three sections for the course of ECI 205 - Introduction to Teaching Humanities and Social Sciences in Spring

1999. One of the sections was chosen as the Experimental Group mainly because the instructor was willing to integrate advanced technologies into her teaching, and the other two sections were selected as Control Groups I and II. Three different instructors taught the three sessions.

All three groups took both the pretests and posttests. Pretests and posttests in the beginning and at the end of the semester were used to measure: students' cognitive and moral development growth; their computing concerns; demographic profile information. Responding to the survey was voluntary. It took 30-40 minutes to complete each time and was administered during the students' regular class schedule.

The total sample (Experimental, Control I, Control II) has sixty-eight pre-service teachers. The Experimental Group consists of twenty students, Control Group I has twenty-eight students, and Control II has twenty students. Data from a final total of fifty-one and sixty-one pre-service teachers were analyzed for the Defining Issues Test (DIT) and the Computing Concerns Questionnaire (CCQ) (Appendix I), because of missing data (see Table 3.2).

Table 3.2.

Breakdown of Three Groups

	Original Sample	Students Completing DIT	CCQ
Experimental Group	20	12	17
Control Group I	28	23	25
Control Group II	20	16	19
Total	68	51	61

The issue of external validity is a factor in this study. The results of all studies using non-random sampling procedures must be generalized with caution. While the results may not be generalized to a population of all pre-service teacher education programs in the United States, it is believed that these results may be generalizable with caution, to other universities with pre-service teacher education programs in the United States in similar settings.

Training

No computer training was provided to students or the instructors in the Control Groups. The Control Groups used the traditional teaching format without any involvement of computer technology. Pre-service teachers in the Control Groups attended classes, had in-class discussions, made eight classroom visits in public schools, and turned in structured self-evaluation journals and field notes on paper.

This researcher is aware that the proficiency of the students with computer applications plays a critical role in the study. Therefore, computer training was woven into the class time in the Experimental Group in the first six weeks of class before these students went out to visit classrooms in public schools. Training included the use of the Internet, E-mail, electronic forms and NetForum in the area of technical knowledge and hands-on activities. Approximately three sessions of 30-minute each were given. Students used the Internet to submit their assignments in structured self-evaluation journals and field notes; E-mails and Listserv were used among instructors and students for communication; NetForum was used for group discussions on social issues. In addition to the in-class training, the researcher also took a lab attendant role during

the semester working ten hours a week to help any students in the Experimental Group.

The same training was given to the university instructor of the Experimental Group before the semester started. Materials and training were developed and provided by the researcher (See Appendix J). Students in the Experimental Group used the computer laboratory provided by the college or their home computers to fulfill the requirements.

Curriculum Layout

The ECI 205 course - Introduction to Teaching Humanities and Social Sciences is required for pre-service teachers in the Middle School Language Arts and Social Studies program, and pre-service teachers in the Secondary English Education and Social Studies program. The course is required for acceptance into the Teacher Education program. Students must earn a grade of B or above in the course.

The course's curriculum includes early field experience to help pre-service teachers explore teaching as a career. During this time, they have opportunities to observe and assist public school teachers in middle schools and secondary schools. Eight required visitations to a public school classroom provide opportunities for students to observe effective teaching practices, to become acquainted with the structure of schooling, and to assist the teacher in relevant activities. The students are encouraged to interact fully within the school context and assume as many role-taking positions as possible. The school visitations are designed so that pre-service students will acquire 24 hours (three hours a week for 8 weeks) as observer/assistants. The University recommends that students set aside one block of time each week for regular visitations. A

portion of this time (approximately one hour) was allowed for gathering information concerning the weekly teaching focus. Each student spent approximately one hour interacting with the students in middle or high school or performing some authentic role to assist students or the teacher. Finally, the student had some time each week to reflect with the teacher on questions and concerns. The teaching foci that pre-service students observe and reflect upon through the observation instruments (i.e. curriculum selection/lesson preparation, questioning, positive reinforcements, etc.) (See Appendix L) are an integral part of the experiences in this curriculum as well as in future teaching experiences. When pre-service teachers become student teachers and beginning teachers, their mentors will use these instruments to observe again, to help them reflect, and to promote their growth as educators. Due to the school visitations, this curriculum has extended the traditional instructor and student structure to include school teachers. These cooperating teachers complete a mid-term formative evaluation regarding their student assistants and summative evaluations at the end of the semester regarding their student assistants and the course.

Class Schedule

Students met twice a week for one hour and fifteen minutes each session. For the first six weeks of class, students attended class with assigned readings regarding school, teaching, students, social problems and tensions that affect students, technology and its impact, education reform, history of American education and its philosophical foundations, and ethical and legal issues. Students also wrote logs and clinical analysis/reflection papers of their reading assignments as well as mini-lesson presentations in class before they began school observations. This ensured that students had practice in public

speaking, learned about teaching, and also received feedback from their classmates and instructor.

Once students started their classroom observations, they only met once a week on campus. They brought urgent issues they encountered to class, so that they not only got advice and suggestions from classmates and the instructor, but also returned the signed visitation form from their cooperating teachers to the instructor.

Social Issues - Additional Curriculum

In order to measure the cognitive and moral development of all the students in the study, an external impetus of eight social issues was developed in addition to the regular curriculum for the study. While learning more about teaching and its related fields during the first six weeks of the class, all students were required initially to read and reflect on paper regarding issues in safety, gender, crime, technology, hate crime, environment, race and classrooms (see Appendix K). Issues were assigned at least one per week in combination with the regularly assigned reading material.

Each of the eight social issues was divided into two parts: a problem and a related issue in an educational setting. Using Technology as an example, the problem is stated as follows:

The popularity of technology has led to increase in computer-related crime including theft of money, theft of data, software piracy and theft through unauthorized access as hackers. According to Women's World, 1998, college students and homemakers have a greater chance of becoming Internet addicts. There are 6.2 million people who spend 38 hours a week of their private time on-line. One

university found that a high number of their brightest freshmen were failing to maintain good grades because half of them used the Internet excessively. In the mean time, there are 15.9 million people who use the Internet at work today and the number is expected to rise to 81.2 million by the year of 2000.

The technology-related issue in educational setting is stated as follows:

One of your professors has just completed a lecture on the problems of computer crime, including software piracy. When you return to your residence hall, your roommate is copying software that is not licensed to him. The university expressly prohibits software piracy in its student code of conduct. You are troubled by what you see. However, from time to time, your roommate has provided help when your computer has malfunctioned and you really count on his assistance.

A set of probe questions followed both the problems and the related issue in an educational setting. These questions varied for different issues, but were carefully chosen to prompt reflective/analytical thinking, e.g. What do you think about the statement? How did you come to hold that point of view? Can you ever know for sure that your opinion is correct? How or Why not? What would you do if you faced the situation? How did you come to the solution? Why? What reasons do you have for the actions you took? How would you defend an opposite point of view? These questions were broad and open-ended, and designed to elicit students' critical thinking ability and to promote their learning and development.

Social Issues Assignment - General (See Table 3.3)

After being assigned a social issue, all students reflected on paper their responses based on their life experience, upbringing, beliefs, and current cognitive or moral structure. They turned in their responses on paper at the next class session. On the day that a social issue was due for review, small group and whole class discussion were conducted about the issue. A small group discussion among 4-5 students was conducted for 20-30 minutes with a discussion total time of about 30 - 45 minutes. In addition to the small group discussion, the instructor would allow 5-10 minutes of discussion and clinical analysis/reflection regarding the issue with the entire class.

Comments provided on paper by instructors while reviewing issues followed guided clinical analysis/reflection and differentiated learning, so that students could advance to a higher stage based on their own individual development.

Table 3.3.

Outline the Use of Eight Social Issues

Procedure	Experimental Group	Control Groups
Assign at least one social issue per week for clinical analysis/reflection on paper.	X	X
Small group discussion (4-5 students) on the Social Issue for 20-30 minutes.		X
Entire class discussion (5-10 minutes).		X
Return comments on paper by instructor for review on social issues using guided clinical analysis/reflection and differentiated learning.	X	X
NetForum Discussion	X	

Table 3.4 indicated the major differences in the procedures between the control and Experimental Groups based on Table 3.3.

Table 3.4

Major Differences in the Procedures between the Control and Experimental Groups

Experimental Group	Control Groups
<p>NetForum Discussion Students use this medium for group discussion after class on the assigned social issue that is due for review.</p> <p>NetForum was monitored closely by instructor and researcher during the semester.</p> <p>Only the social issue in the educational setting was used for the group discussion and questions were posted all at once.</p> <p>Discussion time varies.</p>	<p>Small group discussion (4-5 students) on the Social Issue for 20-30 minutes</p> <p>Entire class discussion (5-10 minutes)</p>

Social Issues Assignment - Experimental Group

For the purpose of this research, students in the Experimental Group reflected their thoughts and comments using NetForum in addition to their paper clinical analysis/reflection of issues. The second part of the social issues that were related to educational settings were posted on the NetForum after the issue was assigned in class, and questions that were related to the issues in educational settings were posted on the NetForum all at once. Both paper assignments and NetForum discussions were used for the Experimental Group, since the instructor felt the need to obtain initial assignments on paper from students. The group discussions in class among the students in the Experimental Group were reduced to better utilize the class time, because group discussions were conducted using NetForum through the Internet.

To ensure connectivity and accessibility, NetForum was non-password protected. Students' E-mail ID was tested, and any problems encountered during the training were resolved immediately. The instructor of the Experimental Group planned and prepared an outline of the NetForum for initiating any topics for group discussions or generating potential topics for further discussion. Requirements for students to use the Internet and submit any structured self-evaluation field notes, journals and continue group discussion were discussed and stated in the online syllabus.

Course Pack

The course pack titled Student Handbook for Observation and Assistance had two versions to accommodate the intervention. The Control Group students used a full paper version; the same version used in the previous semesters. It contained information

on objectives, responsibilities of students, instructors and cooperating teachers, visitation questions and requirements, supplemental information for visitations, direction for lesson planning, self-analysis for mini-lessons, activities, visitation sign-off sheets, and formative and summative evaluations. A reduced paper version was used for the Experimental Group that only contained selected information in objectives, condensed questions for visitations, and visitation sign-off sheets. The remaining information was transferred to the class website for the Experimental Group.

The main reason for having two versions of the student handbook was to test the feasibility of integrating technology into the teacher education curriculum. Converting the paper version of the handbook to a website for students to access through the Internet was just a first step. After each visitation, Control Group students analyzed and reflected on their visitation in structured self-evaluation journals and field notes on the listed questions in the student handbook, and turned it into the instructors for review. However, the students in the Experimental Group wrote and submitted their assignments in structured self-evaluation journals and field notes using the electronic forms through the class website. The instructor received the students' assignments in her E-mail account. Comments and suggestions were then sent back to the students' E-mail account after review. The shortened handbook also provided an outline of the course pack to students in the Experimental Group with the sign-off sheets for school visitations and served as a transition between paper and virtual environments.

Evaluation - Cooperating Teachers

To continuously improve the course, there were formative and summative evaluations that cooperating teachers filled out in

the middle and at the end of the semester. Normally, cooperating teachers filled out the mid-term formative evaluation and students would deliver it to instructors, it was to evaluate the performance of our pre-service teachers. The end-of-semester summative evaluation was sent from the Department to cooperating teachers with a self-addressed postage paid envelope as in the past. This evaluation consisted of two parts, one about the pre-service teachers, and the other part an evaluation of the course. For the study, the summative evaluation was converted to an electronic form and only a letter disclosing the URL (Uniform Resource Locator) of the summative evaluation form was sent to cooperating teachers. All cooperating teachers who participated in the course received the letter.

The early field experience is built into the curriculum to help pre-service teachers explore teaching as a career so that they have an early understanding of the complexities, as well as the 'behind-the-scenes' work of public school teachers.

Curriculum Integration in Technology

The process of creating a web-based curriculum from an existing course is challenging and time-consuming. A careful evaluation of the existing course is the first step. It is also equally important to know what kind of technology applications are available to faculty and students. The advancement of technologies provides user-friendly interfaces that offer greater accessibility to users without any programming skills, such as Listserv, NetForum and E-mail. Because the nature of this study, which was to investigate the development of cognition and ethics of pre-service teachers in a virtual environment through an interactive web-based curriculum in an open-ended and flexible structure, computer programs had to be created to extract data

through the Internet, such as the field notes and journals. Perl script was used for the study.

There were 46 computer programs written for the study. To ensure the data integrity and accuracy of the computer programs, approximately 300 hours were spent writing and debugging these programs and testing the process from data entry on the website to reviewing submitted data on the specified email account(s). Testing was a very time-consuming process, especially given the large number of programs that were written for the study, but it played a crucial role in the usefulness and effectiveness of the web-based curriculum in the intervention of Technology-Assisted-Reflection.

Assessment instruments

Two instruments were used to measure the dependent variables in the quantitative research study: the Computing Concerns Questionnaire (CCQ) (Martin, 1989) (Appendix I) and the Defining Issues Test (DIT) (Rest, 1979). The Reflective Judgment Interview (RJI) (King & Kitchener, 1994) and the Linguistic Inquiry and Word Count (LIWC) (Pennebaker, 1992) were used for the qualitative component in cognitive development.

The Computing Concerns Questionnaire (CCQ)

The Computing Concerns Questionnaire (Appendix I) was developed by Jean Buddington Martin (1989). She based her research on the data collected from college students, staff, and administrators. The questionnaire contains 32 statements of concern. This questionnaire was developed in three phases to determine how the Stages of Concerns could be applied to the computing experience.

First, Martin identified 156 types of concern about computing through a broad range of individuals at two higher education institutions using a stratified convenience sample to gain a representative sample of individuals. An open-ended, statement-of-concerns form was used following the guidelines provided in A Manual for Assessing Open-Ended Statements of Concern About an Innovation (Newlove and Hall, 1976) and the results were sorted into categories.

In the second phase of her study, the 78-item statements were merged into eight categories of Stages of Computing Concerns to develop a questionnaire. Later, Martin examined the responses from subjects using factor analysis with varimax rotation procedures toward the hypothesized structure that resulted in development of a smaller, 32-item questionnaire.

In the third phase of her study, Martin administered her modified questionnaire and validated it through Cronbach's alpha and by test-retest correlation to determine consistency and stability in the responses over time. A third higher education institution was included in the sample, and most students who participated were enrolled in classes that utilized computers. The correlation gathered in her study did support six of her eight stages. The strongest correlation was given to stages: Contextual (0), Informational (1), and Personal (2). In addition, Martin found some validation for the stages of Consequence for Self (4s), Collaboration (5) and Refocusing (6). There appears to be mixed support for the factors associated with stage 3 as it loaded higher on other stages. Stage 4o item was associated with stage 3 (Management) and dispersed throughout stages 3, 4s, and 5. (See Appendix C for Martin's Stages of Concern about Computing.)

Reliability and Validity

The Computing Concerns Questionnaire (Appendix I) was developed from the Stages of Concerns Questionnaire (SoCQ) (Hall, George & Ruthford, 1979). SoCQ stage correlation of internal consistency (alpha-coefficients) ranged from .64 to .83 with six of the seven coefficients being above .70. Table 3.5 summarizes alpha coefficients for the Stage of Concerns Questionnaire.

Table 3.5
Stages of Concern Questionnaire Alpha-Coefficients of Internal Reliability (Hall, George & Ruthford, 1979)

N	0	1	2	3	4	5	6
830	.64	.78	.83	.75	.76	.82	.71

In Martin's study using the Computing Concerns Questionnaire, coefficients of internal reliability for different stages ranged from .65 to .83 with six of the seven coefficients above .70. Table 3.6 summarizes alpha coefficients for the Computing Concerns Questionnaire.

Table 3.6
Computing Concerns Questionnaire Alpha Coefficients of Internal Reliability (Jean Buddington Martin, 1989)

N	0	1	2	3	4	5	6
388	.78	.78	.73	.65	.71/.78*	.83	.76

Computing Concerns Questionnaire Test-Retest Correlation

(Jean Buddington Martin, 1989)

N	0	1	2	3	4	5	6
388	.78	.75	.84	.66	.72/.77*	.74	.79

* Martin suggested two stages for Stage 4.

The purposes of Martin's study were: to expand the base of information available regarding the Concerns Based Model (CBAM); to develop an instrument to measure concerns teachers would have in regard to computing; to determine if there would be a relationship between the level of computing education and user concerns; to determine if there is a relationship between the intensities of various concern stages and changes in hardware and/or software; and to determine whether or not their concerns would be related to general demographic information.

When learning new knowledge or skills, students' anxiety level should be carefully monitored by the instructor to ensure and enhance learning, therefore, training was given to students in the beginning of the semester for this study. The instructor was given workshops prior to the start of the semester in preparation for the course. Handouts were provided to both the students and the instructor to reinforce skills and knowledge development and the ease of use of the telecommunication technology.

Black, Klingstein and Songer (1995) stated that:
 "Mastering the tools is challenging, applying them is even more challenging. Mastering the tools of the Internet requires access, time, training, patience and tenacity. Applying these tools and resources takes all of that plus more time, creativity,

endurance, proclivity towards change, a willingness to take risks, plus collegial and administrative support."

This study integrates technology into a curriculum in the teacher education program, therefore, the Computing Concerns Questionnaire was utilized to find out students' stages of concerns in this computing innovation.

The Defining Issues Test (DIT)

The Defining Issues Test (DIT) taps into the basic conceptual framework of a person by which a subject analyzes a social-moral problem and judges the proper course of action. The main concentration is to identify moral reasoning of an individual's preference and his or her comprehension of stage description in the adequacy of moral thinking (Thoma, 1993). Though it is the individual who determines right and wrong (Kohlberg, 1965), the moral decision is associated with a person's social values. Hence it is in our interest to find out a new approach toward the development of ethics through the use of Technology-Assisted-Reflection. Most importantly, dialogues within the teacher education classes are conducted under guided clinical analysis/reflection to establish conditions for growth.

Rest's Defining Issue Test (DIT) evolved from the work of Kohlberg. Rest developed a "paper and pencil" test instead of interviews to measure Kohlberg's stages. The DIT can be group-administered and computer scored. DIT's measurement method assesses the patterns of student responses across various stage orientations and then estimates development on a low to high continuous scale (Thoma, 1993). An individual is given six moral dilemmas, each dilemma contains 12 issues. Individuals evaluate each item and rate it by its importance. Individuals rank issues from the most important to the least important. Each of the 12

issues has a predefined scale, based on the ranks given by individuals. The four most important issues are assigned a score of 4, or 3, or 2, or 1, then the scores are added, and multiplied by 10 to obtain a P-score. The P-score is the "Principled" morality score, which is used for comparison of group averages to identify an individual's moral stage. It is assumed that people define the most important issue of each dilemma in different ways and that the selection of issues indicates an individual's moral development as their own moral preference and comprehension.

There have been over 1000 studies conducted in four different countries using the DIT. Approximately 50 new DIT studies are generated every year. Kohlberg (1969) and Rest (1986) reported that most adults function at the midpoint of their scales as well, somewhat between social conformity (stage 3) and law and duty (stage 4) (Sprinthall, Reiman, Thies-Sprinthall, 1993). However, Rest has tried to give an additional moderate explanation in defining stage 5 and 6. Individuals who make decisions to reach group consensus are at Stage 5 of moral development. Individuals at stage six not only have the vision of how to organize the ideal society, but also can win the support from others to improve the society. Mother Teresa, and Martin Luther King, Jr., for instance, were in this stage. In general, higher stages deal with more complex social problems than the lower stages (Rest, 1994).

Reliability and Validity

DIT asks not only what kind of action the subject favors, but it is also concerned with an individual's reason for their choice (Rest, 1979). Test-retest reliability for the P index is generally in the high .70s or .80s and the Cronbach's Alpha index of internal consistency is generally in the high .70s (Davison & Robbins, 1978). On a sample of 160 subjects, Alpha was .77 for

the P index. Alpha was .77 for the P index on a 1,080 sample (Rest, 1974).

For the study, all 6 stories were used because the study had a pretest and posttest design. As Rest (1986, P.5.3) stated "studies using repeated testings (as in a pre-post design) are cautioned against splitting the 6-story form into two-story form. Instead, Rest recommends using the same 6 stories on repeated testing." Also, the collected data in the Defining Issues Test (DIT) is sent to the Center for the Study of Ethical Development for analysis.

Studies on test-retest reliabilities showed that with only a 1 to 3 week interval, the differences in means between testing was non significant. Change is more related to time between the tests (presumably "real" development) than simply retaking the test (Rest, 1986). A ten year longitudinal study (Rest, 1986) showed significant changes over time which can be traced to changes in education and in life experience. Life experience codes correlate .6 with the DIT scores of young adulthood. The DIT elicits a person's best notion of justice and fairness, therefore "faking good" does not appreciably increase the scores.

Education and IQ have the most consistent relationship with the DIT (Rest, 1986). Gender, SES, political party, profession or college major does not have clear and consistent relationships with the DIT. Whether or not Technology-Assisted-Reflection can promote the moral development of students through discussion or dialogue in the moral realm remains to be answered. Students with minor concentrations and post-bachelor degrees all have different life experiences and opportunities, and individual traits, which are not clearly represented in Rest (1986). Could minor and post-bachelor degrees have an impact on the moral development through the use of technology?

Dependent Variables

Two dependent variables were used in the quantitative component of the study, the Stages of Concerns About Computing, and the Defining Issues Test for moral development. The Reflective Judgment Interview (RJI) and the Linguistic Inquiry and Word Count (LIWC) were used in the qualitative component.

Stages of Concerns about Computing

When a person faces a changing situation, concerns progress through a sequential process. The concerns include feelings, thoughts, and considerations given to a particular issue or task. This is measured by the Computing Concerns Questionnaire. The seven stages are awareness, informational, personal, management, consequence concerns of self, consequence concerns of others, collaboration and refocusing (See Appendix C for a description of each stage and Appendix D for Scoring of the Stages of Concerns for Computing.)

Defining Issue Test

Moral judgment assessment is an assessment of conceptual adequacy of moral thinking. It does not portray a person's worth as a person, kindness or loyalty, but indicates an important aspect of personality. This is measured by the Defining Issue Test, which taps the basic conceptual framework by which a subject analyzes a social-moral problem and judges the proper course of action. The six stages are: obedience; instrumental Egoism and simple exchange "let's make a deal"; interpersonal concordance; law and Duty to Social order; Societal consensus; non-arbitrary social cooperation. (See Table 2.4 for the Stages of Moral Development)

Cognitive Development

The Reflective Judgment Interview (RJI) and the Linguistic Inquiry and Word Count (LIWC) (Pennebaker, 1992) were used for the qualitative component in the study that focused on cognitive development

Reflective Judgment Interview (RJI)

The RJI was developed in late 1970s. Each RJI stage describes both the individual's conception of the nature of knowledge and the process of justification for knowledge. The model has three general levels in pre-reflective, quasi-reflective and reflective (King & Kitchener 1994; Hofer & Pintrich, 1997) (See Table 2.3.) Kitchener and King (1994) further defined that reflective thinking relates to the structure of problems on which thinking is focused. Kitchener and King's (1994) focus was not on well-structured problems, but rather in the ill-structured domain. From ill-structured problems, students can learn to construct and defend reasonable solutions for the problem. The development of reflective judgement is the outcome of an interaction between the individual's conceptual skills and the environment that promotes the acquisition of skills.

There is no doubt of the importance of students engaging in reflective thinking and making reflective judgements while in school. It is the responsibility of educators in higher education to facilitate and promote students' thinking processes. Based upon the research of King and Kitchener (1994) in the Reflective Judgment Model (RJM), using the interview clarifies the functional level of reasoning (Table 2.3) and the justification of the judgment that students make. This study adapted the questioning prompts in written format into two parts. One part stated a current social issue, and the other translated the

social issue into an educational setting. The social issues included in the study were safety, gender, race, technology, crime, hate crime, environment, and classrooms (Appendix K).

Reflective thinking existed only after the recognition of real problems (Dewey, 1938), therefore, if there is no concern about the current understanding of an issue, there would be no reflecting thinking. The social issues brought the attention of students to uncertain or problematic situations. Their thinking process of a temporal solution for an issue would require ongoing verification and identification of beliefs, assumptions, and hypotheses. Putting the issues within the boundaries of a classroom setting emphasized professional training and understanding as pre-service teachers explored teaching as a career. In addition, it is very important for educators to know that students need practice and feedback with sustained support, challenge, and guided clinical analysis/reflection about their learning. Without these provisions, students will probably learn less than educators have planned for them (Fischer, 1980; Reiman, 1997).

For the intervention, students in all three groups participated in reflective discourse of social issues, and reflected their thoughts on paper first. Small group discussions were conducted in class and then followed by an entire class discussion for the Control Groups. Students in the Experimental Group continued their discussions using the NetForum on the Internet with minimum emphasis on in-class group discussions.

Using a short-term intervention for a semester as the study, it is hard to actually detect any cognitive development. The concept of the Reflective Judgement Interview (RJI) and its questioning probes were adapted in this study of the eight social issues, however, the instrument and its scoring scheme were not

used. The collected data was used in quantitative and descriptive formats in conjunction with the Linguistic Inquiry and Word Count (LIWC) for the qualitative analysis.

The Linguistic Inquiry and Word Count (LIWC)

LIWC is composed of 2,290 words and word stems. Each word or word stem defines one or more word categories or subdirectories. The domain of word categories included are: standard linguistic dimensions (word count, words per sentence, sentences ending with question mark(?), pronoun, negations, articles and prepositions); psychological processes (affective, emotional, cognitive, sensory, perceptual); relativity (time, space, motion); and personal concerns (occupation, leisure activity, money or financial issues, physical states, abstract issues). LIWC mean scores across forty-three studies captured an average of 80% of the words people used in writing and speech.

These instruments were used to analyze the qualitative data gathered through the social issues.

Independent Variables

The independent variables for this study were the time of test and the teaching method. The teaching method included Technology-Assisted-Reflection (Experiment) and traditional (Control I, Control II) and the Time of Test consisted of pretest and posttest.

Control Variables

The control variables for this study were whether participants had minor (with minor and without minor) and post-bachelor degrees (with post-bachelor degree and without post-

bachelor degree). This information was used in the investigation of whether pre-service teachers' prior experience had any effect on their cognition, ethics, or stages of concern in computing. The control variables were derived from the sample on the Demographic Profile of Respondents sheet (See Appendix F-H for the demographic profile).

The first control variable, minors, represents nominal measurement (with minor and without minor). 30% of students (n=6) in the Experimental Group had a minor. Control Group I had 21% students (n=6) with a minor, and 25% of the students (n=5) had a minor in Control Group II.

The second control variable, Post-Bachelor degree, represents nominal measurement. The Experimental Group had 20% of students (n=4) with Post-Bachelor degrees. Control Group I had only 4% students (n=1) with Post-Bachelor degrees, and Control Group II had 15% of students (n=3) with Post-Bachelor degrees.

Research questions

The study employed both quantitative and qualitative components with a descriptive and quasi-experimental research design. The primary goal for this study was to examine whether students who used Technology-Assisted-Reflection in ECI 205 course - Introduction to Teaching Humanities and Social Sciences would show growth in cognitive and ethical areas, and a greater reduction of their concerns related to computing than students who use a traditional teaching method. The research questions were:

1. Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in cognitive development than the Control Groups that used a traditional teaching method?

2. Did students with minors in the Experimental Group have greater gains in cognitive development than students with minors in the Control Groups that used a traditional teaching method?
3. Did students with post-bachelor degrees in the Experimental Group have greater gains in cognitive development than students with post-bachelor degree in the Control Groups that used a traditional teaching method?
4. Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in moral development than the Control Groups who used the traditional teaching method?
5. Did students with minors in the Experimental Group have greater gains in moral development than students with minors in the Control Groups that used a traditional teaching method?
6. Did students with post-bachelor degrees in the Experimental Group have greater gains in moral development than students with post-bachelor degrees in the Control Groups that used a traditional teaching method?
7. Did the various levels of stages of concern in the Experimental Group of Technology-Assisted-Reflection differ from the levels in the Control Groups that used the traditional teaching method?

Human development is a slow process. Researchers have shown that the probability of getting statistically significant findings decreases with short term interventions. Since this study was a 4-month intervention, the instrument for detecting cognitive development, the Reflective Judgment Interview (RJI), was not used, but the concept of the RJI was used in interpreting students' ill-structured social issues as descriptive information. LIWC and the RJI instruments were used in the qualitative analysis of cognitive development in this study.

Hypotheses

The hypotheses assumed that pre-service teachers in the Experimental Group would show more growth in the areas of cognition and ethics, and a reduction in their concerns about computing when compared to the students in the more traditional course.

Hypothesis 1:

Technology-Assisted-Reflection in the Experimental Group will promote greater gains in cognitive development than in the Control Groups that used a traditional teaching method.

Hypothesis 2:

Students with minors would show higher mean gain scores in their cognitive growth between the Experimental Group and the Control Groups than students without minors.

Hypothesis 3:

Post-bachelor students would show higher mean gain scores in their cognitive growth between the Experimental Group and the Control Groups than students without Post-bachelor degrees.

Hypothesis 4:

There will be a statistically significant mean difference score (posttest - pretest) for moral growth of students in the Experimental Group. Students in the Experimental Group (Technology-Assisted-Reflection) will show a significant mean gain score in the higher stages of moral development. Students in the Control Groups will show no significant mean gain in stages of moral growth.

Hypothesis 5:

Students with minors will show higher mean gain scores in their moral growth between the Experimental Group and the Control Groups than students without minors.

Hypothesis 6:

Post-bachelor students would show higher mean gain scores in their moral growth between the Experimental Group and the Control Groups than students without Post-bachelor degrees.

Hypothesis 7:

There will be a statistically significant mean difference score (posttest - pretest) the stages of concerns in computing of students in the Experimental Group. Students in the Experimental Group (Technology-Assisted-Reflection) will show a significant mean gain score in the higher stages about computing than students in the Control Groups.

The sample size for both minor and post-bachelor degree students in the study was small. The Experimental Group had 30% of students (n=6) with minors. Control Group I had 21% students (n=6) with minors, and 25% of the students (n=5) have a minor in Control Group II. The Experimental Group has 20% of students (n=4) with Post-Bachelor degrees. Control Group I had only 4% students (n=1) with Post-Bachelor degrees and Control Group II had 15% of students (n=3) with Post-Bachelor degrees. Therefore, Hypotheses 2, 3, 5 and 6 were eliminated from further analysis.

Procedure (Implementation Plan)

Before the semester started, this researcher met with the instructor of the Experimental Group and exchanged information on the technical aspects of the course. Changes in the electronic forms were made based on input from the instructor to better identify submissions from individual students through the Internet. Training was also provided to get the instructor familiarized with the online course pack, electronic forms, and NetForum. A laptop was provided to the instructor to facilitate the teaching and learning environment.

The researcher also met with all three instructors of the course sections prior to the start of the semester, explained the purpose of the study and the eight social issue assignments, and the roles of instructors as classroom teachers in dealing with these social issues. Instructors and the researcher met frequently during the semester to keep everyone updated on the progress, and to discuss problems and solutions. A focus group was conducted before the instructors left for the summer to exchange and share information of their experiences as instructors of the experimental and Control Groups.

The total sample of pre-service teachers (Experimental Group - 20, Control Group I - 28, Control Group II - 20) were surveyed with the Computing Concerns Questionnaire (CCQ) (Martin, 1989) (Appendix I), the Defining Issue Test (DIT) (Rest, 1979) and the demographic profile on the first day of class. The posttest was administered during the last week of the semester.

HyperText Markup Language (HTML) and Perl Script were used to set up a class website and electronic forms for field notes and journal assignments. Listserv and E-mail were also utilized for communication among students and teachers. Listserv, E-mail,

and NetForum were new to students in the Experimental Group, therefore, workshops were integrated into the class schedule in the beginning of the semester to get students up to speed to grasp the technologies. Approximately three sessions of 30-minute each were given. In addition to the workshop, Internet etiquette was also introduced to students in the workshop.

The maximum seats that each classroom held for the ECI 205 was 25. The computer laboratory to which students in the Experimental Group were assigned was equipped with 10 computers. The ratio for computers and students was approximately 1:2.

The researcher assisted in setting up NetForum and Listserv and sat in as an observer with students in the Experimental Group for the entire semester to take descriptive notes with limited participation to answer technical questions whenever it was necessary. The researcher also served as a coordinator for all three sections of the course to ensure that course contents, assignments, supplemental materials and requirements in all sections were similar and compatible.

Significance

If the study is successful, the model will be expanded and applied to other college courses in teacher education at institutions with students similar to those in the study.

Statistical Analysis

The Statistical Analysis System (SAS) software program (1998) was used for the statistical analysis of the data. See Table 3.7 for statistical analysis of the data listed by hypothesis.

Table 3.7
Statistical Analysis

Hypothesis	Dependent Variable	Dependent Level of Measurement	Independent or Control Variable	Independent Level of Measurement	Data Analysis
1	RJI/LIWC	Interval	Time of Test Teaching Method	nominal nominal	Qualitative Component
2	RJI	Interval	Minor	nominal	Eliminated due to small sample size
3	RJI	Interval	post-bachelor	nominal	
4	DIT	Interval	Time of Test Teaching Method	nominal nominal	one-Sample <i>t</i> -test
5	DIT	Interval	Minor	nominal	Eliminated due to small sample size
6	DIT	Interval	post-bachelor	nominal	
7	CCQ	Interval	Time of Test Teaching Method	nominal nominal	one-Sample <i>t</i> -test

Summary

This study used both quantitative and qualitative components with descriptive and quasi-experimental statistical designs. The statistical part of the study involved dependent variables (the Computing Concerns Questionnaire and the Defining Issues Test) with the difference between the time of test for Control and Experimental Groups. The qualitative component was conducted using the Reflective Judgment Interview and the Linguistic Inquiry Word Count. Due to small sample size, students' academic status (with minor versus without minor) and educational level (with post-bachelor versus without post-bachelor degrees) were eliminated for further analysis.

The descriptive part of the study involved characterizing the subjects in the groups. Data were drawn from the demographic profile, surveys, interviews, online discussion, Listserv and E-mails.

Chapter 4 discusses the analyses of this study - statement of the problem, introduction, demographic variable analysis and findings on the hypothesis.

Chapter 4

Presentation and Discussion of Data

Statement of the Problem

The purpose of this research was to discover: (1) Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in cognitive development than the Control Groups that used a traditional teaching method? (2) Did students with minors in the Experimental Group have greater gains in cognitive development than students with minors in the Control Groups that used a traditional teaching method? (3) Did students with post-bachelor degrees in the Experimental Group have greater gains in cognitive development than students with post-bachelor degrees in the Control Groups that used a traditional teaching method? (4) Did Technology-Assisted-Reflection in the Experimental Group promote greater gains in moral development than the Control Groups who used the traditional teaching method? (5) Did students with minors in the Experimental Group have greater gains in moral development than students with minors in the Control Groups that used a traditional teaching method? (6) Did students with post-bachelor degrees in the Experimental Group have greater gains in moral development than students with post-bachelor degrees in the Control Groups that used a traditional teaching method? (7) Did the various levels of stages of concern in the Experimental Group of Technology-Assisted-Reflection differ from the levels in the Control Groups that used the traditional teaching method?

When the control variables of minors and post-bachelor degrees were implemented, the sample size in the resulting cells was very small (see Table 4.13). The Experimental Group had 30% of students (n=6) with minors, Control Group I had 21% students (n=6) with minors, and 25% of the students (n=5) had minors in Control Group II. The Experimental Group had 20% of students (n=4) with Post-Bachelor degrees, Control Group I had only 4%

students (n=1) with Post-Bachelor degrees, and Control Group II had 15% of students (n=3) with Post-Bachelor degrees. Due to the small cell size, the variables minor and post-bachelor degrees were eliminated from further analysis.

Chapter 4 contains results of both the qualitative and statistical analyses of the data.

Introduction

It was hypothesized that Technology-Assisted-Reflection would promote pre-service teachers' cognitive and moral growth and decrease their personal concerns for computing. The pre-service teachers in the teacher education program were chosen for this study because the North Carolina State Board of Education adopted a position statement calling for formal assessment, revision, and improvement of the technology competencies for educators and the establishment of assessments. The initial licensure requirement from the North Carolina Department of Public Instruction (NCDPI) stipulates that pre-service teachers complete a technology portfolio before graduation from a Teacher Education program. Many seniors have high anxiety and a fear of not being able to obtain their license due to a lack of training and education in technology. Instructors are looking for solutions to integrate technology into their teaching to accommodate for the new requirements. However, adding new courses to an already established full program is very difficult. This study attempted to demonstrate that it is possible to integrate advanced technologies such as the Internet, electronic forms, NetForum, Listserv and E-mail into an established course, as well as evaluate the development of students in their cognitive and moral growth under the enriched environment of Technology-Assisted-Reflection.

All students in the study were registered in ECI 205 course - Introduction to Teaching Humanities and Social Sciences. The curriculum was to help them understand the teaching profession as their career for the future. The total sample included 68 students from the same college.

This study employed both quantitative and qualitative components with descriptive and quasi-experimental research designs. The statistical part of the study employed one-sample *t*-tests to calculate the mean score of the difference between the pretest and posttest, and to find out whether or not there was a significant increase of moral development and a decrease of computing concerns in both experimental and Control Groups. In addition, a factorial analysis of variance (ANOVA) design was planned to allow the evaluation of more than one independent variable and their interaction (e.g. with minor and without minor, with post-bachelor and without post-bachelor degrees). This ANOVA was eliminated due to small cell size in the sample.

The descriptive part of the study involved characterizing the three groups on the measures of the Defining Issues Test and the Computing Concerns Questionnaire scores (mean, median, standard deviation) to indicate the average score and the variability of scores for the sample and frequencies for categorical data. According to Gall, Borg and Gall (1996), descriptive research is used to investigate and provide detailed information and characteristics of a sample or population. Observational and survey methods are frequently used to collect descriptive data.

A qualitative component of this research involved interviewing and observing a random sample of students in Experimental and Control Groups, as well as collecting data from open-ended questionnaires, social issues, E-mails, NetForum,

informal interviews and in-class observations throughout the semester. The Reflective Judgment Interview (RJI) and the Linguistic Inquiry and Word Count (LIWC) (Pennebaker, 1992) were used for the qualitative component in cognitive development.

The two instruments for analyzing the quantitative component were the Computing Concerns Questionnaire (CCQ) (Martin, 1989) (Appendix I), and the Defining Issues Test (DIT) (Rest, 1979).

Demographic Variables

The percentage breakdown on the age variable for the 68 pre-service teachers is shown in Table 4.1. The majority of the pre-service teachers (69%) were in the 18-22 age category (n=47); 21% were in the 23-30 age group (n=14); and 10% were in the 31-45 age category (n=7).

Table 4.1

Age of the Pre-Service Teachers by Groups

Age	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
18-22	11(55)	23(82)	13(65)	47(69)
23-30	5(25)	3(11)	6(30)	14(21)
31-45	4(20)	2(7)	1(5)	7(10)
Total	20(29)	28(41)	20(29)	68(100)

The age groups of the participating pre-service teachers are depicted in a bar chart in Figure 4.1

Figure 4.1

Graph of Age of the Pre-Service Teachers by Groups

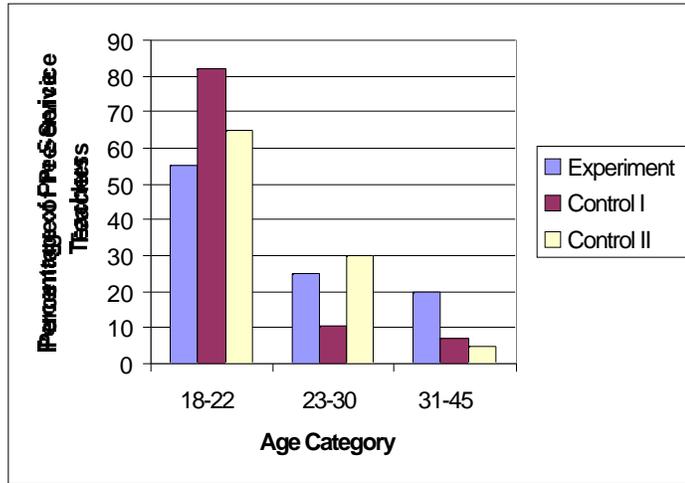


Table 4.2 illustrates the frequency and percentage breakdown of the gender of the pre-service teachers. Female pre-service teachers (n=37) represent 54% of the total participants. There were 31 male pre-service teachers who represent 46% of the total participants.

Table 4.2

Gender of the Pre-Service Teachers by Groups

Gender	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Female	9(45)	18(64)	10(50)	37(54)
Male	11(55)	10(36)	10(50)	31(46)
Total	20(29)	28(41)	20(29)	68(100)

The gender of the participating pre-service teachers are depicted in a bar chart in Figure 4.2

Figure 4.2

Graph of Gender of the Pre-Service Teachers by Groups

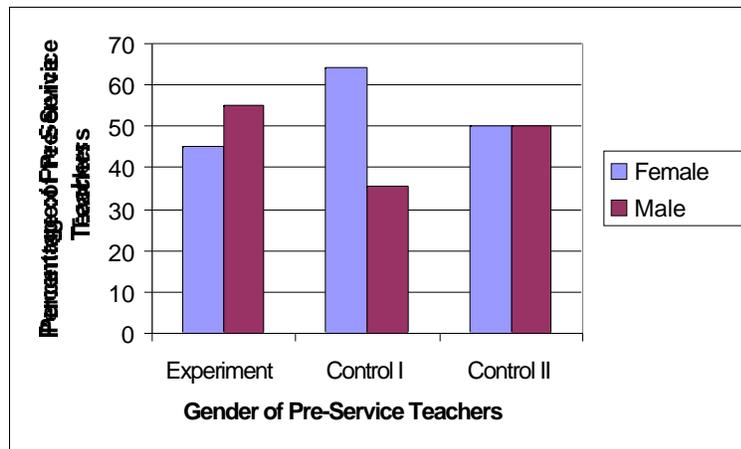


Table 4.3 illustrates the frequency and percentage breakdown of the number of the pre-service teachers with minors. The Experimental Group had 30% of students with minors. Control Group I had 21% of students with minors, and Control Group II had 25% of students with minors. There was a total of seventeen pre-service teachers (25%) with minors in the study.

Table 4.3

Pre-Service Teachers with Minors versus without Minor by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Minor	6(30)	6(21)	5(25)	17(25)
No Minor	14(70)	22(79)	15(75)	51(75)
Total	20(29)	28(41)	20(29)	68(100)

The minor and no minor academic status of the participating pre-service teachers are depicted in a bar chart in Figure 4.3.

Figure 4.3

Graph of Pre-Service Teachers with and without Minors by Groups

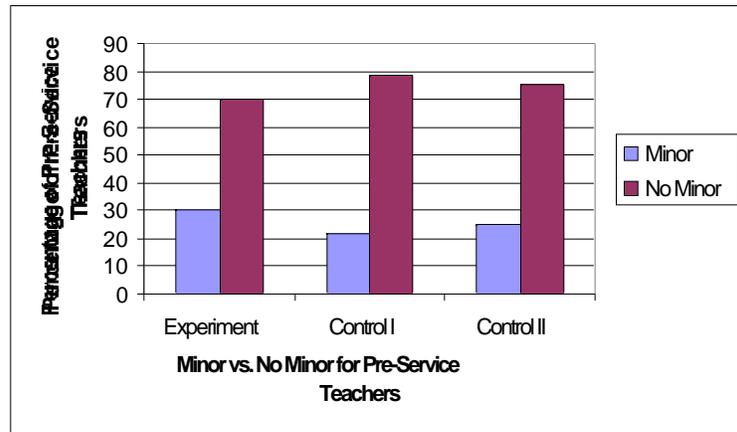


Table 4.4 illustrates the frequency and percentage breakdown of the number of the pre-service teachers with Post-Bachelor degrees. The Experimental Group had 20% of students with Post-Bachelor degrees. Control Group I had 4% of students with Post-Bachelor degrees, and Control Group II had 15% of students with Post-Bachelor degrees. There were eight pre-service teachers (12%) represented of the total with Post-Bachelor degrees in the study.

Table 4.4

Pre-Service Teachers' Post-Bachelor versus no Post-Bachelor Degree by groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Post-Bachelor	4(20)	1(4)	3(15)	8(12)
No Post-Bachelor	16(80)	27(96)	17(85)	60(88)
Total	20(29)	28(41)	20(29)	68(100)

The educational level in Post-Bachelor degrees of the participating pre-service teachers are depicted in a bar chart in Figure 4.4.

Figure 4.4

Graph of Pre-Service Teachers' Educational Level by Groups

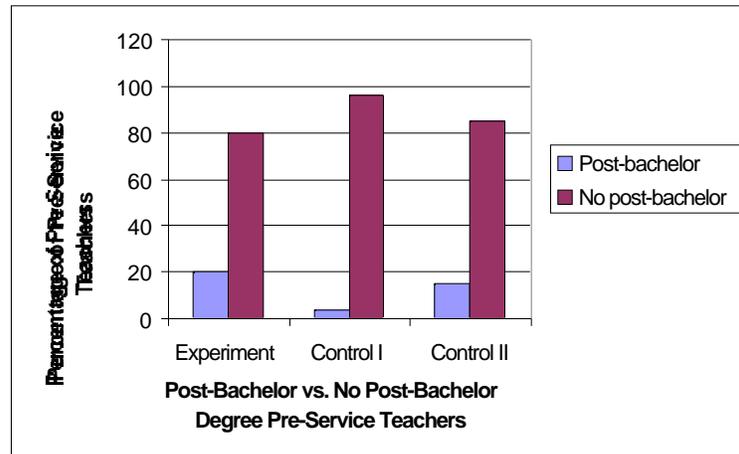


Table 4.5 illustrates the frequency and percentage breakdown of the number of the pre-service teachers who had home computers. The Experimental Group had 55% of students (n=11) with home computers. Control Group I had 71% of students (n=20) with home computers, and Control Group II had 95% of students (n=18) with home computers. There were forty-nine pre-service teachers (72%) represented of the total with home computers in the study.

Table 4.5

Pre-Service Teachers with Home Computers by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n (%)
Home computer	11(55)	20(71)	18(90)	49(72)
No Home computer	9(45)	8(29)	2(10)	19(28)
Total	20(29)	28(41)	20(29)	68(100)

The percentage representing home computer vs. no home computer in each participating group is shown in Figure 4.5.

Figure 4.5

Graph of Pre-Service Teachers' with and without Home Computers by Group

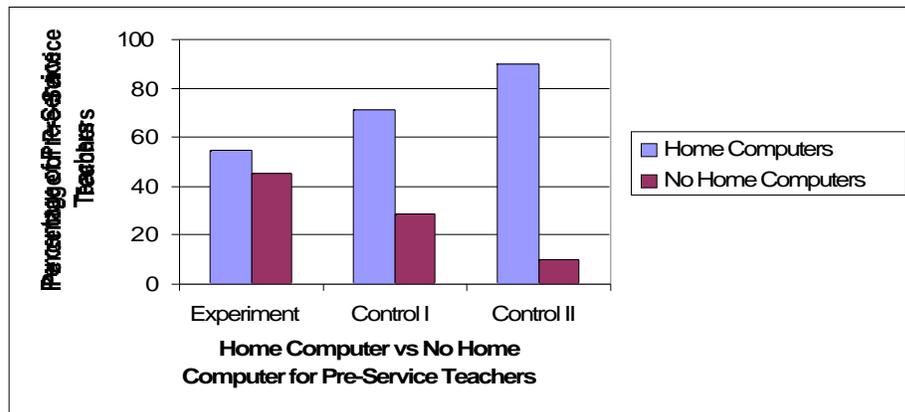


Table 4.6 illustrates the frequency and percentage breakdown on the types of home computers that pre-service teachers had. Pre-service teachers (n=49) represented approximately 72% of the total (n=68) with home computers (PC) and as shown in the table, 48 students out of the 49 students had PC or PC compatibles at home (98%).

Table 4.6

Pre-Service Teachers' Type of Home Computers by Group

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n (%)
PC compatible	11(55)	19(68)	18(90)	48(71)
Macintosh	0(0)	1(4)	0(0)	1(1)
None	9(45)	8(29)	2(10)	19(28)
Total	20(29)	28(41)	20(29)	68(100)

The percentage of home computers in the use of PC or Macintosh from each group is also categorized and illustrated in Figure 4.6.

Figure 4.6

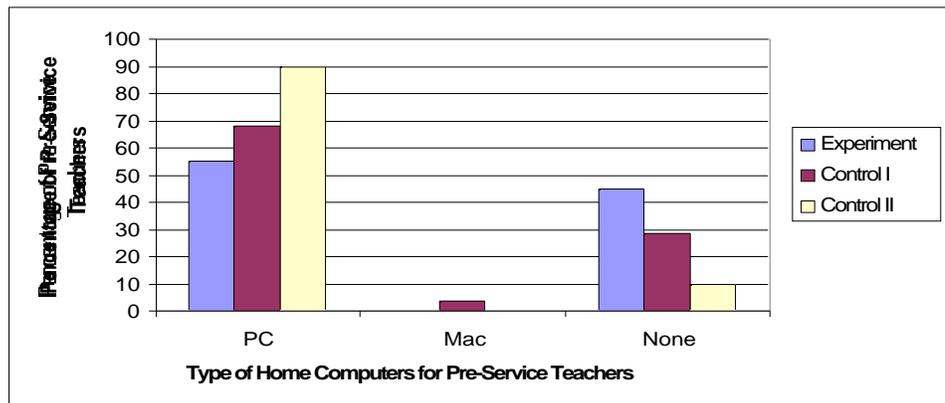
Graph of Pre-Service Teachers' Type of Computers Owned by Group

Table 4.7 illustrates the frequency and percentage breakdown of the number of the pre-service teachers who had access to the Internet off campus. Pre-service teachers (n=67) represented 99% of the total with access to the Internet.

Table 4.7

Pre-Service Teachers' with Home Access to the Internet Off Campus by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Internet Access	19(95)	28(100)	20(100)	67(99)
No Internet Access	1(5)	0(0)	0(0)	1(1)
Total	20(29)	28(41)	20(29)	68(100)

The percentage of student access in each group is also depicted in Figure 4.7 below.

Figure 4.7

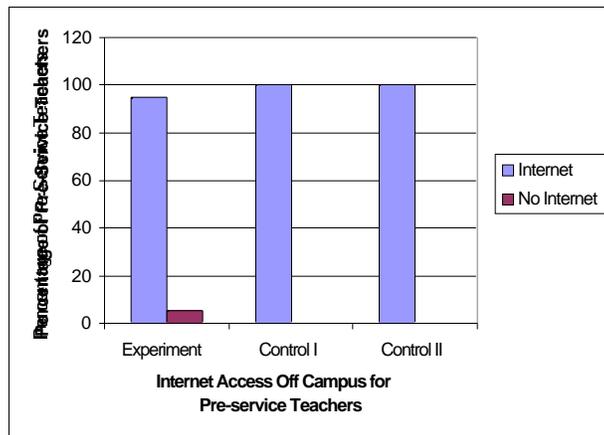
Graph of Pre-Service Teachers with Internet Access Off Campus by Group

Table 4.8 illustrates the frequency and percentage breakdown of the number of pre-service teachers who had access to E-mail off campus. Pre-service teachers (n=65) represented 96% of the total with access to E-mail.

Table 4.8

Pre-Service Teachers' with E-mail Access Off Campus by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
E-mail Access	19(95)	28(100)	18(90)	65(96)
No E-mail Access	1(5)	0(0)	2(10)	3(4)
Total	20(29)	28(41)	20(29)	68(100)

The percentage representing E-mail access vs. no E-mail access in each participating group is shown in Figure 4.8.

Figure 4.8

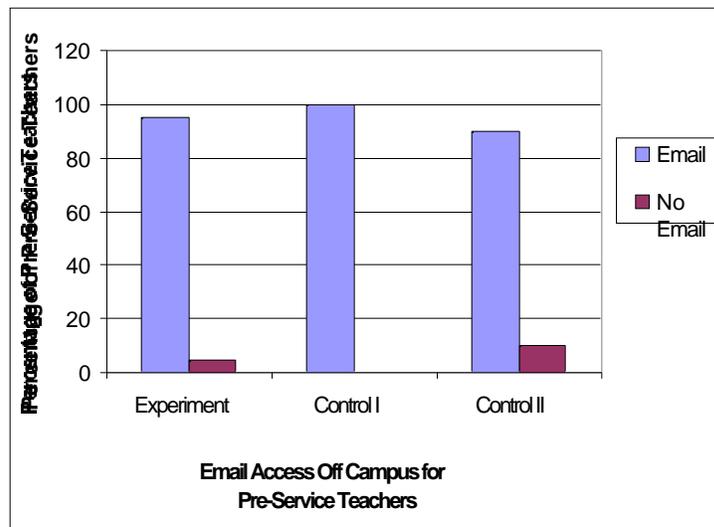
Graph of Pre-Service Teachers with and without E-mail Access Off Campus by Group

Table 4.9 illustrates the frequency and percentage breakdown for pre-service teachers on the purpose for using computers: academia or leisure. A slightly higher percentage of

students used computers in the area of leisure (49%) rather than for academia (47%).

Table 4.9

Pre-Service Teachers' Purpose for Using Computers in Academia or Leisure by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Academia	11(55)	14(50)	7(35)	32(47)
Leisure	9(45)	12(43)	12(60)	33(49)
Both	0(0)	2(7)	0(0)	2(3)
Work	0(0)	0(0)	1(5)	1(1)
Total	20(29)	28(41)	20(29)	68(100)

The percentage representing the use of computers in each participating group is shown in Figure 4.9.

Figure 4.9.

Graph of Pre-Service Teachers' Purpose for Using Computers in Academia or Leisure by Group

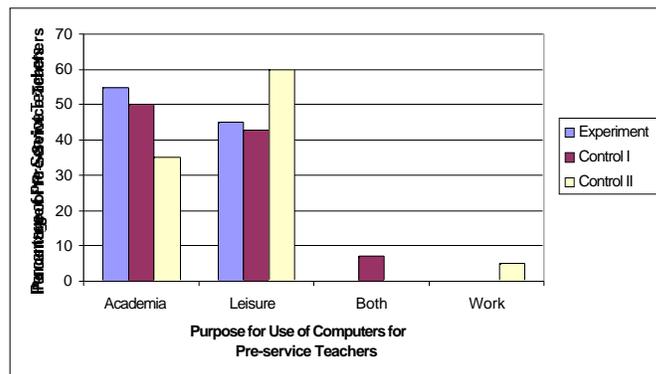


Table 4.10 illustrates the frequency and percentage breakdown of the age at which pre-service teachers started using

computers. There were 20% of students in the Experimental Group who used computers after nineteen years of age; whereas, students in both Control Groups who used computers after nineteen years of age were 3.6% and 5%, respectively.

Table 4.10

Age at which the Pre-Service Teachers Started Using Computers by Group

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
6-9	2(10)	9(32)	7(35)	18(26)
10-12	7(35)	11(40)	8(40)	26(38)
13-15	4(20)	4(14)	2(10)	10(15)
16-18	3(15)	3(11)	2(5)	8(12)
19 -	4(20)	1(4)	1(5)	6(9)
Total	20(29)	28(41)	20(29)	68(100)

Figure 4.10

Age at which the Pre-Service Teachers Started Using Computers by Group

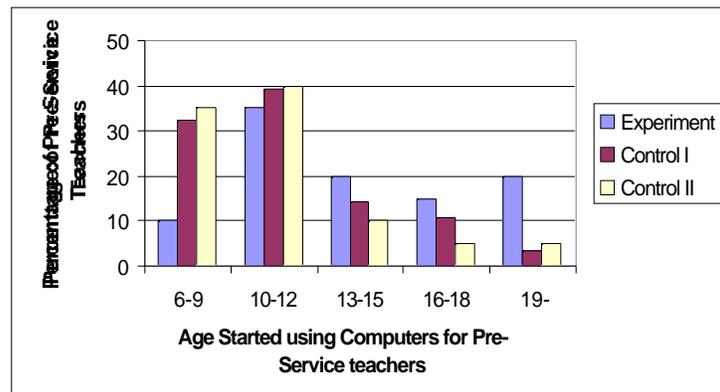


Table 4.11 illustrates the frequency and percentage breakdown in regard to the pre-service teachers' attitude toward computing. When encountering computing problems, 43% of students thought that it was an opportunity to learn more about computing. It was discovered that more than half of the students (57%) in the study did not take the opportunity as a chance to learn when they encountered problems and would ask for assistance immediately.

Table 4.11

Pre-Service Teachers Attitude Towards Computing by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Opportunity to Learn	8(40)	10(36)	11(55)	29(43)
Not an Opportunity to Learn	12(60)	18(64)	9(45)	39(57)
Total	20(29)	28(41)	20(29)	68(100)

The percentage representing students' attitudes toward computer problems in each participating group is shown in Figure 4.11.

Figure 4.11

Graph of Pre-Service Teachers' Attitude Towards Computing by Group

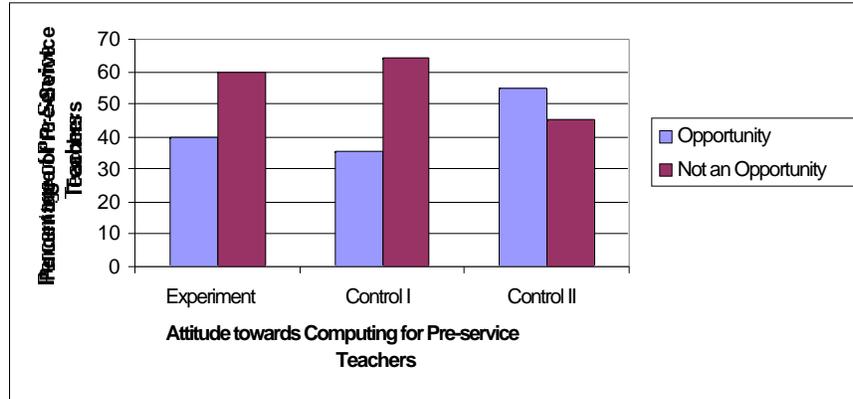


Table 4.12 illustrates the frequency and percentage breakdown of pre-service teachers' interest in technology. 72% of the students in the study were interested in computer technology.

Table 4.12

Pre-Service Teachers Interest in Technology by Groups

	Experiment n(%)	Control I n(%)	Control II n(%)	Total n(%)
Interest in technology	15(75)	21(75)	13(65)	49(72)
Not Interest in technology	5(25)	7(25)	7(35)	19(28)
Total	20(29)	28(41)	20(29)	68(100)

The percentage representing students' interests in technology in each participating group is shown in Figure 4.12.

Figure 4.12

Graph of Pre-Service Teachers' Interests in Technology by Group

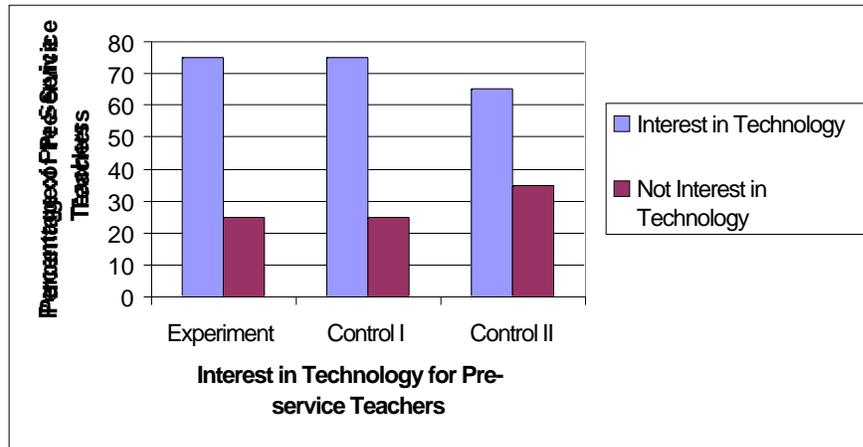


Table 4.13 lists the demographics of students in gender, age, minors, Post-Bachelor degree, age beginning using computers, home computer accessibility, leisure or homework access, and attitude toward computer problems.

Table 4.13

Demographics of Students in the Sample

	Experimental Group n(%)	Control I Group n(%)	Control II Group n(%)
Gender			
Male	11(55)	10(36)	10(50)
Female	9(45)	18(64)	10(50)
Total	20(100)	28(100)	20(100)
Age			
18-22 age group	11(55)	23(82)	13(65)
23-30 age group	5(25)	3(11)	6(30)
31-45 age group	4(20)	2(7)	1(5)
Total	20(100)	28(100)	20(100)
Minor			
Minor	6(30)	6(21)	5(25)
No Minor	14(70)	22(79)	15(75)
Total	20(100)	28(100)	20(100)

Post-Bachelor	4(20)	1(4)	3(15)
No Post-Bachelor	16(80)	27(96)	17(85)
Total	20(100)	28(100)	20(100)
Started Using	4(20)	1(4)	1(5)
Computers After 19	16(80)	27(96)	17(95)
Total	20(100)	28(100)	20(100)
Home Computer	11(55)	20(71)	18(90)
Accessibility	9(45)	8(29)	2(10)
Total	20(100)	28(100)	20(100)
Leisure Access	9(45)	12(43)	12(60)
Academia Access	11(55)	16(57)	8(40)
Total	20(100)	28(100)	20(100)
Attitude Toward Computer Problems			
Opportunity to learn	8(40)	10(36)	11(55)
Not an Opportunit	12(60)	18(64)	9(45)
to learn			
Total	20(100)	28(100)	20(100)

Comments on Computing Concerns Questionnaire (Martin) Scoring procedures

There are 32 statements in the questionnaire and eight stages for Stages of Concern. Each of the eight Stages of Concern is represented by four statements. To score, first, a "raw score" is obtained for each stage by the sum of the responses to the four statements for the stage. Once the four-item raw scores are obtained and added, it is necessary to convert them to percentile scores based on the percentiles chart for raw scores (see Table 4.14) before interpretation. For example, the total score of stage 0 scale is derived by adding the four statements (question number 4, 14, 21 and 32) from the questionnaire assigned to stage 0. (See Appendix D for distribution of Computing Concerns Questionnaire scoring statements.) The raw scores are added and converted to percentile scores based on the responses of 388 participants in Martin's study (p. 123) and Table 4.14.

Table 4.14

Percentiles for Raw Scores for Eight Stages of Concern (SoC) Across twenty-nine Raw Scores N=388 (Martin, 1989)

Raw Score	Soc 0	Soc 1	Soc 2	Soc 3	Soc4s	Soc 4o	Soc 5	Soc 6
0	1	0	0	2	1	6	1	6
1	3	0	1	2	1	10	2	11
2	5	1	1	3	1	13	4	15
3	9	1	3	4	2	18	7	19
4	25	2	5	6	2	21	12	23
5	33	3	8	8	2	26	14	27
6	41	5	10	10	2	30	17	30
7	49	8	15	13	3	33	19	34
8	53	10	21	16	3	38	24	38
9	58	14	26	21	3	44	28	42
10	64	16	33	26	4	47	32	45
11	68	19	38	28	4	51	36	49
12	72	25	43	33	5	54	40	56
13	77	29	48	40	7	56	43	61
14	80	32	53	46	8	60	49	64
15	83	35	58	51	12	64	54	70
16	85	43	63	57	13	69	59	75
17	87	48	67	61	17	74	62	80
18	90	53	71	68	20	78	67	83
19	91	58	75	74	22	81	73	86
20	93	63	78	78	27	84	76	91
21	94	68	81	84	35	86	80	92
22	95	73	84	88	43	89	84	94
23	96	79	86	90	50	91	87	95
24	97	83	90	93	59	94	90	97
25	98	87	92	95	68	95	92	98
26	99	90	94	96	76	96	94	98
27	99	92	95	98	83	97	96	99
28	100	100	100	100	100	100	100	100

After the percentile score for individual is calculated, a difference scores was determined (posttest - pretest) for each case. Using a one-sample *t*-test the researcher tested the hypothesis that the population mean of the difference scores was equal to zero. This *t*-test was conducted for each group.

Findings on Hypotheses

A one-sample *t*-test was performed by creating a difference score variable for a particular stage, and determining whether the mean difference score for the population was significantly different from zero for each group (Experimental, Control I and Control II), (Hatcher & Stepanski, 1994). If the experiment shows the expected effect, this means that the technology ratings obtained under the experimental condition would show significance in the higher stages. If the manipulation shows the predicted effect, the average difference score in higher stages should be both positive and significantly different from 0.

This analysis will be divided into quantitative and qualitative sections. Hypothesis 1 will be discussed in the qualitative section; Hypotheses 4 and 7 will be discussed in quantitative section; Hypotheses 2, 3, 5, 6 will be eliminated from further analysis due to small cell sizes in the sample related to students with minors and post-bachelor degrees.

Qualitative Study

Hypothesis 1

Technology-Assisted-Reflection in the Experimental Group will promote greater gains in cognitive development than in the Control Groups that used a traditional teaching method.

Hypothesis 2 and Hypothesis 3: these hypotheses were eliminated due to small sample sizes.

Quantitative Study**Hypothesis 4**

There will be a statistically significant mean difference score (posttest - pretest) for moral growth of students in the Experimental Group. Students in the Experimental Group (Technology-Assisted-Reflection) will show a significant mean gain score in the higher stages of moral development. Students in the Control Groups will show no significant mean gain in stages of moral growth.

The average of difference scores between pretest and posttest on the DIT was derived. A positive mean value would mean that, on average, scores from the posttest tended to be higher than scores from pretest. If the p value was much higher than the standard cutoff value of 0.05, the mean difference score would not be significantly different from 0.

Table 4.15 depicts that the mean gain score for each moral stage from the posttest was not significantly different from zero for each group. In other words, technology had no affect on the Experimental Group statistically. However, there was a shift on moral stage from a lower stage to a higher stage. Results were analyzed using a one-sample *t*-test.

Table 4.15

The Means Procedure for the Experimental Group on the DIT

Variable	N	Mean	Std Error	Std Dev	t Value	Pr > t
stage2	12	-0.33	0.50	1.72	-0.67	0.52
stage3	12	0.58	1.04	3.60	0.56	0.59
stage4	12	-0.58	1.72	5.96	-0.34	0.74
stage5a	12	0.08	1.36	4.72	0.06	0.95
stage5b	12	0.67	0.74	2.57	0.90	0.39
stage6	12	-0.92	1.05	3.63	-0.87	0.40
Principle	12	-0.29	2.95	10.23	-0.10	0.92

$p < 0.05$

This analysis revealed non-significant findings for the one-sample t -test conducted on the mean of the differences scores as illustrated in Table 4.15, the values were $t(12) = -0.67$, $p > 0.05$ in stage 2; $t(12) = 0.56$, $p > 0.05$ in stage 3; $t(12) = -0.34$, $p > 0.05$ in stage 4; $t(12) = 0.06$, $p > 0.05$ in stage 5a; $t(12) = 0.90$, $p > 0.05$ in stage 5b; $t(12) = -0.87$, $p > 0.05$ in stage 6; $t(12) = -0.10$, $p > 0.05$ in principle score which is a sum of scores for stage 4, stage 5a and stage 5b.

The sample means are displayed in Table 4.16, which shows that the mean posttest scores ($\underline{M} = 2.33$, $SD = 2.06$) are lower than the mean for the pretest conditions ($\underline{M} = 2.67$, $SD = 2.06$) in stage 2. Mean posttest scores ($\underline{M} = 6.67$, $SD = 2.64$) are slightly higher than the mean for the pretest conditions ($\underline{M} = 6.08$, $SD = 3.34$) in stage 3. The mean posttest scores ($\underline{M} = 18.50$, $SD = 7.45$) are lower than the mean for the pretest conditions ($\underline{M} = 19.08$, $SD = 6.53$) in stage 4. The mean posttest scores ($\underline{M} = 16.83$, $SD = 5.77$) are slightly higher than the mean for the pretest conditions ($\underline{M} = 16.75$, $SD = 4.33$) in stage 5a. The mean posttest scores ($\underline{M} = 4.83$, $SD = 2.69$) are slightly higher than the mean for the pretest conditions ($\underline{M} = 4.17$, $SD = 3.38$) in stage 5b. Mean posttest scores ($\underline{M} = 4.08$, $SD = 2.15$) are lower than the mean for the pretest conditions ($\underline{M} = 5.00$, $SD = 2.92$) in stage 6. Finally, the mean posttest scores ($\underline{M} = 42.91$, $SD = 10.50$) are lower than the mean for the pretest conditions ($\underline{M} = 43.20$, $SD = 9.63$) in the principle score.

Table 4.16

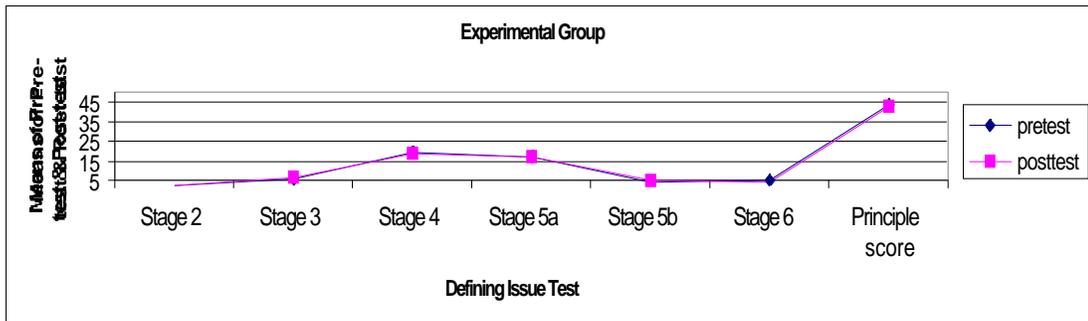
The Means procedure for the Experimental Group in DIT

Variable	N		Mean		Std Dev		Minimum		Maximum	
	pre	post	Pre	Post	Pre	Post	Pre	Post	pre	Post
stage2	12	12	2.67	2.33	2.06	2.06	0	0	8.00	6.00
stage3	12	12	6.08	6.67	3.34	2.64	1.00	2.00	11.00	11.00
stage4	12	12	19.08	18.50	6.53	7.45	7.00	4.00	27.00	31.00
stage5a	12	12	16.75	16.83	4.33	5.77	11.00	9.00	25.00	28.00
stage5b	12	12	4.17	4.83	3.38	2.69	0	0	11.00	9.00
stage6	12	12	5.00	4.08	2.92	2.15	0	0	10.00	8.00
Principle	12	12	43.20	42.91	9.63	10.50	25.00	21.70	56.70	63.30

Figure 4.13 represents the moral stages between pretest and posttest in the Experimental Group.

Figure 4.13

Moral Stages for Experimental Group on the DIT



The lines in Figure 4.13 depicting pretest versus posttest are overlapping. There are slightly increased mean gain scores in stage 5a and stage 5b. The principle score (p score) is an indication for stages 4, 5a and 5b, which shows a decrease because of the lower mean for the posttest scores in stage 4. The descriptive statistics using SPSS from the Center for the study of Ethics Development (n=270) show mean scores for college students in Stage 3 (\underline{M} = 8.6, SD = 5.14), Stage 4 (\underline{M} = 17.01, SD = 8.070), Stage 5a (\underline{M} = 15.81, SD = 6.31), Stage 5b (\underline{M} = 5.20, SD = 3.40), Stage 6 (\underline{M} = 4.89, SD = 3.34), and a p score (\underline{M} = 43.19,

SD = 14.32). Despite the non-significant statistical result, Figure 4.13 indicates moral development of the pre-service teachers at Stage 4 in the Experimental Group, since Stage 4 is the stages with the highest posttest mean (\underline{M} = 18.50) as shown in Table 4.16. The non-significant statistics suggest the possibility of no effect of Technology-Assisted-Reflection in promoting moral development of students.

The statistical result of the DIT for Control Group I will be analyzed below. Results were analyzed using a one-sample t -test. Table 4.17 represents the moral stages on the mean of the difference scores for the Control Group I.

Table 4.17

The Means Procedure on the DIT for Control Group I

Variable	N	Mean	Std Error	Std Dev	t Value	Pr > t
stage2	23	0.52	0.54	2.60	0.96	0.35
stage3	23	0.63	1.02	4.88	0.62	0.54
stage4	23	-1.00	1.53	7.34	-0.66	0.52
stage5a	23	-0.03	1.26	6.04	-0.02	0.98
stage5b	23	-0.30	0.72	3.44	-0.42	0.68
stage6	23	-0.52	0.60	2.88	-0.87	0.39
Principle	23	-1.43	2.66	12.74	-0.54	0.59

$p < 0.05$

This analysis revealed non-significant findings for the one-sample t -test conducted on the mean of the difference scores as illustrated in Table 4.17. The values were $t(23) = 0.96$, $p > 0.05$ in stage 2; $t(23) = 0.62$, $p > 0.05$ in stage 3; $t(23) = -0.66$, $p > 0.05$ in stage 4; $t(23) = -0.02$, $p > 0.05$ in stage 5a; $t(23) = -0.42$, $p > 0.05$ in stage 5b; $t(23) = -0.87$, $p > 0.05$ in stage 6; and $t(23) = -0.54$, $p > 0.05$ in principle score. The sample means are displayed in Table 4.18, which shows that the mean posttest scores (\underline{M} = 3.04, SD = 2.25) are slightly higher than mean from the pretest conditions (\underline{M} = 2.53, SD = 1.98) in stage 2. The mean posttest scores (\underline{M} = 8.86, SD = 5.12) are slightly higher than the mean from the pretest conditions (\underline{M} = 8.23, SD = 4.73) in stage 3.

The mean posttest scores ($\underline{M} = 22.78$, $SD = 9.56$) are lower than the mean for the pretest conditions ($\underline{M} = 23.79$, $SD = 8.61$) in stage 4. The mean posttest scores ($\underline{M} = 14.16$, $SD = 7.09$) are lower than the mean for the pretest conditions ($\underline{M} = 14.19$, $SD = 7.47$) in stage 5a. The mean posttest scores ($\underline{M} = 3.67$, $SD = 2.63$) are lower than the mean for the pretest conditions ($\underline{M} = 3.97$, $SD = 3.20$) in stage 5b. The mean posttest scores ($\underline{M} = 3.22$, $SD = 3.30$) are lower than the mean for the pretest conditions ($\underline{M} = 3.74$, $SD = 3.42$) in stage 6. Mean posttest scores ($\underline{M} = 35.07$, $SD = 14.87$) are lower than the mean for the pretest conditions ($\underline{M} = 36.50$, $SD = 16.21$) in principle scores.

Table 4.18

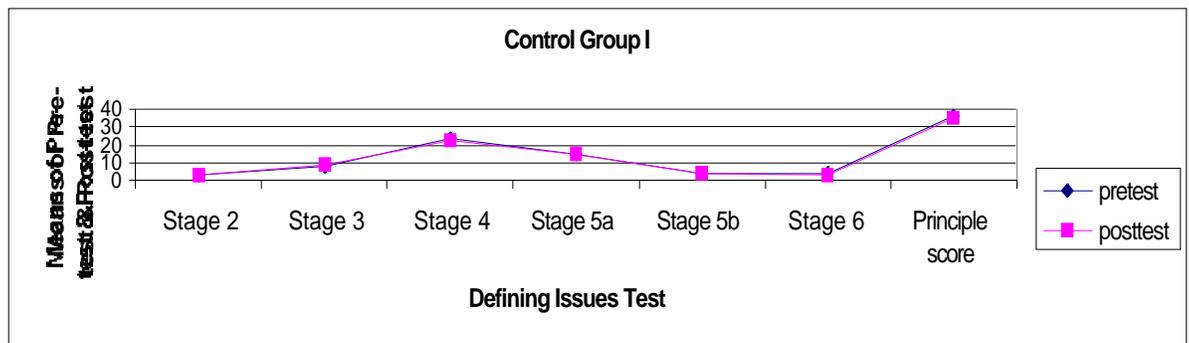
The Means procedure for Control Group I on DIT

Variable	N		Mean		Std Dev		Minimum		Maximum	
	pre	post	Pre	Post	Pre	Post	Pre	Post	pre	Post
stage2	23	23	2.53	3.04	1.98	2.25	0	0	7.00	7.00
stage3	23	23	8.23	8.86	4.73	5.12	0	0	17.00	16.00
stage4	23	23	23.79	22.78	8.61	9.56	8.00	5.00	40.00	38.00
stage5a	23	23	14.19	14.16	7.47	7.09	1.00	3.00	27.00	28.00
stage5b	23	23	3.97	3.67	3.20	2.63	0	0	12.00	9.00
stage6	23	23	3.74	3.22	3.42	3.30	0	0	12.00	13.00
Principle	23	23	36.50	35.07	16.21	14.87	11.70	18.30	70.00	73.30

$p < 0.05$

Figure 4.14

Moral Stages for Control Group I on DIT



The lines in Figure 4.14 depicting pretest versus posttest are overlapping. The principle score (p score) is an indicator for stages 4, 5a and 5b. The descriptive statistics using SPSS from the Center for the study of Ethics Development (n=270) show mean scores for college students in Stage 3 (\underline{M} = 8.6, SD = 5.14), Stage 4 (\underline{M} = 17.01, SD = 8.07), Stage 5a (\underline{M} = 15.81, SD = 6.31), Stage 5b (\underline{M} = 5.20, SD = 3.40), Stage 6 (\underline{M} = 4.89, SD = 3.340), and p score (\underline{M} = 43.19, SD = 14.320). Despite the non-significant statistical result, Figure 4.14 indicates moral development of the pre-service teachers at Stage 4 in the Control Group I, since Stage 4 is the stages with the highest posttest mean (\underline{M} = 22.78) as shown in Table 4.18.

The statistical result of DIT for the Control Group II will be discussed next. Results were analyzed using a one-sample *t*-test.

Table 4.19

The Means Procedure for Control Group II on DIT

Variable	N	Mean	Std Error	Std Dev	t Value	Pr > t
stage2	16	-0.82	0.81	3.25	-1.01	0.33
stage3	16	0.24	1.45	5.78	0.17	0.87
stage4	16	-0.46	1.60	6.39	-0.29	0.78
stage5a	16	1.55	1.75	7.00	0.89	0.39
stage5b	16	-0.39	0.88	3.54	-0.44	0.67
stage6	16	0.18	1.11	4.43	0.16	0.87
Principle	16	2.13	3.42	13.66	0.62	0.54

$p < 0.05$

This analysis revealed non-significant findings for the one-sample *t*-test conducted on the mean of the difference scores as illustrated in Table 4.19. The values were $t(16) = -1.01$, $p > 0.05$ in stage 2; $t(16) = 0.17$, $p > 0.05$ in stage 3; $t(16) = -0.29$, $p > 0.05$ in stage 4; $t(16) = 0.89$, $p > 0.05$ in stage 5a; $t(16) = -0.44$, $p > 0.05$ in stage 5b; $t(16) = 0.16$, $p > 0.05$ in stage 6; $t(16) = 0.62$, $p > 0.05$ in principle score. The sample means are displayed in Table 4.20, which shows that mean posttest scores (\underline{M} = 2.75, SD

= 2.08) are lower than the mean for the pretest conditions (\underline{M} = 3.57, SD = 2.42) in stage 2. Mean posttest scores (\underline{M} = 7.00, SD = 4.68) are slightly higher than the mean for the pretest conditions (\underline{M} = 6.76, SD = 4.79) in stage 3. Mean posttest scores (\underline{M} = 22.38, SD = 7.86) are lower than the mean for the pretest conditions (\underline{M} = 22.83, SD = 6.22) in stage 4. Mean posttest scores (\underline{M} = 17.13, SD = 7.50) are slightly higher than the mean for the pretest conditions (\underline{M} = 15.58, SD = 5.59) in stage 5a. Mean posttest scores (\underline{M} = 3.94, SD = 3.21) are lower than the mean for the pretest conditions (\underline{M} = 4.33, SD = 3.58) in stage 5b. Mean posttest scores (\underline{M} = 3.94, SD = 3.23) are slightly higher than the mean for the pretest conditions (\underline{M} = 3.76, SD = 3.02) in stage 6. Mean posttest scores (\underline{M} = 41.66, SD = 11.57) are slightly higher than the mean for the pretest conditions (\underline{M} = 39.53, SD = 11.76) in principle score.

Table 4.20

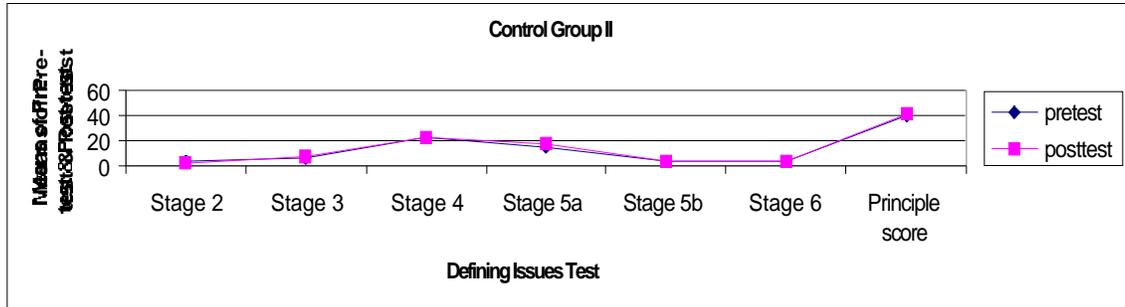
The Means procedure for Control Group II

Variable	N		Mean		Std Dev		Minimum		Maximum	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
stage2	16	16	3.57	2.75	2.42	2.08	0	0	8.00	7.00
stage3	16	16	6.76	7.00	4.79	4.68	0	0	15.00	16.00
stage4	16	16	22.83	22.38	6.22	7.86	13.00	5.00	35.00	34.00
stage5a	16	16	15.58	17.13	5.59	7.50	9.00	8.00	30.00	30.00
stage5b	16	16	4.33	3.94	3.58	3.21	0	0	12.20	11.00
stage6	16	16	3.76	3.94	3.02	3.23	0	0	10.00	10.00
Principle	16	16	39.53	41.66	11.76	11.57	23.30	18.30	66.70	60.00

$p < 0.05$

Figure 4.15 represents the moral stages between pretest and posttest in the Control Group II.

Figure 4.15

Moral Stages for Control Group II on the DIT

The lines Figure 4.15 depicting pretest versus posttest are overlapping. The descriptive statistics using SPSS from the Center for the Study of Ethics Development ($n = 270$) showed mean scores for college students in Stage 3 ($\underline{M} = 8.6$, $SD = 5.14$), Stage 4 ($\underline{M} = 17.01$, $SD = 8.07$), Stage 5a ($\underline{M} = 15.81$, $SD = 6.31$), Stage 5b ($\underline{M} = 5.20$, $SD = 3.40$), Stage 6 ($\underline{M} = 4.89$, $SD = 3.34$), and p score ($\underline{M} = 43.19$, $SD = 14.32$). Despite the non-significant statistical result, Figure 4.15 indicates moral development of the pre-service teachers at the Stage 4 in Control Group II, since the highest posttest mean ($\underline{M} = 22.38$) is in stage 4 (See Table 4.20).

The non-significant statistical results did not support the hypothesis that Technology-Assisted-Reflection promotes moral growth in the Experimental Group. Because of the slow process of human development, the insignificant results may be explained by the short-term (4-month) intervention and the small sample size. Tables 4.16, 4.18 and 4.20 illustrated that the dominant stages for the pre-service teachers moral stages in the study were in stage 4 and 5a.

An analysis was also performed on each individual's DIT score to investigate the possibility of a significant change. Rest (1993,

P.23) suggested the use of an estimate of the Standard Error of Measurement for each stage for interpreting the amount of the change. If the observed change exceeds the standard error of measurement for that stage, then the shift in score is indicated as a true change. When data were further analyzed with this suggestion, the results were that Experiment Group (N = 12), had 58% of students categorized as "gainers" (N = 7), Control Group I (N = 23) had 70% of students categorized as "gainers" (N = 16), and Control Group II (N = 16) had 56% of students categorized as "gainers" (N = 9). 42% of students (N = 5) over age of 20 in the Experimental Group were "gainers" (N = 12), 61% of students (N = 14) over age of 20 in the Control Group I were "gainers" (N = 23) and 31% of students (N = 5) over age of 20 in the Control Group II were "gainers" (N = 16) (see Table 4.21).

Table 4.21.

Gainers of DIT in Group

	Experimental n(%)	Control I n(%)	Control II n(%)
Gainer	7(54)	16(64)	9(56)
Non-Gainer	5(46)	8(36)	7(44)
Total	12(100)	34(100)	16(100)
Gainer- over 20	5(31)	14(58)	5(31)
Non-Gainer- over 20	7(69)	10(42)	11(69)
Total	12(100)	34(100)	16(100)

Education, life experience, and age are possible indicators of moral growth (King & Kitchener, 1994; Rest, 1986). Educational interventions influencing changes in the DIT are slow and gradual, and the amount of change is less in short-term than in longer-term longitudinal studies (Rest, 1979). The change induced by educational intervention requires a heavy focus on moral problem

solving (Rest, 1986, 1993). This can explain why the four-month intervention in Technology-Assisted-Reflection did not reach statistically significant results. A more focused intervention in either cognition or ethics may be more effective.

Hypothesis 5 and Hypothesis 6: Hypotheses 5 and 6 were eliminated due to small sample size.

Hypothesis 7

There will be a statistically significant mean difference score (posttest - pretest) the stages of concerns in computing of students in the Experimental Group. Students in the Experimental Group (Technology-Assisted-Reflection) will show a significant mean gain score in the higher stages about computing than students in the Control Groups.

Table 4.22

The Mean Procedure on Differences between Pretest & Posttest in Experimental Group on Computing Concerns Questionnaire

Variable	N	Mean	Std Error	t Value	Pr > t
context	17	-5.18	4.35	-1.19	0.25
informative	17	4.59	5.70	0.81	0.43
personal	17	-4.06	7.08	-0.57	0.57
management	17	7.82	6.58	1.19	0.25
concern (self)	17	-5.35	8.44	-0.63	0.53
concern (others)	17	9.94	6.09	1.63	0.12
collaboration	17	-2.82	6.04	-0.47	0.65
refocus	17	7.76	6.79	1.14	0.27

$p < 0.05$

The results were analyzed using a one-sample *t*-test, and revealed that the mean difference score (posttest - pretest) was not significantly different from zero. As indicated in Table 4.22, the values illustrate that $t(17) = -1.19$, $p > 0.05$ in the context stage; $t(17) = 0.81$, $p > 0.05$ in the information stage; $t(17) = -0.57$, $p > 0.05$ in the personal stage; $t(17) = 1.19$, $p >$

0.05 in the management stage; $t(17) = -0.63$, $p > 0.05$ in the concern for self stage; $t(17) = 1.63$, $p > 0.05$ in the concern for others stage; $t(17) = -0.47$, $p > 0.05$ in the collaboration stage; and $t(17) = 1.14$, $p > 0.05$ in the refocus stage. None of these one-sample t test conducted on the mean of the difference scores were significant. The sample means are displayed in Table 4.23, which shows that mean posttest scores ($\underline{M} = 71.5$, $SD = 21.24$) are lower than the mean from the pretest conditions ($\underline{M} = 72.95$, $SD = 23.92$) in the Context stage. Mean posttest scores ($\underline{M} = 43.83$, $SD = 23.50$) are slightly higher than the mean from the pretest conditions ($\underline{M} = 42.75$, $SD = 30.02$) in the information stage. Mean posttest scores ($\underline{M} = 43.67$, $SD = 30.24$) are lower than the mean from the pretest conditions ($\underline{M} = 47.20$, $SD = 31.66$) in the personal stage. Mean posttest scores ($\underline{M} = 59.17$, $SD = 29.03$) are slightly higher than the mean from the pretest conditions ($\underline{M} = 53.25$, $SD = 28.73$) in the management stage. Mean posttest scores ($\underline{M} = 48.17$, $SD = 24.44$) are lower than the mean from the pretest conditions ($\underline{M} = 54.15$, $SD = 29.39$) in the concern for self stage. Mean posttest scores ($\underline{M} = 53.94$, $SD = 18.68$) are slightly higher than the mean from pretest conditions ($\underline{M} = 45.45$, $SD = 26.47$) in the concern for others stage. Mean posttest scores ($\underline{M} = 46.06$, $SD = 23.44$) are lower than the mean from the pretest conditions ($\underline{M} = 49.75$, $SD = 30.67$) in the collaboration stage. Mean posttest scores ($\underline{M} = 55.94$, $SD = 24.03$) are slightly higher than the mean from pretest conditions ($\underline{M} = 51.70$, $SD = 27.77$) in the refocus stage.

Table 4.23 illustrates some general information regarding the stages of concerns. The "minimum" and "maximum" numbers in the column of means show that observed values fell inside the range (Hatcher & Stepanski, 1994). The difference scores between pretest and posttest for each stage was derived and then the mean was calculated. A positive value indicates that, on average, scores on posttest tended to be slightly higher than scores on pretest. If

the p value is much slightly higher than the standard cutoff of 0.05, the mean difference score are not significantly different from 0.

Table 4.23

The Means procedure of Pretest & Posttest for Experimental Group on Computing Concerns Questionnaire

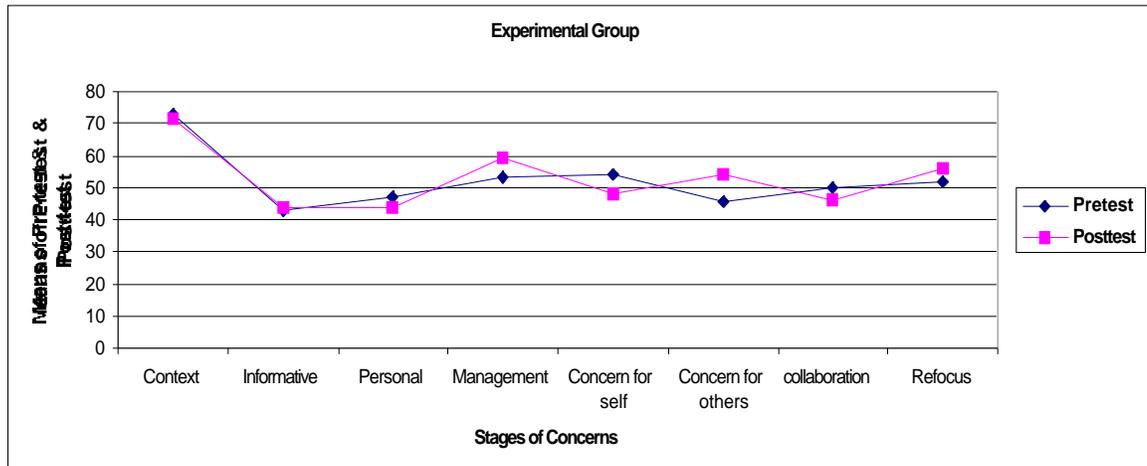
Variable	N		Mean		Std Dev		Minimum		Maximum	
	Pre	post	Pre	Post	Pre	Post	Pre	Post	pre	Post
context	20	17	72.95	71.5	23.92	21.24	1.00	25.00	100.00	99.00
informative	20	17	42.75	43.83	30.02	23.50	0	8.00	100.00	87.00
personal	20	17	47.20	43.67	31.66	30.24	1.00	5.00	100.00	100.00
management	20	17	53.25	59.17	28.73	29.03	2.00	6.00	98.00	96.00
concern (self)	20	17	54.15	48.17	29.39	24.44	8.00	12.00	100.00	100.00
concern (other)	20	17	45.45	53.94	26.47	18.68	6.00	21.00	95.00	78.00
collaboration	20	17	49.75	46.06	30.67	23.44	2.00	12.00	100.00	92.00
refocus	20	17	51.70	55.94	27.77	24.03	11.00	15.00	99.00	98.00

$p < 0.05$

Figure 4.16 lists the mean scores of each stage of concern from the posttest and the pretest. The technology had little effect on the Experimental Group statistically. However, there is a trend to shift the concerns stage from a lower stage to a slightly higher stage. The mean scores of the Stages of Concerns between pretest and posttest of the participating pre-service teachers in the Experimental Group is depicted in a line chart in Figure 4.16.

Figure 4.16

Stages of concerns Mean scores of Pretests & Posttests for Experimental Group on Computing Concerns Questionnaire



Analyzing the mean differences scores in the Experimental Group (see Table 4.22), the Experimental Group tended to have shifted their concerns from Self ($\underline{M} = -5.18$ in the context, $\underline{M} = -4.06$ in the Person) to the Management ($\underline{M} = 7.82$), the concerns for others ($\underline{M} = 9.94$) and the refocus ($\underline{M} = 7.76$). The negative scores in the context and the personal stages may indicate less concern in the areas of economic impact, influence on children, health and dependencies on computers. The positive scores in the Management stages may show more concern for inadequate instructional materials, help resources, data integrity, availability of resources and the steps to complete a computer task. Furthermore the positive mean scores in the concerns for others and the refocus stages suggest that there would be a possible shifting of students' concerns from the management stage to higher Stages of Concern in the concern for others and the refocusing. These stages focus on the quality of the computer-related work produced by the individual and its impact on people evaluating or using the output, students focus on the extension of the benefits of computer use, and the possibility of major changes and alternatives in the use of the technology. Stages of Concerns for self and collaboration show more concern for the effect the individual's expertise with computers has on himself/herself ($\underline{M} = -5.35$), this lack of confidence might affect the ability to collaborate with others ($\underline{M} = -2.82$).

Results were also analyzed using a one-sample *t*-test on the difference scores for Control Group I.

Table 4.24

The Means Procedure Control Group I on Computing Concerns
questionnaire

Variable	N	Mean	Std Error	t Value	Pr > t
context	25	-1.60	3.53	-0.45	0.65
informative	25	-0.68	3.55	-0.19	0.85
personal	25	-3.68	5.34	-0.69	0.50
management	25	7.96	5.93	1.34	0.19
concern (self)	25	-2.44	5.49	-0.44	0.66
concern (other)	25	2.00	4.81	0.42	0.68
collaboration	25	-6.44	4.60	-1.40	0.17
refocus	25	4.28	5.02	0.85	0.40

p < 0.05

This analysis revealed non-significant finding for the one-sample *t*-test conducted on the mean of the difference score as illustrated in Table 4.24. The values were $t(25) = -0.45$, $p > 0.05$ in the Context stage; $t(25) = -0.19$, $p > 0.05$ in the information stage; $t(25) = -0.69$, $p > 0.05$ in the personal stage; $t(25) = 1.34$, $p > 0.05$ in the management stage; $t(25) = -0.44$, $p > 0.05$ in the concern for self stage; $t(25) = 0.42$, $p > 0.05$ in the concern for others stage; $t(25) = -1.40$, $p > 0.05$ in the collaboration stage; and $t(25) = 0.85$, $p > 0.05$ in the refocus stage. The sample means are displayed in Table 4.25, which show that mean posttest scores ($\underline{M} = 64.88$, $SD = 25.52$) are slightly higher than the mean from the pretest conditions ($\underline{M} = 63.89$, $SD = 23.76$) in the context stage. Mean posttest scores ($\underline{M} = 42.44$, $SD = 25.01$) are slightly higher than the mean from the pretest conditions ($\underline{M} = 40.14$, $SD = 26.71$) in the Information stage. Mean posttest scores ($\underline{M} = 42.00$, $SD = 28.49$) are lower than the mean from the pretest conditions ($\underline{M} = 44.25$, $SD = 31.28$) in the personal stage. Mean posttest scores ($\underline{M} = 47.48$, $SD = 24.76$) are slightly higher than the mean from the pretest conditions ($\underline{M} = 40.71$, $SD = 25.98$) in the management stage. Mean posttest scores ($\underline{M} = 37.12$, $SD = 25.05$) are lower than the mean from the pretest conditions ($\underline{M} = 42.11$, $SD = 29.08$) in the concern for self stage. Mean posttest scores ($\underline{M} = 42.96$, $SD = 23.33$) are slightly higher than the mean from the pretest

conditions ($\underline{M} = 42.46$, $SD = 24.36$) in concern for others stage. Mean posttest scores ($\underline{M} = 38.20$, $SD = 24.18$) are lower than the mean from the pretest conditions ($\underline{M} = 45.68$, $SD = 26.65$) in collaboration stage. Mean posttest scores ($\underline{M} = 51.64$, $SD = 25.95$) are slightly higher than the mean from pretest conditions ($\underline{M} = 47.18$, $SD = 25.48$) in the refocus stage.

Table 4.25

The Means procedure for Control Group I on Computing Concerns Questionnaire

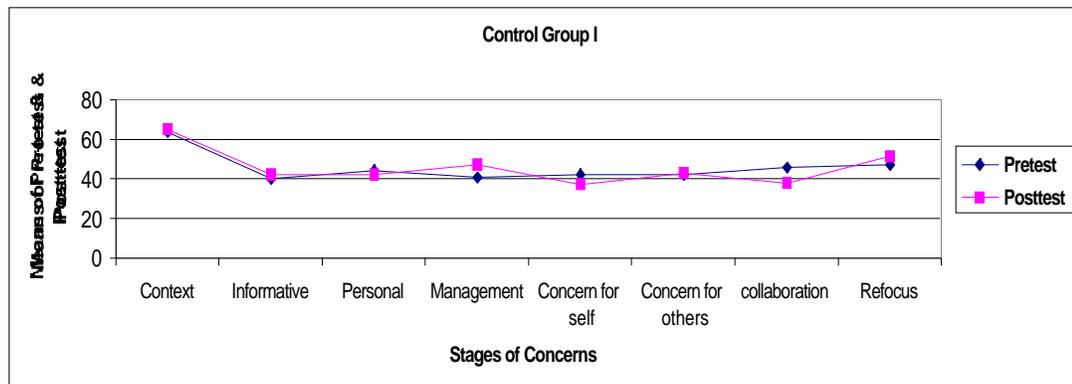
Variable	N		Mean		Std Dev		Minimum		Maximum	
	pre	post	Pre	Post	Pre	Post	Pre	Post	pre	Post
context	28	25	63.89	64.88	23.76	25.52	25.00	1:00	99.00	99.00
informative	28	25	40.14	42.44	26.71	25.01	0	2:00	90.00	92.00
personal	28	25	44.25	42.00	31.28	28.49	5.00	1:00	95.00	84.00
management	28	25	40.71	47.48	25.98	24.76	6.00	4:00	95.00	93.00
concern (self)	28	25	42.11	37.12	29.08	25.05	8.00	8:00	100.00	100.00
concern (other)	28	25	42.46	42.96	24.36	23.33	6.00	6:00	96.00	78.00
collaboration	28	25	45.68	38.20	26.65	24.18	4.00	0:00	100.00	76.00
refocus	28	25	47.18	51.64	25.48	25.95	6.00	11:00	94.00	94.00

$p < 0.05$

The Stages of Concerns between pretest and posttest of the participating pre-service teachers in the Control Group I is depicted in a line chart in Figure 4.17.

Figure 4.17

Stages of concerns for Control Group I on Computing Concerns Questionnaire



Analyzing the differences of the means in the Control Group I (Table 4.24) showed that the first Control Group had a tendency to shift their concerns from self ($\underline{M} = -1.6$ in context, $\underline{M} = -3.68$ in person) to management ($\underline{M} = 7.96$). Concerns for others ($\underline{M} = 2.00$), refocus stages ($\underline{M} = 4.28$) have mean scores lower than the Experimental Group. The results suggest that students' concerns in technology are low in the economic impact, influence on children, health and dependencies on computers; they may have advanced to the next stage because of the positive scores in Management stage. This stage shows more concern for the inadequate instructional material, help resources, data integrity, availability of resources and the steps to complete a computer task. However, the positive mean scores in concerns for others and refocus stages may suggest that there is a slight shifting of students' concerns from management stage to higher Stages of Concern in concern for others and refocus. These two stages focus on the quality of the computer-related work produced by the individual and its impact on people evaluating or using the output, students focus on the extension of the benefits of computer use and its possibility of major changes and alternatives in the use of technology. Stages for Concerns for self and collaboration show a higher concern in the individual's expertise with computers on himself/herself ($\underline{M} = -2.44$). The lack of confidence might affects students' ability to collaborate with others ($\underline{M} = -6.44$).

Results were analyzed using a one-sample *t*-test on the difference scores for Control Group II.

Table 4.26

The Means Procedure of Control Group II on the Computing Concerns Questionnaire

Variable	N	Mean	Std Error	t Value	Pr > t
context	19	6.58	6.92	0.95	0.35
informative	19	-14.68	7.63	-1.92	0.07
personal	19	-7.74	4.67	-1.66	0.11
management	19	7.84	6.35	1.23	0.23
concern on self	19	-6.34	7.01	-0.90	0.38
concern on other	19	-8.32	5.84	-1.42	0.17
collaboration	19	-10.53	5.72	-1.84	0.08
refocus	19	-10.53	5.78	-1.82	0.09

$p < 0.05$

This analysis revealed non-significant findings for the one-sample t -test conducted on the mean of the difference scores as illustrated in Table 4.26. The values were $t(19) = 0.95$, $p > 0.05$ in the context stage; $t(19) = -1.92$, $p < 0.05$ in the information stage; $t(19) = -1.66$, $p > 0.05$ in the personal stage; $t(19) = 1.23$, $p > 0.05$ in the management stage; $t(19) = -0.90$, $p > 0.05$ in the concern for self stage; $t(19) = -1.42$, $p > 0.05$ in the concern for others stage; $t(19) = -1.84$, $p > 0.05$ in the collaboration stage; and $t(19) = -1.82$, $p > 0.05$ in the Refocus stage. The sample means are displayed in Table 4.27, which show that mean posttest scores ($\underline{M} = 61.42$, $SD = 26.74$) are slightly higher than the mean from the pretest conditions ($\underline{M} = 58.19$, $SD = 29.19$) in the context stage. Mean posttest scores ($\underline{M} = 27.53$, $SD = 22.89$) are lower than the mean from the pretest conditions ($\underline{M} = 44.67$, $SD = 27.64$) in the Information stage. Mean posttest scores ($\underline{M} = 27.42$, $SD = 20.26$) are lower than the mean from the pretest conditions ($\underline{M} = 36.76$, $SD = 25.49$) in the personal stage. Mean posttest scores ($\underline{M} = 46.95$, $SD = 29.13$) are slightly higher than the mean from pretest conditions ($\underline{M} = 41.81$, $SD = 26.05$) in the management stage. Mean posttest scores ($\underline{M} = 33.89$, $SD = 22.77$) are lower than the mean from the pretest conditions ($\underline{M} = 42.1$, $SD = 27.63$) in the Concern for self stage. Mean posttest scores ($\underline{M} = 36.84$, $SD = 17.52$) are lower than the mean from the pretest conditions ($\underline{M} = 45.95$, $SD = 20.30$) in the

concern for others stage. Mean posttest scores ($\bar{M} = 28.37$, $SD = 16.65$) are lower than the mean from the pretest conditions ($\bar{M} = 38.00$, $SD = 19.77$) in the collaboration stage. Mean posttest scores ($\bar{M} = 41.58$, $SD = 23.41$) are lower than the mean from the pretest conditions ($\bar{M} = 53.86$, $SD = 23.78$) in the refocus stage.

Table 4.27

The Means procedure for Control Group II on the Computing Concerns Questionnaire

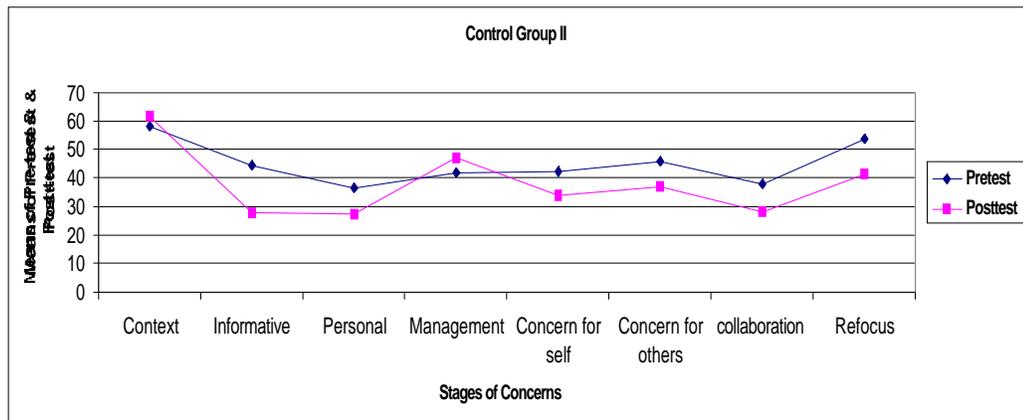
Variable	N		Mean		Std Dev		Minimum		Maximum	
	pre	post	Pre	Post	Pre	Post	Pre	Post	pre	Post
context	21	19	58.19	61.42	29.19	26.74	5.00	5.00	98.00	99.00
informative	21	19	44.67	27.53	27.64	22.89	2.00	2.00	100.00	79.00
personal	21	19	36.76	27.42	25.49	20.26	5.00	5.00	78.00	67.00
management	21	19	41.81	46.95	26.05	29.13	6.00	10.00	88.00	95.00
concern (self)	21	19	42.10	33.89	27.63	22.77	4.00	12.00	100.00	100.00
concern (other)	21	19	45.95	36.84	20.30	17.52	6.00	6.00	94.00	84.00
collaboration	21	19	38.00	28.37	19.77	16.65	7.00	1.00	73.00	62.00
refocus	21	19	53.86	41.58	23.78	23.41	19.00	6.00	97.00	91.00

$p < 0.05$

The Stages of Concerns between pretest and posttest of the participating pre-service teachers in Control Group II is depicted in a line chart in Figure 4.18.

Figure 4.18

Stages of concerns for Control Group II on Computing Concerns Questionnaire



Analyzing the differences scores in the Control Group II (Table 4.26) showed that only the management stage indicated a slightly higher mean score and context stage ($\underline{M} = 6.58$), however, its mean score for personal stage is low ($\underline{M} = -7.74$). The concerns for others ($\underline{M} = -8.32$), collaboration ($\underline{M} = -10.53$) and refocus ($\underline{M} = -10.53$) have negative mean scores. The results could suggest that students concerns in technology were high in self with the possibility of shifting to management stage. The mean scores in the information concerns ($\underline{M} = -14.68$) showed a negative desire for learning more about technology, therefore the recognition of the need to gain more knowledge about technology decreased.

The results could suggest that students concerns in technology are high in the areas that relate to use of computers in society, such as economic impact, influence on children, health and dependencies on computers in context stage ($\underline{M} = 6.58$). Students seem to have less concerns about the demands of computing and the adequacy of his/her ability to meet those demands in personal stage ($\underline{M} = -7.74$). They may have shifted to the next stage because of the positive scores in the management stage ($\underline{M} = 7.84$). These stage shows more concerns for the inadequate instructional material, help resources, data integrity, availability of resources and the steps to complete a computer task. However, the negative mean scores in concerns for self ($\underline{M} = -6.32$) show slightly higher concerns for the individual's expertise with computers. Concerns for others suggested that students have concerns on the quality of the computer-related work produced by the individual ($\underline{M} = -8.32$). Furthermore, the ability to refocus to extend the benefit of computer use was affected.

Based on Fuller's work (1972) with teachers' concerns about teaching, Stages of Concerns about an innovation appear to

develop from early unrelated, to self, to task, and finally to impact concerns. This suggested three stages of concerns from self, task and impact. This researcher regrouped the eight stages into three based on Fuller's guidelines. SAS output was produced using the one-sample *t*-test on the mean of the differences scores for the Stage of Concern in self (including context, personal, informative stages), task (including management stage) and impact (including concerns for self, concern for others, collaboration, and refocus stages). Therefore, the concerns model was categorized from a eight-stage model to a three-stage model in self (stage 0,1,2), task (stage 3) and impact (4,5,6) (Martin, 1989, p 24). Data were further analyzed and described below.

Despite the non-significant result of statistical procedures described in Table 4.28 using a one-sample *t*-test, the Experimental Group revealed an early sign of shifting of concerns from self ($\underline{M} = -4.65$) to impact ($\underline{M} = 9.53$), the concern for self was indicated with a minus sign which meant that the mean scores of concern for self in posttest was less than the pretest. This trend illustrates a possibility of gaining confidence in computing and concerns shifted to concerns of collaboration with others and extension of computer use in the Experimental

Table 4.28

The Means Procedure for Experimental Group

Variable	N	Mean	Std Error	t Value	Pr > t
self	17	-4.65	12.34	-0.38	0.71
task	17	8.00	6.58	1.22	0.24
impact	17	9.53	19.73	0.48	0.64

$p < 0.05$

It was, however, not clearly displayed in both of the Control Groups that the Stages of Concern shifted to the impact stage, because there was a decreased mean score in the Impact

Stage for both of the Control Groups, $\bar{M} = -6.6$ (Table 4.29) and $\bar{M} = -34.11$ (Table 4.30).

Table 4.29

The Means Procedure for Control Group I

Variable	N	Mean	Std Error	t Value	Pr > t
self	25	-8.56	9.29	-0.92	0.37
task	25	7.96	5.94	1.34	0.19
impact	25	-6.60	16.24	-0.41	0.69

$p < 0.05$

Table 4.30

The Means Procedure for Control Group II

Variable	N	Mean	Std Error	t Value	Pr > t
self	19	-21.42	11.61	-1.85	0.08
task	19	7.84	6.35	1.23	0.23
impact	19	-34.11	19.14	-1.78	0.09

$p < 0.05$

The bar chart representing 3-stage concerns in each participating group is shown in Figure 4.19

Figure 4.19

Mean Scores Differences in Self, Task and Impact Stages on the Computing Concerns Questionnaire

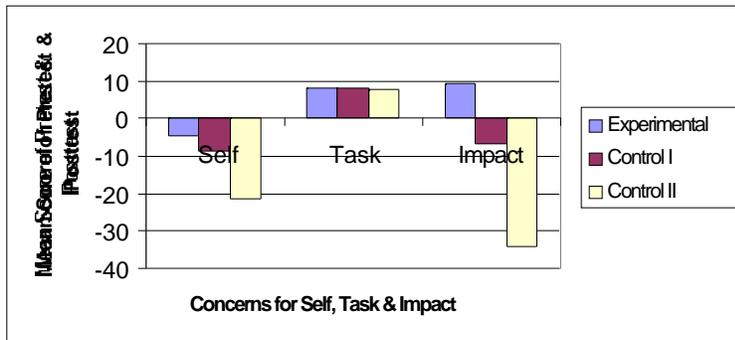


Figure 4.19 indicates that the difference between mean scores of the Experimental Group and the Control Groups. All three groups have their concerns in the task stage, and only the Experimental Group has advanced their concerns into the impact stage. 20% of students in the Experimental Group did not have computer experience until age of 19, versus 4% and 5% in the Control Groups I and II, and 45% of students in the Experimental Group did not own home computers versus 29% and 10% in the Control Groups I and II. Students in the Experimental Group had less experience with computers before the study, and still the data had showed a trend for the Technology-Assisted-Reflection to decrease students' concerns with computing. This result supports the studies conducted by Vasu & Atkins (1997) and Hall & Loucks (1978), teachers with more technology training were at slightly higher stages of concern. People must be personally comfortable with using a technology (innovation), before they can be concerned with implementation and impact. Concerns have a direct effect on performance and lower level concerns must be alleviated before slightly higher level concerns can emerge.

The need to gain information no matter how much knowledge has already been obtained or is still unknown by students is certain. Even though the hypothesis may not be supported by statistical analysis, students in the Experimental Group (Technology-Assisted-Reflection) show slightly higher mean gain scores in their reduction of concerns on computing than students in the Control Groups.

Computer technology is evolving and the information gained can become obsolete rather quickly. It is not practical for anyone to know it all or to keep up with every new technological development, but the intensity of concerns will change as one gains experience with computers (Martin, 1989). The recognition of the necessity to gain more information and the process of learning more

about computer technology can relieve the enormous amount of pressure on students, and students can advance to higher Stage of Concerns. Without a doubt, technology will continue to advance. Students, especially pre-service teachers, should be supported in the process of adaptation to technology.

Qualitative Section

Cognitive Growth & Technology-Assisted-Reflection

King & Kitchener (1994) indicated that first year college students have typically scored just above 3.5 on the RJI. Study by Kitchener, Lynch, Fisher and Wood (1993) indicated that the functional level of college students is between stage 3 and 4 with a possibility of achieving stage 5 depending on education, age and/or educational support. This suggested a possibility of only a half stage cognitive development in a four-year college study. In a short-term intervention like this study it is hard to actually detect the cognitive development, therefore the concept of Reflective Judgement Interview through the questioning of ill-structured problems was adapted in this study through eight social issues, but the instrument and its scoring scheme were not used. The collected data will be used in qualitative and descriptive formats in conjunction with the Linguistic Inquiry and Word Count (LIWC).

Eight ill-structured social issues in educational settings were designed with the questioning prompts for the ill-structured problem as in the Reflective Judgment Interview. It was suggested that the RJI taps students' underlying assumptions about knowledge, not the assumptions they hold about a specific discipline (King & Kitchener, 1994). For the study, the eight issues were in areas of safety, gender, crime, technology, hate

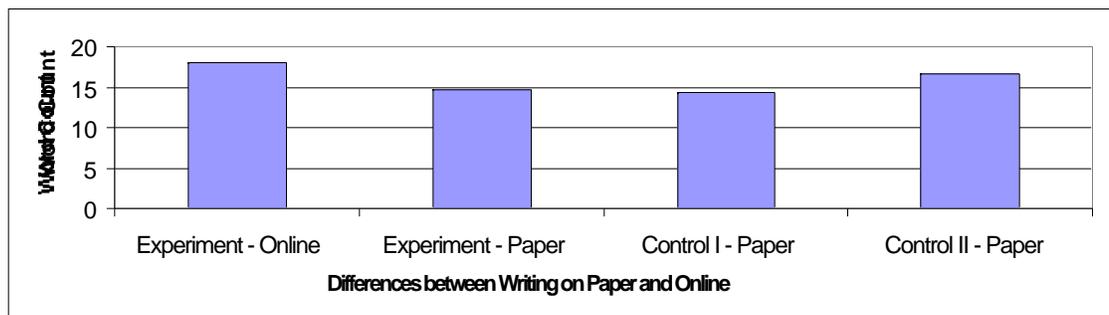
crime, environment, race and classrooms to expose students to the issues that could be encountered by every classroom teacher.

The eight social issues were integrated into the curriculum to promote clinical analysis/reflection of the pre-service teachers in the study to elicit their cognitive and ethical development. All students responded to the social issues on paper in addition to group discussions through NetForum for the students in the Experimental Group. Both results on paper and online were analyzed using LIWC by Pennebaker (1992). For the study, approximately 76% of written assignments could be interpreted by LIWC. Also, a mean of 19 words was found for students who used words longer than six letters when writing about social issues, which was higher than the mean scores by 43 studies using LIWC (13.1 in emotional writing, and 14.1 in control writing). Word counts in paper assignments, online discussions in social issues, and the writing style between paper and online settings will be discussed further.

Figure 4.20 illustrated the responses by counting the words in the social issues assignment both on paper and online. It illustrated an average word count of 18 per social issue asked in the NetForum discussion on the Internet. The average dropped to 15 words per social issue on the paper assignment in the Experimental Group. Control Group I had an average of 14 words per social issue on their paper assignments and Control Group II had an average of 17 words per questions (See Figure 4.20).

Figure 4.20

Word Count in Social Issues by Groups

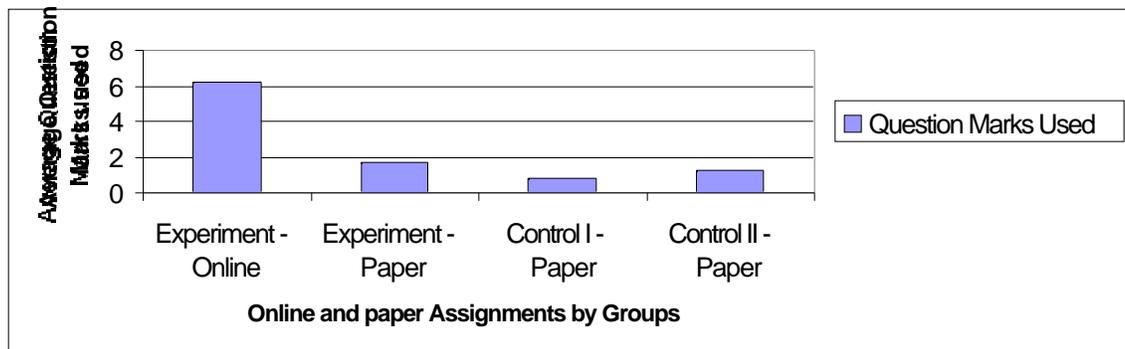


One of the possible reasons for the higher word counts in the Experimental Group could be contributed to the older age sample, forty-five percent of students (n=9) were at least 23 of age or older.

When reflecting thoughts on paper, students conducted a one-on-one conversation between himself/herself and the instructor. During online conversations, students conducted a one-to-many conversation. Would the discourse between the paper assignment and the online assignment create a different environment for reflecting thoughts of students' thinking? Both paper and online assignments were analyzed by calculating the questions marks used to see if students reflect their thoughts differently (see Figure 4.21). Reflecting on paper follows a single idea to its conclusion in a private format between student and teacher in a one-on-one process. On the other hand, electronic conversations permit more student participation, students do not have to wait for teachers, and multiple readers will read their postings.

Figure 4.21

Mean scores in the usage of question marks by group for social issues



In an online environment, an average of 6 question marks were used by the students. The average number of question marks was only two in the Experimental Group's paper assignment, and one for both Control Groups. A higher number of question marks in the Experimental Group could possibly be explained by the interactive process in the online environment. Students had to read responses from other students before responding. Students learned that other students and the instructor would do it the same way and the response could be interactive and asynchronized. As a result, students tended to ask more questions. However, since the students in Control Groups would only have their instructors responding to their answers on the social issues, they tended to make more concrete and definite statements. Students in the Experimental Group were more likely to seek answers from their peers or to confirm their reflective thoughts. Figure 4.22 indicated the differences in social issues between the experimental and Control Groups (see Figure 4.22).

Figure 4.22

Mean scores in social issues by groups

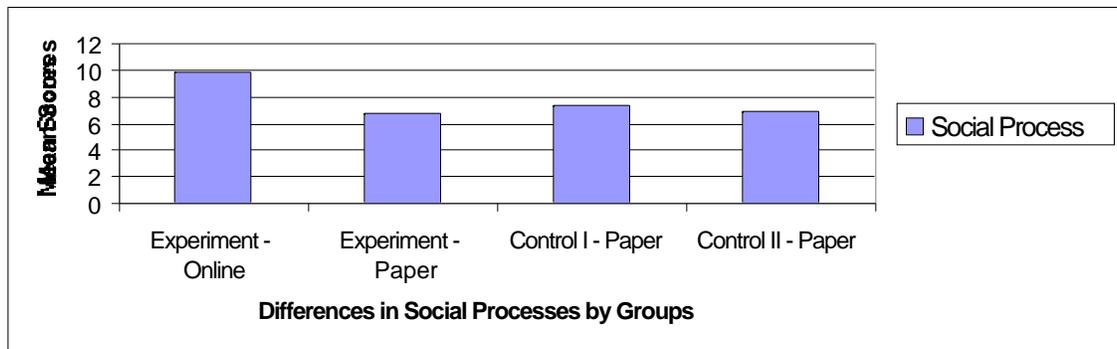


Figure 4.22 confirmed that students referenced other people, family members, and friends more in an online environment.

The functional level of college students in the RJI is between stage 3 and 4 (Kitchener, Lynch, Fisher and Wood, 1993). These stages usually would be determined by certified raters. The social issues by students in the study were evaluated based upon the criteria of the Reflective Judgement Interview. The same result was found as the stages for college students as stated above with more students between stages 3 and 4, however, this researcher conducted the evaluation with completion only in the training of the Reflective Judgment Interview. The conclusions drawn here are preliminary and need to be validated by professional raters for RJI.

Can these discipline-specific ill-structured social issues be justifiably used as the ill-structured problems in the RJI? A study by Kitchener and King (1985) stated that the average scores on the discipline-specific problems have almost been identical to the scores earned by the same participants on the standard RJI problems (p. 118). In addition, Hayes (1981) compared scores on two standard RJI problems with scores on the problems familiar to education students and found no substantial differences among them. It was suggested that RJI taps students' underlying assumptions about knowledge, not the assumptions they hold about a specific discipline.

In addition to responding to social issues on paper, students in the Experimental Group also reflected their thoughts on the NetForum through the Internet. This online communication seemed to be a catalyst to eliminate the isolation among students. They opened themselves up to others very easily. In the third week into the class, one of the students posted a message on the NetForum after one classmate responded that he would not to stand up for victims regarding "Hate Crime", this student stated:

I would have loved it if someone would have helped or stood up for me, because I would rather be embarrassed for a day, a month, or a school year, than to be in an emergency room for 10-12 hours with cat scans, MRI scans, surgery and the lasting physical and emotional scars from it. The emotional scars from being embarrassed compare little to those from deliberate hateful attacks.

It was a very personal response that the student kindly shared with classmates to bring the issue closer to the heart and raise awareness among every one. It is also worth mentioning that the response was posted right after the class before a holiday break. It showed that students were drawn to this type of communication process and they felt comfortable in sharing their views and experiences.

In conclusion, students in the study perceived and acknowledged that knowledge was uncertain, and that the knowledge claimed about these uncertainties included element(s) of knowing that are limited to one's personal impressions on the topic or uncertainty. There are no absolutely certain ways to adjudicate answers. The following excerpt was adapted from a response to one of the social issues.

"No. My opinion can never be fact. I have never participated racial or sexual "hate crime" or had it happen to me, so I do not know how it feels. I can only make assumptions. I would hope that America strides to stamp out both racial and sexual crimes but unfortunately it will never go away completely."

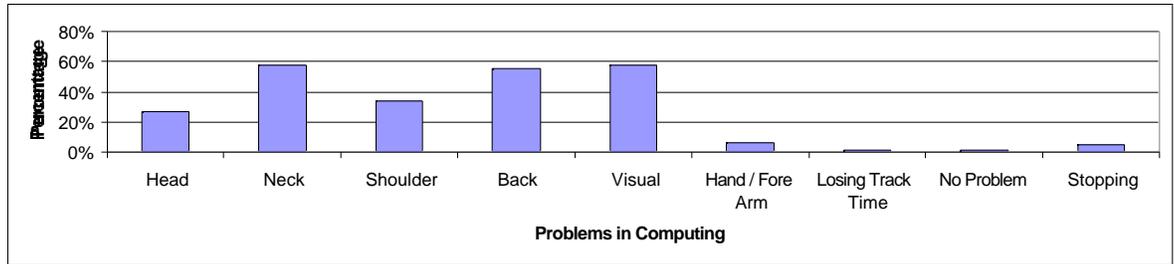
Harrington (1992) stated that unless teachers become critically reflective, it is unlikely that they can become effective life-long learners committed to an ongoing critique of educational systems, as effective citizens, consumers or parents. Teachers need to become active contributing members of a democratic society able to provide an equitable and quality education for all students (Bowers, 1987; Brookfield, 1987; Harrington 1991, 1992; Mezirow, 1991). It is important to design an environment that fosters reflective thinking and promotes opportunities for practice in teacher education programs. It is essential to promote reflective thinking using social issues, so that students can come to realize the environments and issues that they live in and face every day. Teachers need to be able to provide effective methods for problem solving when decisions have to be made in the heat of the moment during their teaching career.

Technostress

There are limited statistics about technology-related injuries in K-12 students. The majority of pre-service teachers in this research study revealed the problems that they have encountered pertaining to computer use. About 98% (n= 67) of them complained about problems in their necks, backs and vision after long hours working in front of a computer. Only 1% of the students in the Experimental Group have had no problems, and 1% of the students in the Experimental Group indicated the problem for them was losing track of time (Figure 4.23). Figure 4.23 illustrated the distribution of the problems related to computer usage in the study.

Figure 4.23

General Problems faced by Students in Computing



According to Dr. Robert Markison, associate professor of medicine at the University of California at San Francisco, typing and cursor movements on computer keyboards possibly cause stress in delicate muscles, tendons, ligaments and other soft tissues of fingers, hands, wrists and arms. Today, schools are at the risk of making the same mistake as some companies ten years ago (Quilter, & Pascarelli, 1994; Young, 1996).

Curriculum Update

As the popularity of the Internet increases, E-mail, Listserv, NetForum and online inquiry on the World Wide Web become more popular. However, the online submission of homework assignments are seldom integrated into the curricula in teacher education. Students spent a lot of time collecting data for field notes and writing reflective/analytical thoughts in journals. When the procedure changed from turning in paper assignments in class to submitting through the Internet, students were anxious in the beginning, which can be explained by multiple submission of the same assignments as a common practice of a few students in the beginning. Therefore, a webpage to track submitted assignments was created for students.

Assignments after each visit were grouped into one section whenever it was possible. For example, students have to reflect/analyze journal and field notes regarding the school,

students, teachers and curriculum after their first visit. The four assignments were combined into one for submission on the Internet.

The group discussions on the NetForum were closely monitored by the instructor and researcher to avoid any improper messages or conversations among students. During the workshop, Internet etiquette was introduced to students in the Experimental Group. It is important to educate students about Internet etiquette. Changing to a virtual platform does not mean that people should ignore common courtesy. It is more important to prepare students with proper etiquette to communicate with people possibly around the world as well as the concerns for ethical computing education.

When students in the Experimental Group were asked how they conducted their visitations before online submissions, 19% (n=3) of students simply memorized anything that happened in the classroom as much as they could and did not take notes, whereas other 12% (n=2) of students took notes after class when their memories were still fresh, and 69% of students (n=11) would take notes in class whenever they were able to (See Table 4.31).

Table 4.31.

Methods of Note-Taking in the Experimental Group

None n(%)	After class n(%)	In-class n(%)
3(19)	2(12)	11(69)

N = 16

Ninety four percent (94%) of students (n=15) also directly typed and reflected on the electronic form before submitting. Six percent (6%) of students (n=1) would composed directly on the

electronic form, but would copy and paste on a word processor before submitting. Students did not compose on the word processor first, then copy and paste from electronic form to a word processor before submitting (See Table 4.32).

Table 4.32.

Methods of Homework Submission in the Experimental Group

Direct typing on the web n(%)	Direct typing on the web & Print n(%)	Direct typing on the web & save n(%)
15(94)	0	1(6)

N = 16

While handwritten homework was acceptable, it opened the possibility for students to complete their homework during the lecture. The submission through the Internet seemed to solve this problem when class met mainly in the classroom. Students had to use computers to type and send assignments before the class started, thereby eliminating the opportunity for students to finish their homework in class and increasing the chance to be on task.

Does technology assist in reflecting students' visits and thoughts? 75% (n=12) of students responded yes to the question. The positive response reflected the realization that technology provided a means to analyze, reflect and organize ideas for each visit in a comfortable and no-distraction environment. The technology helped to have each visit reviewed by the instructor and returned through E-mail. The revision was completed easier and faster on the computer.

Thirty-one percent (31%) of the students (n=5) responded that they were able to enjoy free writing because the writing

helped to formulate their thoughts and feelings whether they were typed or written.

Students in the Experimental Group were asked about their most valuable experiences in Technology-Assisted-Reflection of Listserv, online discussion, Internet, E-mail, and online submission for assignment. Multiple responses were allowed. 69% of the students (n=11) selected the Internet, 63% of the students (n=10) selected E-mail, 44% of the students (n=7) chose online discussion; 38% of the students (n=6) preferred Listserv, and 89% of the students (n=14) selected online submission of assignments as one of the most valuable experiences.

The online summative evaluation by cooperating teachers at the end of the semester was used by one-third of teachers. Instructors of the course revealed that the reason for a low online return rate was that most of classroom teachers did not have the Internet connection at school or in their classrooms, therefore the traditional paper and pencil evaluation procedure was still a good method at the moment.

The instructor of the Experimental Group has been teaching the same course for a numbers of years. She revealed that students in the Experimental Group did produce a better quality of work in their clinical analysis/reflection and structured self-evaluation in journals, field notes and papers when she recalled and compared her experience in the past. As a result, their final projects contained a high-level of thinking, synthesis and evaluation. "The quantity is more and the quality is better than before when comparing to the past experiences in teaching the same course", the instructor stated. However, the amount of work was tremendous. Since everything was online, instructor spent about ten hours a week in front of the computer and online during the duration of the intervention. This created

an inconvenience because most families had only a single phone line for both students and the instructor. Students complained that family members would pick up the telephone and dial, then found that their family member was in the middle of journal or field note assignment.

The class was held mainly in a regular classroom, and students' observation assignments were submitted through the Internet. As a result, their time on task was increased in the classroom.

The instructor in the Experimental Group also echoed the same finding as in Wu (1997). As students communicated through a less rule-governed virtual environment, they were free of the bounds of grammar and syntax.

Since discussion and assignments were conducted and transferred through the Internet, the instructor in the Experimental Group had to make changes to handle the digital information. It was important to keep the laptop up and running at all times. There was less paper handling for both students and the instructor.

Difficulties Encountered

Computer labs should be equipped with the capacity that provides a computer:student access ratio of 1:1, one computer per student at the college level. Universities should first consider the capacity of their computer laboratories before they decide the maximum seats that are available for a course, especially if the use of computers is required.

Also, many of the public schools that pre-service teachers observed did not provide teachers with an Internet connection. It

is important to provide in-service teachers not only with a computer but also with its accessories, so that in-service teachers can keep up with the progress of the information age.

Chapter 5 will present the conclusions of this research and provide recommendations for further research in the future.

Chapter 5

Summary, Conclusions and Recommendations

Introduction

The focus of this study was technology assisted analysis and reflection for pre-service teachers. Such a focus might inform teacher educators in improving the quality of pre-service teacher education. Naturally, irrespective of the context, data on students should inform policy and practice in teacher education. When teacher educators design collegiate programs for novice teachers, they must make decisions that will have far ranging consequences for teachers and the students they serve (Murray, 1996). Further, there has been extraordinary interest in the role of reflection and analysis in teacher education programs (Carter & Anders, 1996). As well, there are compelling technology needs to assess and when appropriate, to embed in teacher education programs (Lambdin, 1996). Thus, this study with its emphasis on pre-service teachers' technology-assisted analysis and reflection has implications for redesigning programs of teacher preparation. More specifically, the study could have implications for promoting dimensions of professional performance, judgment and cognitive development.

Statement of the Problem

One of the major issues for teacher education related to computers is the structure under which education is offered. Todd (1993) indicated that teacher preparation programs were faced with providing computer experiences by faculty who themselves often have limited computing experience and insufficient resources. Collis (1994) found that, in general, computer-related courses were conducted by persons without an academic background in teacher education, and furthermore, teacher education has not

effectively prepared future teachers to use technologies as pedagogical tools (POET, 1997).

Another concern in teacher education programs is the inability of programs to overcome the powerful influence of the pre-service teachers' own personal schooling. This problem requires more powerful pedagogies to break the hold of pre-service teachers' prior conceptions. Furthermore, successful teachers are both effective and responsible. This means that teachers not only have an understanding of curriculum and instruction, but also they can interact with students and parents/caregivers in respectful ways. Thus, teacher education programs need to give equal weight to both good teaching models and the moral dimensions of teaching. The connections to students are direct in that the teacher and schools hope to develop in students not only knowledge and skills, but values and sensibilities as well. A reflective and ethically responsible approach is needed in pre-service teacher education to prepare students to be able to manage a complex classroom experience, and to reflect upon and analyze various classroom situations (Schon, 1991; William & Niles, 1987b; Nelson & Smith, 1995). Teacher education programs should be tailored to meet each individual student's learning and developmental needs.

There is a great need for teacher education programs to include more specially designed analysis and reflective activities and assignments. Technology-Assisted-Reflection is designed to promote the cognitive and moral development of pre-service teachers as well as their stages of concerns in computing.

The quasi-experimental design followed a pretest and posttest format. It used an Experimental Group ($N_E = 20$) and two comparison groups ($N_{C_I} = 28$, $N_{C_{II}} = 20$ respectively). Students in

the study were taking the course of ECI205 Introduction to Teaching Humanities and Social Sciences to decide if teaching should be their career. Students in the Experimental Group participated in the Technology-Assisted-Reflection intervention.

Procedures

During the Spring and Fall of 1998, the introductory course in teaching for the pre-service teachers in Middle School Language Arts and Social Studies and Secondary English Education and Social Studies was converted to a website. All assignments for the eight visitations to schools were programmed to online electronic forms using Perl scripts and Hypertext Markup Language (HTML). Students could submit their assignments through the class website after each school visitation. In the end, forty-six programs were written using Perl scripts and HTML. In addition to setting up the website, online electronic forms, Listserv and NetForum were also requested through the Computing Center. Every student at the University had an E-mail account. However, there were many students who still had not had a chance to use their E-mail accounts. It was important to check and find out students' E-mail addresses before class.

Technology-Assisted-Reflection in Listserv, E-mail, NetForum, and online electronic forms were integrated into the curriculum for students of the Experimental Group. Group discussions for social issues were conducted on the NetForum, and all assignments were submitted through the Internet except the eight social issues to which students responded on paper.

Students must be personally comfortable with using technology (innovation) before they can be concerned with implementation and impact. Therefore, Listserv, NetForum, and E-mail were woven into the curriculum in the first six weeks of class in the Experimental Group.

An additional curriculum in social issues was developed to promote students' cognitive and moral development. These social issues focused on safety, gender, race, crime, technology, hate crime, environment, and classrooms. Questioning prompts for these issues were developed following King and Kitchener's ill-structured problem format (1994). The format has no fixed or correct answers to the problems. In addition, these social issues in educational settings were targeted for pre-service teachers to be familiar with social issues that they could be facing in their future classrooms.

All comments provided by instructors on paper or online while reviewing issues followed guided clinical analysis/reflection and differentiated learning, so that students could grow to a higher stage based on their own individual development (Reiman, 1988).

Students of the Control Groups followed traditional teaching methods for the curriculum and had no technology integration. All assignments were turned in on paper and all discussions were held in class.

The Computing Concerns Questionnaire (Martin, 1989) and the Defining Issue Test (Rest, 1979) were used as two instruments for the study.

Hypotheses and Analyses

The major research question set up for this study was: Can Technology-Assisted-Reflection in pre-service teacher education promote cognitive and moral development and reduce concerns for computing among pre-service teachers?

Analyses

Hypothesis 1:

Technology-Assisted-Reflection in the Experimental Group will promote greater gains in cognitive development than in the Control Groups that used a traditional teaching method.

The ill-structured problem format of questioning developed by King and Kitchener (1994) was adapted and social issues were developed for the qualitative component. Using the Linguistic Inquiry Word Count (LIWC) software to evaluate the qualitative data, the investigator found that there was an average word count of 18 per social issue in the NetForum discussion on the Internet. The average dropped to 15 words per social issue on the paper assignment in the Experimental Group. Control Group I had an average of 14 words per social issue on their paper assignments and Control Group II had an average of 17 words. Students in the Technology-Assisted-Reflection environment did analyze and reflect more in their journals, field notes and papers, although no statistical tests were conducted.

Students in the Experimental Group showed higher average scores in using question marks ($M=6$) in NetForum than on the paper assignments in the Experimental Group and the Control Groups. The mean gain scores dropped to two in the Experimental Group's paper assignment, and one for both Control Groups respectively. A higher mean gain score for using question marks in the Experimental Group could possibly be explained by the interactive process of the online environment. Students in the Experimental Group were more likely to seek answers from their peers or to confirm their reflective thoughts. Also online discussion was more likely to enhance communication and reference to others. When reflecting on paper, students followed a single thread to its conclusion in a

private format, and electronic conversations permitted more student participation. Students did not have to wait for teachers. Their postings would be read by multiple readers, and the purpose of their writings was to find out an answer to an important question, to help a colleague in need, and to determine if their feelings and fears were warranted.

As students indicated at the end of semester, social issues encouraged them to be more aware of differences in problems. These issues made them think about problems that they had not otherwise thought about, be more open-minded, and look at a particular scenario differently.

It is difficult to confirm that Technology-Assisted-Reflection has promoted cognitive development, however, the qualitative data that was obtained by this study showed the potential of using an external impetus of technology to assist students' cognitive development through differentiated learning and guided clinical analysis/reflection.

Hypothesis 2:

Students with minors would show higher mean gain scores in their cognitive growth between the Experimental Group and the Control Groups than students without minors.

The Experimental Group had 30% of students (n=6) with minors, Control Group I had 21% students (n=6) with minors, and 25% of the students (n=5) were with minors in Control Group II. Due to the small cell size in the sample, Hypothesis 2 was eliminated from further analysis.

Hypothesis 3:

Post-bachelor students would show higher mean gain scores in their cognitive growth between the Experimental Group and the Control Groups than students without Post-bachelor degrees.

The sample size for students with post-bachelor degree in the study was small (see Table 4.13). The Experimental Group had 20% of students (n=4) with Post-Bachelor degrees, Control Group I had only 4% students (n=1) with Post-Bachelor degrees and Control Group II had 15% of students (n=3) with Post-Bachelor degrees. Therefore, Hypothesis 3 was eliminated from further analysis.

Hypothesis 4:

There will be a statistically significant mean difference score (posttest - pretest) for moral growth of students in the Experimental Group. Students in the Experimental Group (Technology-Assisted-Reflection) will show a significant mean gain score in the higher stages of moral development. Students in the Control Groups will show no significant mean gain in stages of moral growth.

The statistical part of the study involved one-sample *t*-tests to test the hypothesis that the population mean difference score (posttest - pretest) on each stage of moral development as measured by the DIT was equal to zero for the Experimental Group, Control Group I and Control Group II. No statistical significance was found.

The technology did not have a statistically significant effect on the Experimental Group or the Control Groups. The findings did not support Hypothesis #4.

Hypothesis 5:

Students with minors will show higher mean gain scores in their moral growth between the Experimental Group and the Control Groups than students without minors.

The sample size for students with minors in the study was small (see Table 4.13). The Experimental Group had 30% of students (n=6) with minors, Control Group I had 21% students (n=6) with minors, and 25% of the students (n=5) were with minors in Control Group II. Therefore, Hypothesis 5 was eliminated from further analysis.

Hypothesis 6:

Post-bachelor students would show higher mean gain scores in their moral growth between the Experimental Group and the Control Groups than students without Post-bachelor degrees.

The sample size for students with post-bachelor degrees in the study was small (see Table 4.13). The Experimental Group had 20% of students (n=4) with Post-Bachelor degrees, Control Group I had only 4% students (n=1) with Post-Bachelor degrees and Control Group II had 15% of students (n=3) with Post-Bachelor degrees. Therefore, Hypothesis 6 was eliminated from further analysis.

Hypothesis 7:

There will be a statistically significant mean difference score (posttest - pretest) the stages of concerns in computing of students in the Experimental Group. Students in the Experimental Group (Technology-Assisted-Reflection) will show a significant mean gain score in the higher stages about computing than students in the Control Groups.

The statistical part of the study involved one-sample *t*-tests to test the hypothesis that the mean of the difference scores (posttest - pretest) on each stage of the Computing Concerns Questionnaire in the population was equal to zero for the experimental and Control Groups. No significant differences were found from pretest to posttest, however, there was a shifting of the concern stages from lower stages to higher stages. Further analysis was conducted by combining eight stages of concerns into three (self, task, impact) based on Fuller's work (1972). Even though the findings did not support Hypothesis #7, the result showed a trend of concerns moving to the impact stage in the Experimental Group. Students from both Control Groups were in the task management stage. Pre-service teachers with more technology training were at higher Stages of Concerns.

Conclusion

Increasingly, telecommunications are playing an essential role in our daily lives. Both federal and state governments are investigating the effectiveness of such technologies in teaching and learning environments. For example, North Carolina requires an 8th grade computer competency test that students must pass before their graduation from high school. These actions from federal and state governments indicate a realization of the need to educate students to become technologically savvy as they face the changing world. As the capacity of computer hardware increases, the software that are applied also becomes more sophisticated. Programs in drill and practice no longer satisfy the varied needs in education. The demand for skillful teachers who are proficient in a wide variety of technology usage has increased. Many universities that have education programs face the same problems of integrating technology into their established programs and full schedule. The temporary solution has been to deliver the training in technology through workshops. Most of the time, the approach is to teach the technical

areas that are required by the State examination, which is not effective. Students' concerns about technology are still high and they may struggle to get through training to obtain their initial licenses.

The Technology-Assisted-Reflection used in this study was an attempt by the researcher to rethink the curriculum of teacher education in the information age. The ultimate aim is to promote learning and development of the pre-service teachers. The results from the study suggest trends rather than statistically significant effects. The qualitative component of the study revealed a trend toward growth in cognition and ethics through Technology-Assisted-Reflection. Students in the Experiment Group disclosed that Technology-Assisted-Reflection helped them think more deeply, and the instructor revealed that a better quality of work was produced by students in the Experimental Group in this term than in the previous semesters. Human development progresses slowly. For example, King and Kitchener (1994) found a half-stage of cognitive growth between the averaged scores of college freshmen and seniors during a four-year process. Age and education are good indicators of moral and cognitive development, but it is difficult to evaluate growth with a four-month intervention.

Despite the lack of significant cognitive growth, findings from this study suggest that advanced technologies can be integrated into courses in pre-service teacher education. The technical skills of students increase as well as their confidence in using technology. When students experience first-hand technology integration and the gradual growth of cognition and ethics, the results seem positive and show potential benefit.

Converging and Diverging Patterns with Prior Research and Theory

As was mentioned in Chapter 2, guided clinical analysis and reflection had been major emphases of the course of ECI 205 - Introduction to Teaching Humanities and Social Sciences at North Carolina State University. During the course work, students participated in intensive dialogic and structured self-evaluation and reflection pedagogy. The Watson quasi-experimental study (1994) had significant effects. There were positive gains in instructional planning and presentation. As well, students in the Experimental Group showed significant positive gains in cognitive and moral development. The developmental variables were associated with greater tolerance for ambiguity and greater use of principles in terms of conflict. A second study by Reiman and Parramore (1993) examined the role of differentiated analysis and reflection on pre-service teachers. Once again, students in the Experimental Group showed significant gains in moral development, and there were strong trends (positive but non-significant gains) in cognitive development. Concerns were not assessed in the study. Further, these prior studies collaborated a meta-analysis of role-taking/reflection interventions completed by Reiman (1999). In his synthesis, seven studies of novice and pre-professionals were examined. The average effect size for moral/ethical reasoning was +0.72. The strength of the association between moral judgment and action has been estimated in a range of 10% to 15% (Thoma, 1994). Although, the strength of this relation may appear low, by comparison, the data are quite consistent with other estimates of judgment and action in related fields (Ajzen, 1988). Further, Sprinthall and Thies-Sprinthall (1983) outlined five principles for teacher adult development programming. In general, studies employing these design principles show gains. Programs showed both improved positive increases in professional performance and improved professional judgment as measured by instruments such as the Defining Issues

Test. The principles include role-taking, guided reflection, as well as balance between the new role and reflection, support, challenge and continuity.

The current study of Technology-Assisted-Reflection both converges and diverges with prior studies mentioned in Chapter 2. The reasons for these trends are now discussed.

Convergence with Prior Studies

1. The four-month intervention in Technology-Assisted-Reflection to promote cognitive and moral learning of students was inadequate. Educational interventions influencing changes in the DIT are a slow and gradual process. The amount of change is less in short-term than in long-term longitudinal studies (Rest, 1979). Adults do not change significantly on moral judgment in a 9-month time period (Rest, 1986). King & Kitchener (1994) found a possible half stage of growth in cognition during a four-year college period. Human development is a slow process, therefore, a four-month intervention appears to be inadequate to obtain any statistical significance in cognitive and moral development.
2. Qualitative data collected under the Technology-Assisted-Reflection pedagogy may increase the quality and quantity of written analysis and reflection, but this is based on anecdotal information. Thus, one must be guarded about such conclusions. Reasons for this pattern may be as follows:
 - 2.1. The virtual environment has contributed to quantity and quality of written analysis. The writing process changed from private and isolated activities to collaborative and interactive ones. The teacher-student relationship became interdependent and reflective and the classroom climate was

enhanced rather quickly with Technology-Assisted-Reflection. Students tended to ask more questions to get their classmates involved in a dialogic communication, which is different from a one-on-one communication between students and their instructor in a traditional classroom (Wu, 1997; Garside, 1996; Bruning, 1995; Stahlhut & Hawkes, 1994; Bump, 1993; Varricchio, 1992).

- 2.2. Technology-Assisted-Reflection has changed the traditional teaching format, and added new interest and excitement to students' learning (Piburn & Middleton 1997; Holm & Quatroche, 1997; Shoemake, 1997; Pearson, 1996; Geisert & Futrell, 1995; Burke, 1994).
- 2.3. Most students responded that they were able to enjoy free writing in Technology-Assisted-Reflection, because the writing helped them to formulate their thoughts and feelings. In addition, they could edit text quickly and easily, however, it does not free them from syntax errors (Wu, 1997).
3. Technology-Assisted-Reflection provided flexibility in students' learning. The around-the-clock accessibility and participation provided feedback and solutions to burning issues and questions efficiently and effectively (Burke, 1994).
4. Social issues were designed to involve students in reflective and analytical thinking to verify, synthesize, judge, and evaluate ill-structured problems, so that students could be more insightful and become better decision makers. However, the Reflective Judgment Interview questioning probes were adapted for the social issues, and the distribution of social issues was once a week. Students were quite annoyed by a

particular question, which asks "Can you ever know for sure that your opinion is correct?" King & Kitchener (1994) revealed the same concerns in their research.

5. Ill-structured social issues in Technology-Assisted-Reflection were helpful in promoting pre-service teachers' understanding of important issues and problems in education. The familiarity of the ill-structured problems to certain professions seemed to have no effect (Hayes, 1981) or a minimum effect (King & Kitchener, 1994) on the solutions and justification of the problems.
6. Technology-Assisted-Reflection helps students get comfortable with technology (innovation). The more students use technology, the less anxiety they have. About 50% of the students in the Experimental Group were computer illiterates in the beginning of the class, but only the Experimental Group students showed a trend toward higher stages of concern (impact) and the Control Groups were in the management concerns stage in the end. Teachers with more technology training were at slightly higher Stages of Concerns (Vasudevan et al, 1997 & Hall & Loucks, 1978).

Divergence with Prior Studies

1. There was no statistically significant gain in moral development. Reasons for this pattern may be the following:
 - 1.1. A more focused intervention in either cognition or ethics may be more effective. The change induced by educational intervention requires a heavy focus on moral problem solving (Rest, 1986, 1993). The intervention of Technology-Assisted-Reflection includes components in role-taking, social issues and technology. Students could be in a constant

disequilibrium position, therefore no statistical significant result could be reached, but a trend was suggested by the qualitative data.

- 1.2. Both Hunt's match-mismatch model and Vygotsky's zone of proximal development emphasize that instruction should stimulate one stage above a person's current level of reasoning. In fact, the curriculum should gradually mismatch a student's current conceptual level and maximize the potential for enriching intellectual performance. Furthermore, a new experience that involves "helping others and taking the perspective of others" becomes a very powerful, complex, and growth-promoting activity. The classroom visitation by the students as observers/assistants is an example of this activity. (Sprinthall, Reiman & Thies-Sprinthall, 1996). The intervention in Technology-Assisted-Reflection could be too discontinuous vis à vis the number of pedagogical innovations in social issue discussions and the new role-taking experience in middle or high school classrooms. The learning environment could be too disequilibrating to match students' current conceptual level and to maximize their potential growth.

2. Technology was implemented into Teacher Education in some studies separately, e.g. multimedia development, presentation in Power Point, Listserv, E-mail or the Internet (Shoemake, 1997; Piburn & Middleton, 1997; Holm & Quatroche, 1997; Audet, Hickman & Dobrynina, 1996; Thomas, Clift & Sugimoto, 1996; Ross, 1995; Bruning, 1995). Technologies in Listserv, E-mail, NetForum, electronic forms and the Internet were integrated as a whole into this study as well as the promotion of cognitive and moral development and the Stages of Concerns in Computing in the Technology-Assisted-Reflection.

Recommendations for Further Research

This research investigated the effect of Technology-Assisted-Reflection on pre-service teachers cognitive and moral development and computing concerns. The conclusions reached by the researcher suggest several areas for further research as well as crucial elements that need to be attended with caution when replicating the study.

1. Social Issues Curriculum:

There is a need to actively engage pre-service teachers in ill-structured problems and issues in an educational setting, so that pre-service teachers can analyze and reflect on simulated situations in education while enhancing their cognitive and moral development.

2. Length of Study:

Studies that investigate the cognitive domain of students should be longer than four months, a minimum of a two-semester study is needed.

3. Technostress:

The problems that come from long hours of computer use could be detrimental to the physical growth of students of any age. It is important for instructors to monitor any physical complaints students' experience through using computers, especially in K-12 classrooms.

4. Equity:

Not everyone can have access to a computer at home and not every home computer owner has an Internet connection. Equity and access should be kept in mind when designing a course of this type.

5. Electronic Submission of Assignments:

When submission assignments are online, students prefer to get a confirmation of their submission. For future study, E-mail message can be automatically generated and sent to students every time they successfully or unsuccessfully submit their assignments. Consequently, the webpage should be updated on the class website, and instances of redundant submission or missing assignments from students will be eliminated.

6. Preparation:

To access the Internet, there should be student accounts. NetForum and Listserv should be setup in advance and all electronic forms should be tested to ensure data transmission and integrity through the Internet. To assure access from either off or on campus, students who have commercial E-mail accounts should be added to the Listserv.

7. Expectations:

Students should be informed on the first day of class regarding the expectations needed to their participation in NetForum and Listserv. This would ensure that the discussion would stay on track and assignments would be turned in on time.

8. Additional Phone Line:

An instructor who teaches a course of this kind should be provided with an additional phone line at his/her residence. This dedicated line will be used for reading and responding to E-mail, Listserv, and electronic submission from students and colleagues.

9. Additional Laptop Computers:

An instructor who teaches a course of this kind should be provided with a laptop and its accessories for the Internet

connection. So that the instructor can login to the University server as well as learn new software or applications at his/her convenience.

10. Online discussion versus In-Class Discussion:

Students tended to ask more questions during online discussions than on their paper discussions. Future studies should investigate the number of questions asked between the online environment and the in-class discussion within the same group, since the environments are more comparable.

11. Collaboration and Cooperation in Technology Integration:

When integrating technologies into the curriculum, researcher(s) and instructor(s) should work closely to meet the requirements and the needs of students.

References

- Ajzen, I. (1988). *Attitudes, Personality, and Behavior*. Chicago: The Dorsey Press.
- Anshel, J. (1997). *Computer Vision Syndrome: Causes and Cures*. Corporate Vision Consulting.
- Arlin, P. (1993). Wisdom and expertise in teaching: An integration of perspectives. Learning and Individual Differences, 4(5), 341-350.
- Atencio, R. (1996). Eyestrain: The Number One Complaint of Computer Users. Computers in Libraries, 16(8), 40-43.
- Atkins, N. (1997). Using Teacher Stages of Concern and An Assessment of Middle School Teachers' Use of Technology in the Classroom: A Model for Technology Staff Development. Doctoral dissertation, North Carolina State University.
- Audet, R.; Hickman, A. & Dobrynina, G. (1996). Learning Logs: A Classroom Practice for Enhancing Scientific Sense Making. Journal of Research in Science Teaching, 33(2), 205-222.
- Beacham, B. & Kester, D. (1994). Getting Educated Drivers onto the Information Highway: A North Carolina Initiative to Begin the Journey from Country Lanes to the Superhighway. ED 378 173.
- Berger, C. F. & Carlson, E. (1988). A Model of Incorporating Learning Theories into Pre-service Computer Training. Outlook: A Publication of the Special Interest Group on Computer Users in Education. Association for Computing Machinery, 20 (1), 32-34.
- Black, L., Klingstein, K., & Songer, N. B. (1995). Observations from the Boulder Valley Internet Project. T.H.E. Journal, 22(11), 54-57.
- Bly, C. (1993). Technology-Related Staff Development: Teacher Concerns and Perceptions. Doctoral dissertation, University of La Veerne.

- Bowers, C. (1987). The Promise of Theory: Education and the Politics of Cultural Change. New York: Teachers College Press.
- Branoff, T. (1998). The Effects of Adding Coordinate Axes to a Mental Rotations Task in Measuring Spatial Visualization Ability: An Information-Processing Approach Relating to Teaching Methods of Undergraduate Technical Graphics Education. Doctoral dissertation, North Carolina State University.
- Brookfield, S. D. (1987). Developing Critical Thinkers: Challenging Adults to Explore Alternative Ways of Thinking and Acting. San Francisco: Jossey-Bass.
- Bruning, S. (1995). Classroom Exercise That Incorporates Internet Discussion Groups as an Integral Element in a Communication Course. Paper presented at the Annual Meeting of the Central States Communication Association. IN: Indianapolis.
- Burke, J. (1994). Using E-mail to Teach: Expanding the Reach of BI. Research Strategies, 14(1), 36-43.
- Bump, J. (1993). Sexual Difference and Participatory Pedagogy. Paper Presented at the Meeting of the Conference on College Composition and Communication.
- Burns, P. K. & Bozeman, W. C. (1981). Computer Assisted Instruction and Mathematics Achievement: Is there a Relationship? Educational Technology, 21, 32-37.
- Campbell, D., & Standley, J. (1963). Experimental and Quasi-experimental Design for Research. Boston: Houghton Mifflin.
- Carter, K. (1990). Teachers knowledge and learning to teach. In W. Robert Houston (Ed.), Handbook of research on teacher education. New York: Macmillan Publishing Company.
- Carter, K., & Anders, D. (1996). Program Pedagogy. In F. Murray (Ed.), The Teacher Educator's Handbook: Building a Knowledge Base for the Preparation of Teachers (pp. 557-592). San Francisco: Jossey Bass.

- Case, R. (1992). The Mind's Staircase. Hillsdale. New Jersey: Lawrence Erlbaum Associates.
- Cash, C. (1997). Environment Tied to Successful Learning. School Planning and Management, 36(1), 12-14.
- Chen, G. M. (1994). The Effect of E-mail Debate as a Teaching Tool. A Pilot Study. Paper Presented at the Meeting of the Speech Communication Association.
- Cipoletti, R. (1997). Analysis of Results from April, 1, 1997 to May, 31, 1997 [Online] Available.
- Collis, B. (1994). A Reflection on the Relationship between Technology and Teachers Education: Synergy or Separate Entities? Journal of Information Technology for Teacher Education, 3(1).
- Colon, B., Willis, J., Willis, D., & Austin, L. (1995). In D. Willis, B. Robin, & J. Willis (Eds.). Technology and Teacher Education Annual (pp. 791-794). Charlottesville, VA: Association for the Advancement of Computing in Education.
- Conrad, D. & Hedin, D. (1981). Natural Assessment of Experiential Education. Experiential Education, 7, 6-20.
- Cook, T. & Campbell, D. (1979). Quasi-Experimentation: Design & Analysis Issues for Field Settings. Rand McNally College Publishing Company. Chicago.
- Cruickshank, D., & Metcalf, K. (1990). Training within teacher preparation. In W. R. Houston (Ed.) New York: Macmillan.
- Crawford, L. (1994). Virtually Text Depictions of Self. Paper Presented at the Meeting of the Western States Communication and Association.
- Davydov, V. (1995). The Influence of L.S. Vygotsky on Education: Theory, Research, and Practice. Educational Researcher, 24(3), 12-21.
- Dewey, J. (1904). The relation of theory to practice in education. In C.A. McMurry (Ed.), The relation of theory to practice in the education of teachers (Third yearbook of

- the National Society for the Scientific Study of Education, Part I). Chicago: University of Chicago Press.
- Dewey, J. (1910). How we think. Boston: D.C. Heath and Co.
- Dewey, J. (1933). How we think: A restatement of the relation of reflective thinking to the educative process. Chicago: Henry Regnery.
- Dewey, J. (1938). Experience and education. New York: MacMillan.
- Dewey, J. (1944). Democracy and Education: An Introduction to Philosophy of Education. New York: Free Press.
- Emurian, H. (1989). Human-Computer Interactions: Are There Adverse Health Consequences? Computers in Human Behavior, 5, 265-275.
- Evertson, C. M. (1990). Bridging knowledge and action through clinical experiences. In D. D. Dill (Ed.), What teachers need to know (pp. 94-109). San Francisco: Jossey-Bass.
- Fann, G., Lynn, & Murranka, P. (1989). Integrating Technology: Attitudes as a Determinant of the Use of Microcomputers. Journal of Educational Technology Systems, 17(4), 307-317.
- Feiman-Nemser, S. (1990). Teacher preparation: Structural and conceptual alternatives. In W. Robert Houston (Ed.), Handbook of research on teacher education. New York: Macmillan Publishing Company.
- Fey, M. H. (1993). Reader Response, Collaborative Writing, and Computer Networking. Paper Presented at the Meeting of the National Reading Conference.
- Fischer, K. W. (1980). A Theory of Cognitive Development: The Control and Construction of Hierarchies of Skills. Psychological Review, 87(6), 477-531.
- Fisher, C. (1994). Classroom Technology and the New Pedagogy. Journal of Computing in Childhood Education, 5(2), 119-29.
- Fuller, F. (1969). Concerns of Teachers: A Development Conceptualization. American Educational Research Journal, 6(2), 12-16.

- Fuller, F., & Case, C. (1972). A Manual for Scoring the Teacher Concerns Statement (Report No. 0003). Austin: The University of Texas at Austin, Research and Development Center for Teacher Education. (ERIC Document Reproduction Service. (ED 079 361)
- Gall, M., Borg, W., & Gall, J. (1996). Educational Research: An Introduction. Longman: New York.
- Garside, C. (1994). Building Bridges to Critical Thinking: Utilizing Students Journals in the College Classroom. Paper Presented at the Meeting of the Speech Communication Association.
- Geisert, P. & Futrell, M. (1995). Teachers, Computers and Curriculum. Mass: Needham Heights.
- Graphic, Visualization, & Usability's (GVU) Center (1997). 7th Annual User Survey [Online]. Available: <http://www-survey@cc.gatech.edu>
- Griffin, G. (1987). Clinical teacher education. Journal of Curriculum and Supervision, 2(2), 248-274.
- Hall, G. & Loucks, S. (1978). Assessing and Facilitating the Implementation of Innovation: A New Approach, Educational Technology, 17(2), 18-21.
- Hall, G. & George, A. & Rutherford, W. (1979). Measuring Stages of Concerns About the Innovation: A Manual for Use of The SoC Questionnaire. 2nd Ed., Austin, TX: The University of Texas at Austin, Research and Development Center for Teacher Education.
- Hall, G., & Hord, S. (1987). Changing in Schools: Facilitating the Process. Albany, NY: State University of New York Press.
- Harrington, H. (1992). Fostering Critical Reflection through Technology: Preparing Prospective Teachers for a Changing Society. Journal of Information Technology for Teacher Education, 1(1), 67-82.
- Haselkorn, D. (1994). Shaping the Profession that Shapes America's Future. Quality Teaching, 4(1), 4.

- Hatcher, L., & Stepanski, E. (1994). A step-by-step approach to using the SAS system for univariate and multivariate statistics. SAS Institute: Cary, N.C.
- Hayes, A. (1981). An Investigation of the Effect of Dilemma Content on Level of Reasoning in the Reflective Judgment Interview. Dissertation Abstracts International.
- Head, F. (1994). Modifying Moral Dilemmas for Mentors and Supervising Teachers: An Initial Validation Study of a Cognitive Developmental Assessment Model. A Dissertation at North Carolina State University.
- Hedin, D. (1979). Teenage health educators: An action learning program to promote psychological development. Unpublished doctoral thesis. University of Minnesota.
- Hirokawa, R. & Garside, C. (1995). Building Relationships on the Information Superhighway. Paper Presented at the Meeting of the Central State Communication Association.
- Hirschbuhl, J. & Bishop, D. (1996). (Eds.) Computers in Education. Guilford, CT: Dushkin.
- Hofer, B. & Pintrich, P. (1997). The Development of Epistemological Theories: Beliefs about Knowledge and Knowing and Their Relation to Learning. Review of Educational Research, 67(1), 88-140.
- Holloway, E. & Wampold, B. (1986). Relation between conceptual level and counseling related tasks. Journal of Counseling Psychology, 33(3), 310-319.
- Holm, D. & Quatroche, D. (1997). Constructing an Understanding of Electronic Mail: Pre-service Teachers Making Connections. Paper presented at the Annual Meeting of the Midwest Association of Teacher Educators. ED 407 412.
- Hunt, D. E. (1971). Matching models in education: the coordination of teaching methods with student characteristics. The Ontario Institute for Studies in Education.
- Hunt, D. E. (1981). Teachers' adaptation: "Reading" and "flexing" to students. In B. Joyce, C. Brown, & L. Peck (Eds.),

- Flexibility in teaching: An excursion into the nature of teaching and training (pp. 59-71). New York: Longman.
- Ilandoli, C. & Norris, W. (1997) Contractions and Asides: A Social Critique of the Internet. The Journal of Technology Studies, 23(2), 35-41.
- Inhelder, B., & Piaget, J. (1958). The Growth of Logical Thinking from Childhood to Adolescence. New York: Basic Books.
- Integration of Technology in Pre-service Teacher Education Programs (1998, January). The Southern and Islands Regional Profile. SouthEast and Islands Regional Technology Consortium. SERVE, Inc.
- Jones, J. (1997). Teachable Moments: Practical Suggestions for Teaching Ethics Across the Curriculum.
<http://rvcc2.raritanval.edu/~scieng/tmintro.html>
- Johns, B. (1994). Student Perceptions of the Home Office Project. Paper presented at the Meeting of the Western States Communication Association.
- Kay, R. (1990). The Relation Between Locus of Control and Computer Literacy. Journal of Research on Computing in Education, 22, 264-474.
- King, P. & Kitchener, K. (1990). The Reflective Judgement model: ten years of research, in M. Commons, C. Armon, L. Kohlberg, F. Richards, T. Grotzer & J. Sinnott (Eds.) Adult Development: models and methods in the study of adolescent and adult thought (pp. 63-78). New York: Praeger.
- King, P. & Kitchener, K. (1994). Developing Reflective Judgement: Understanding and Promoting Intellectual Growth and Critical Thinking in Adolescents and Adults. San Francisco: Jossey-Bass Publishers.
- Kitchener, K. S., Lynch, C. L., Fischer, K. W., & Wood, P. K. (1993). Developmental Range of Reflective Judgement: The Effect of Contextual Support and Practice on Developmental Stage. Developmental Psychology, 29(5), 893-906.

- Kitchener, K.S., & King, P. (1985). Reflective Judgment Scoring Manual.
- Kohlberg, L. (1969). Stages and Sequence: the Cognitive-Developmental Approach to Socialization. In D. Goslin (Ed.) Handbook of Socialization Theory and Research. Chicago: Rand McNally.
- Kolb, D. (1985). Learning Style Inventory. Boston, MA: McBer and Company.
- Kulik, J., Bangert, R. & Williams, G. (1983). Effects of Computer-Based Teaching on Secondary Students. Journal of Educational Psychology, 75, 19-26.
- Kulik, J. (1983). Synthesis of Research on Computer-Based Instruction. Educational-Leadership, 41(1), 19-21.
- Kulik, J. (1983). Effects of Computer-Based Teaching on Learners. Paper presented at the National Forum of the College Board Symposium on Computer Competency and the Curriculum.
- Kulik, J., Bangert, R., & Williams, G. (1983). Effects of Computer-Based Teaching on Secondary School Students. Journal of Educational Psychology, 75(1), 19-26.
- Kulik, J., Kulik, C., & Bangert-Drowns, K. (1985). Effectiveness of Computer-Based Education in Elementary Schools. Journal of Computers in Human Behavior, 1(1), 59-74.
- Kulik, J. (1985). Consistencies in Findings on Computer-Based Education. Paper presented at the Annual Meeting of the American Educational Research Association.
- Kulik, C., Kulik, J., & Shwalb, B. (1985). The Effectiveness of Computer-Based Adult Education: A Meta-Analysis. Paper presented at the Annual Meeting of the American Educational Research Association. Chicago, IL.
- Kulik, C. & Kulik, J. (1986). Effectiveness of Computer-Based Education in Colleges. Journal of AEDS, 19(2-3), 81-108.
- Kulik, C. & Kulik, J. (1987). Review of Recent Research Literature on Computer-Based Instruction. Contemporary Educational Psychology, 12(3), 222-230.

- Kulik, J. & Kulik, C. (1987). Computer-Based Instruction: What 200 Evaluations Say. Paper presented at the Annual Convention of the Association for Educational Communications and Technology.
- Kulik, C. & Kulik, J. (1991). Effectiveness of Computer-Based Instruction: An Updated Analysis. Computers in Human Behavior, 7(1-2), 75-94.
- LaBoskey, V. (1994). Development of Reflective Practice: A Study of Pre-service Teachers. Teacher College Press: Columbia University,
- Lambdin, D. V. (1996). A Hypermedia System to Aid in Pre-service Teacher Education: Instructional Design and Evaluation. ED 397 808.
- Landoli, C. & Norris, W. (1997). Contradictions and Asides: A Social Critique of the Internet. The Journal of Technology Studies, 23(2), 35-41.
- Lamborn, S. D. & Fischer, K. W. (1988). Optimal and Functional Levels in Cognitive Development: The Individual's Developmental Range. Newsletter of the International Society for the Study of Behavioral Development, 14(2).
- Lind, G. (1996). Educational Environments Which Promote Self-Sustaining Moral Development. Paper presented at the meeting of American Educational Research Association.
- Lewin, K. (1935). A Dynamic Theory of Personality. New York: McGraw-Hill.
- Luria, A., & Yudovich, F. (1959). Speech and the Development of Mental Processes in the Child. Hammonds worth, England: Perguin Books.
- Mann, A. (1992). A Quantitative and Qualitative Evaluation of a Peer Tutoring-Training Course: A Cognitive-Developmental Model. Unpublished Doctoral Dissertation, North Carolina State University, Raleigh, NC.

- Mapartlin, J. (1990). The Terrors of Technostress - There is a Stress Associated with Computer Use that is Determined to our Work and Our Lives. Information Week, 30(280).
- Martin, J. (1989). Measuring the Stages of Concern in the Development of Computing Expertise. (Doctoral dissertation, University of Florida, 1989).
- McIntyre, S. & Tlusty, R. (1995). Computer-Mediated Discourse: Electronic Dialogue Journaling and Reflective Practice. ED 385 232.
- McNamee, S. (1997). Moral Behavior, Moral Development and Motivation. Journal of Model Education, 7(1), 27.
- Mead, G. H. (1934). Mind, Self, and Society. Chicago: University of Chicago Press.
- Mezirow, J. (1991). Transformative Dimensions of Adult Learning. San Francisco: Jossey-Bass.
- Miller, A. (1981). Conceptual Matching Models and Interactional Research in Education. Review of Educational Research, 51(10), 33-84.
- Mischel, W. & Mischel, H.N. (1976). A Cognitive Social Learning Approach to Morality and Self-Regulation. In T. Lickona (Ed.), Moral Development Behavior, New York: Holt, Rinehart & Winston, Chapter 4.
- Miller, P. (1993). Theories of Developmental Psychology. New York: W.H. Freeman Company.
- Moll, L. (Ed.) (1990). Vygotsky and education: Instructional implications and applications of sociohistorical psychology. Cambridge, MA: Cambridge University Press.
- Murray, D. (1985). A Writer Teaches Writing. Boston, MA: Houghton-Mifflin.
- Murray, F. (ed.) (1996). The Teacher Educator's Handbook: Building a Knowledge Base for the Preparation of Teachers. San Francisco: Jossey Bass.
- National Council for Accreditation of Teacher Education. (1997).

- Technology and the new professional: Preparing for the 21st century classroom. Washington, D. C.: Author.
- Nelson, W. A. & Smith, R. E. (1995). Chronicles of Teaching: A Computer-Based System to Support Communication and Reflection about Teaching. Computer in Human Behavior, 11(3-4), 649-660.
- Newlove, B. W. & Hall, G. E. (1976). A Manual for Assessing Open-Ended Statements of Concern About an Innovation. Austin: The University of Texas at Austin, Research and Development Center for Teacher Education.
- O'Keefe, P., & Johnston, M. (1989). Perspective Taking and Teacher Effectiveness: A Connecting Thread through Three Developmental Literatures. Journal of Teacher Education, 40(3), 20-26.
- Office of Technology Assessment. (1995). Teacher and Technology: Making the connection. Washington, DC: Government Printing Office.
- Oja, S. N. & Sprinthall, N. A. (1978). Psychological and moral development of teachers. In N.A. Sprinthall & R.L. Mosher (Eds.), Value development as the aim of education (pp. 117-134). Schenectady, New York: Character Research Press.
- Oja, S. N. & Reiman, A. J. (In Press). Describing and promoting supervision for teacher development across the career span. In J. Firth and E. Pajak (Eds.) Handbook of research on School Supervision. New York: Macmillan.
- Oser, F., Dick, A., & Patry, J. (1992). Effective and Responsible Teaching: the New Synthesis. San Francisco: Jossey-Bass.
- Panel on Educational Technology (1997). Report to the President on the use of Technology to Strengthen K-12 Education in the United States. Washington, DC: Government Printing Office.

- Pedias, M. & Horton, J. (1996). Using Technology to Enhance Teacher Education. Paper presented at the Annual Meeting of the NorthWest Association of Teacher Educators.
- Peace, S. (1992). A Study of school counselor instruction: A cognitive-developmental mentor/supervision training program. Unpublished doctoral dissertation. North Carolina State University, Raleigh, North Carolina.
- Pearson, M. (1996). Look Who's Talking: A Pilot Study of the Use of Discussion Lists by Journalism Educators and Students. Paper presented at the Annual Meeting of the Association for Education in Journalism and Mass Communication. CA: Anaheim.
- Pennebaker, J., & Francis, M. (1992). Linguistic Inquiry and Word Count. The University of Texas at Austin.
- Perry, W. G. (1970). Forms of Intellectual and Ethical Development in the College Years: A Scheme. New York: Holt, Rinehart and Winston.
- Piburn, M. & Middleton, J. (1997). Listserv as Journal: Computer-Based reflection in a Program for Pre-service Mathematics and Science Teachers. Paper presented at the International Conference on Science, Mathematics and Technology Education, Hanoi, Vietnam.
- Poling, D. J. (1994). E-mail as an Effective Teaching Supplement. Educational Technology, 34(5), 53-55.
- Pool, S., Blanchard, S., & Hale, S. A. (1995). From Over the Internet: Users Discuss a New Direction for Learning. Computers in Education.
- Pressley, M. & McCormick, C. (1995). Advanced Educational Psychology: for Educators, Researchers and Policymakers. New York: HarperCollins College Publishers.
- Quilter, D. & Pascarella, E. (1994). Repetitive Strain Injury: A Computer User's Guide. John Wiley & Sons.

- Raymond, A., & Santos, V. (1995). Pre-service elementary teachers and self-reflection: How innovation in mathematics teacher. Journal of Teacher Education, 46(1), 58-70.
- Research Spectrum. (1997). Internet Statistics [Online]. Available: <http://www.researchspectrum.com>.
- Reiman, A. (1988). An Intervention Study of Long-TerMMentor Training: Relationships between Cognitive-Development Theory and Reflection. Unpublished Doctoral Dissertation. North Carolina State University, Raleigh, NC.
- Reiman, A. (1997). Promoting More Thoughtful, Responsible, and Caring Education: the Evaluation of the Social Role taking and Guided Reflection Framework. Paper presented at the Association of Moral Education. Atlanta, Georgia. 1997.
- Reiman, A. (1999). The Evolution of the Social Roletaking and Guided Reflection Framework in Teacher Education: Recent Theory and Quantitative Synthesis of Research. (pp. 597-612). Teaching and Teacher Education. Pergamon.
- Reiman, A. & Parramore, B. (1993). Promoting pre-service teacher development through extended field experience. In M. O'Hair & S. Odell (Eds.) Teacher Education Yearbook I: Diversity and Teaching. (pp. 111-121). Fort Worth, TX: Harcourt Brace Jovanovich.
- Reiman, A. & Sprinthall, L. (1993). Promoting the development of mentor teachers: Theory and research programs using guided reflection. Journal of Research and Development, 26(3), 179-185.
- Rest, J. (1979). Development in Judging Moral Issue. University of Minnesota Press. Minneapolis.
- Rest, J. (1986). Moral Development. New York: Praeger.
- Rest, J. (1987). Moral Judgment: An Interesting Variable for Higher Education Research. Paper Presented at the Annual Meeting of the Association for the Study of Higher Education.
- Rest, J. (1993). Guide for the Defining Issue Test. Center for the study of Ethical Development.

- Rest, J., & Narvaez, D. (1994). Moral Development in the Professions: Psychology and Applied Ethics. Hillsdale, NJ: Erlbaum.
- Ross, T. (1995). Listservs as a Method to Enhance Instruction: Our First Year Experience. Paper presented at the Annual Meeting of the National Council of Professors of Educational Administration.
- Rudden, J. & Mallery, A. (1996). Effects of Internet Instruction and Computer Experience on Pre-service Teachers' Concerns about Its Place in Planning and Teaching. Paper presented at the Annual Meeting of the College Reading Association.
- Ryan, K. & Cooper, J (1998). Those Who Can, Teach. New York: Houghton Mifflin Co.
- Salomon, G. (1991). Transcending the Qualitative-Quantitative Debate: The Analytic and Systemic Approaches to Educational Research. Educational Researcher, 20(6), 10-18.
- Schmidt, J. & Davison, M. (1983). Helping Students Think. The Personnel and Guidance Journal, 61(9), 563-569.
- Schon, D. (1987). Educating the reflective practitioner. San Francisco: Jossey-Bass.
- Schon, D.A. (1991). The Reflective turn: Case studies in and on educational practice. New York: Teachers College Press.
- Selman, R. (1980). The growth of interpersonal understanding. New York : Academic Press.
- Sherry, L., & Lawyer-Brook, D. (1997). The Boulder Valley Internet Project: Teachers Mentoring Teachers. Paper presented at the Annual Meeting of the American Educational Research Association. Chicago, IL.
- Shoemaker, B. (1997). Cyberspace Class: Rewards and Punishment. Eric Clearinghouse on Reading English and Communication.
- Shulman, L. (1986). Those who understand: Knowledge Growth in Teaching. Educational Researcher, 15(2), 4-14.
- Sprinthall, L. (1980). Supervision: An Educative or miseducative process? Journal of Teacher Education, 31(4), 17-30.

- Sprinthall, N. & Hall, J. & Gerler, E. (1992). Peer Helping: Counselors and teachers as facilitators. The peer Facilitator Quarterly, 9(4), 11-15.
- Sprinthall, N. & Scott, J. (1989). Promoting Psychological development, math achievement and success attribution of female students through deliberate psychological education. Journal of Counseling Psychology, 36(4), 440-446.
- Sprinthall, N., & Reiman, A., & Thies-Sprinthall, L. (1993). Role taking and reflection promoting the conceptual and moral development of teachers. Journal of Learning and Individual difference, 5(4), 283-299.
- Sprinthall, N., Reiman, A., & Thies-Sprinthall, L. (1996). Teacher Professional Development. In J. Sikula (Ed.) Second handbook of research on teacher education. (pp. 666-703). New York: Macmillan.
- Sproull, L. S. (1986). Using Electronic Mail for Data Collection in Organizational Research. Academy of Management Journal, 29, 159-169.
- Stahlhut, R. & Hawkes, R. R. (1994). Using Computer Conferencing Technology to Assist Collaboration Between Higher Education Faculty, Student Teachers and K-12 Practitioners. Paper presented at the Mid-America Regional Conference.
- Stillman, P. (1985). A Writer (and Teacher of Writing) Confronts Word Processing. In J. Collins & E. Sommers (Eds.), Writing On-line: Using Computers in the Teaching of Writing (pp.19-28). Upper Montclair, NJ: Boynton-Cook.
- Strudler, N., Quinn, L., McKinney, M., & Jones, W. (1995). From Coursework to the Real World: First Year Teachers and Technology. In D. Willis, B. Robin, & J. Willis (Eds.). Technology and Teacher Education Annual (pp. 774-777). Charlottesville, VA: Association for the Advancement of Computing in Education.

- Summer, M. (1990). New student teachers and computers: An investigation of Experiences and Feelings. Educational Review, 42(3), 261-271.
- Takacs, J., Reed, W. M., Wells, J. & Dombrowski, L. (1999). The Effects of Online Multimedia Project Development, Learning Style, and Prior Computer Experiences on Teachers' Attitudes Toward the Internet and Hypermedia. Journal of Research on Computing in Education, 31(4), 341-355.
- Thach, L. (1995, March-April). Using Electronic Mail to Conduct Survey Research. Educational Technology, 27-31.
- Tharpe, R. G. & Gallimore, R. (1988). Rousing minds to life. Cambridge, MA. Cambridge University Press.
- Thies-Sprinthall, L. (1984). Promoting the Developmental Growth of Supervising Teachers: Theory, Research Programs, and Implications. Journal of Teacher Education, 35(3), 53-60.
- Thornton, J. (1997). Carpal Tunnel Syndrome in ARL Libraries. College & Research Libraries, 58(1), 9-18
- Thoma, S. (1993). The Relationship between Political Preference and Moral Judgment Development in Late Adolescence. Merrill-Palmer Quarterly, 39(3), 359-374.
- Thoma, S. (1994). Moral Judgment and Moral Action. In J. Rest and D. Narvaez (Eds.), Moral Development in the Professions (pp. 199-211). Hillsdale, New Jersey: Erlbaum.
- Thoma, S. (1994). Do Moral Education Programs Facilitate Moral Judgement? A Meta-Analysis of Studies Using the Defining Issues Test. Moral Education, 20-35.
- Thomas, L., Clift, R., & Sugimoto, T. (1996). Telecommunication, student teaching, and method Instruction. An Exploratory Investigation. Journal of Teacher Education, 47(3), 165-174.
- Tyson, H. (1994). Who will teach the children? San Francisco: Jossey-Bass.

- Todd, N. (1993). A Model for Integrating Computer-Based Technologies in Teacher Education. (Doctoral dissertation, University of Washington, 1992).
- Ubelacker, S. (1998). Teachers! Parents! Beware of RSI. Proceedings of the Families, Technology, and Education Conference in Chicago, IL, 1997. ED425002.
- Vasu, E. & Atkins, N. (1997). Measuring Knowledge of Technology Usage and Stages of Concern about Computing: A Study of Middle School Teachers.
- Van Manen, M. (1991). The tact of teaching: The meaning of pedagogical thoughtfulness. Albany: State University of New York Press.
- Varricchio, A. (1992). Electronic mail in a Spanish Language Business Course. Paper Presented at the Eastern Michigan University Conference on Languages and Communication for World Business and the Professions, Ypsilanti, MI.
- Vygotsky, L. S. (1962). Thoughts and Language. Cambridge, M.A.: MIT Press.
- Vygotsky, L. S. (1978). Mind in Society: The development of higher psychological processes. Cambridge, MA: Harvard university Press.
- Vygotsky, L. S. (1986). Thoughts and Language. (A. Kozulin, Trans.). Cambridge, M.A.: MIT Press. (Original English translation published 1962).
- Watson, B. (1994). Early Field Experiences in Teacher Education: A developmental Model. Unpublished dissertation, North Carolina State University, Raleigh.
- Weil & Rosen (1997). TechnoStress: Coping With Technology @WORK @HOME @PLAY. John Wiley & Sons.
- Wells, J. G. & Anderson, D. K. (1997). Learners in a telecommunications course: adoption, diffusion, and stages of concern. Journal of Research on Computing in Education, 30, 83-105.

- William, T.M. & Niles, J.A. (1987). Reflective teachers: Tensions between abstractions and realities. Journal of Teacher Education, 38(4), 25-31.
- Williams, A. (1996). Teacher As Well As the Learner. Paper Presented at the Meeting of Small Computer in Education Summer Conference .
- Wu, H. (1997). Students' Conversations We Have Never Heard: Transparencies on the Listserv. Paper Presented at the Annual Meeting of the Conference on College Composition and Communication.
- Young, J. (1996). Your Guide to Safe Computing: Prevent Computer-Lab Health Hazards for Your Students--and Yourself. Electronic Learning, 16(2), 42-44.
- Young, K. (1998). Caught in the Net. John Wiley & Sons, Inc.
- Zeichner, K. & Gore, J. (1990). Teacher socialization. In W. Robert Houston (Ed.), Handbook of research on teacher education. New York: Macmillan Publishing Company.
- Zeichner, K., & Liston, D. (1987). Teaching Student Teachers To Reflect. Harvard Educational Review, 57(1), 23-48.
- Zellerman, M., Salomon, G., Globerson, T., & Givon, H. (1991). Enhancing writing-related metacognitions through a computerized writing partner. American Educational Research Journal, 28(2), 373-391.
- Zinser, W. (1983). Writing with A Word Processor. New York: Harper & Row.

Appendix A

Summary of Categories Guiding Written Reflections

Interaction	Journal Pattern	Instructor Response
1. Accept Feelings	1a. Teacher has difficulty discerning feelings in both self and others.	Share owns feelings.
	1b. Teacher discerns feelings in both self and students	Accept feelings.
2. Praises or Encourages	2a. Teacher doubts self when trying new instructional strategies.	Offer frequent encouragement.
	2b. Teacher has confident when attempting new instructional strategies.	Offer occasional support.
3. Acknowledges and Clarifies Ideas	3a. Teacher perceives knowledge as fixed and employs a single "tried and true" model of teaching.	Relate ideas to observed events and clarify how ideas affect students' lives.
	3b. Teacher perceives knowledge as a process of successive approximations and employs a diversity of models of teaching.	Accept ideas and encourage examination of hidden assumptions of pedagogy.
4. Prompts Inquiry	4a. Teacher rarely reflects on the teaching/learning process.	Ask questions about observed events in teaching/learning.
	4b. Teacher consistently reflects on diverse aspects of the teaching/learning process.	Ask questions that encourage analysis, evaluation, divergent thinking and synthesis of theory/practice and broader societal issues.
5. Provides	5a. Teacher disdains	Offer information

Information	theory, prefers concrete thinking and had difficulty recalling personal teaching events.	in smaller amounts, relate to observed practice, and review regularly.
	5b. Teacher employs abstract thinking, shows evidence of originality in adapting innovations to the class and is articulate in analysis of his or her own teaching.	Relate information to relevant theory and contrast with competing theories.
6. Gives directions	6a. Teacher needs detailed instructions and high structure, is low on self-direction, and follows curriculum as if it were "carved in stone". 6b. Teacher is self-directed and enjoys low structure.	Offer detailed instructions but encourage greater self-direction. Offer few directions.
7. When problems exist	7a. Teacher has difficulty accepting responsibility for problems and blames students. 7b. Teacher accepts responsibility for actions.	Accept feelings and thoughts, use "I" messages and arrange a conference. Accept feelings and thoughts.

Appendix B

Differentiation of Structure

Factors	High Structure	Low Structure
Concepts	Concrete	Abstract
Time Span	Short	Long
Time on Task	Multiple practice	Single practice
Advance Organizers	Multiple use of organizers	Few (if any) organizers
Complexity of Learning Tasks	Divided into small steps and recycled	Learning tasks clustered into "wholes".
Theory	Concretely matched with experiential examples	Generalized including action research
Instructor Support	Consistent and frequent	Occasional

Appendix C**Interpretation of Stage of Concern About Computing (Martin, 1989)****Contextual**

Society issues and "Orwellian" fears. These concerns are not directly related to the individual's use of a computer. They have to do with the use of computers in society. Emphasis is on negative economic impact, influence on children, health, undue dependencies on computers, and deemphasis of the individual and human values.

Informational

These concerns suggest an interest in having more information about computers in general or about a specific aspect of computing. Emphasis is on concerns about learning how computers can be used and how they function.

Personal

These concerns focus on implications for the individual. There is an uncertainty or anxiety about the demands of computing and the adequacy of his/her ability to meet those demands. Emphasis is on concerns about oneself, personal status, and the opinions others have about them in relation to computing.

Management

These concerns focus on time constraints, limited or inadequate instructional material, help resources, data integrity, availability of resources, and the steps required to complete a computing task.

Consequence (Self)

These concerns focus on the effect the individual's expertise with computers has on himself/herself. Emphasis is on the individual's personal or professional benefits available as a result of having computing know-how.

Consequence (Others)

These concerns focus on the effect the individual's expertise with computers or a particular aspect of computing has on other people. Emphasis is on concerns about the quality of the computer-related work produce by the individual and its impact on people evaluating or using the output of the effort.

Collaboration

These concerns relate to coordination and cooperation with others or a particular application of the technology in order to have increased positive effect of use.

Refocusing

These concerns focus on the extension of the benefits of computer use in a more universal way, including the possibility of major changes and alternatives in the use of the technology. The individual has definite ideas about alternatives to the proposed or existing use of computers or a particular aspect of computing.

Appendix D

Statements of Computing Concerns Questionnaire
for scoring

ID: _____

Percentile Score: _____

Item#	Description	Assigned Score
Awareness		
4.	I think the world is too saturated with computers; people have become numbers rather than individuals.	
14.	I am concerned about the excessive dependence on computers and reemphasis of human skills.	
21.	I am concerned that machines have become more important than people.	
32.	I think that playing computer games may limit a child's creativity and imagination.	
		Raw Score
Information		
6.	I would like to know more about how a computer operates.	
10.	I would like to know more about the many users and applications of computers.	
20.	I am interested in knowing how computers can process data so rapidly and efficiently.	
30.	I am concerned about finding out what tasks I can use a computer to do.	
		Raw Score
Personal		
3.	I feel apprehensive when introduced to a new program, computer application, or equipment.	
8.	I have a fear of pressing the wrong key and messing up what I am working on.	
13.	I am concerned about my ability to do the computing tasks required of me.	
26.	I am concerned about what to do next when using a computer.	
		Raw Score
Management		
12.	The reliable operation of printers and other devices is of real concern to me.	
16.	I am concerned about problems having to do with disks or other file storage equipment.	
22.	The tasks of saving and retrieving my computer work are of real concern to me.	
28.	I see a potential for conflict between the need for computing resources and the availability of funds.	
		Raw Score
Consequence - self		
		I am concerned about the quality and accuracy of the computing tasks that I complete.
11.	It is very rewarding to me when my work is successful.	
15.	It is important to me that my computer work is efficient.	
23.	Learning how to use computers provides me with many benefits.	
		Raw Score
Consequence - other		
5.	I am concerned about the effect I have on others in their use of computers.	
9.	My goal is to provide assistance with computer related work that is beneficial to the recipient.	
18.	I would like to excite others about their involvement with computers.	

31.	I am concerned about how well the computer application I have developed performs when it is used.	
	Raw Score	
	Collaboration	
7.	I would like to have greater interaction with other users of computers to work on common problems.	
19.	I would like to work with others in the accomplishment of computer task.	
24.	I would like to take part in more frequent discussions about computing issues.	
27.	I would like to coordinate more closely with others whose computer work will be associated with mine.	
	Raw Score	
	Refocusing	
2.	I would like to revise my current methods of providing information and/or instruction about the use of computers.	
17.	I want to revise my present methods of providing information about computing in order to include more practical examples.	
25.	I am concerned about incorporating changes that I can make to increase consideration of people in their use of computers.	
29.	I would like to initiate changes that would make the use of computers more rewarding.	
	Raw Score	

Appendix E**Defining Issue Test by Rest****Heinz and the Drug**

In Europe a woman was near death from a special kind of cancer. There was one drug that the doctors thought might save her. It was a form of radium that a druggist in the same town had recently discovered. The drug was expensive to make, but the druggist was charging ten times what the drug cost to make. He paid \$200.00 for the radium and charge \$2000.00 for a small dose of the drug. The sick woman's husband, Heinz, went to everyone he knew to borrow the money, but he could only get together about \$1000, which is half of what its cost. He told the druggist that his wife was dying, and asked him to sell it cheaper or let him pay later. But the druggist said, "No, I discovered the drug and I'm going to make money from it." So Heinz got desperate and began to think about breaking into the man's store to steal the drug for his wife.

Escaped Prisoner

A man had been sentenced to prison for 10 years. After one year, however, he escaped from prison, moved to a new area of the country, and took on the name of Thompson. For 8 years he worked hard, and gradually he saved enough money to by his own business. He was fair to his customers, gave his employees top wages, and gave most of his own profits to charity. Then one day, Mrs. Jones, an old neighbor, recognized him as the man who had escaped from prison 8 years before, and whom the police had been looking for.

Newspaper

Fred, a senior in high school, wanted to publish a mimeographed newspaper for students so that he could express many of his opinions. He wanted to speak out against the war in Vietnam and to speak out against some of the School's rules, like the rule forbidding boys to wear long hair. When Fred started his newspaper, he asked his principal for permission. The principal said it would be all right if before every publication. Fred would turn in all his articles for the principal's approval. Fred agreed and turned in several articles for approval. Fred agreed and turned in published two issues of the paper in the next two weeks. But the principal had not expected that Fred's newspaper would receive so much attention. Students were so excited by the paper that they began to organize protests against the hair regulation and other school rules. As a result of the rising excitement, the

principal ordered Fred to stop publishing. He gave as a reason that Fred's activities were disruptive to the operation of the school.

The Doctor's Dilemma

A lady was dying of cancer which could not be cured and she had only about six months to live. She was in terrible pain, but she was so weak that a good dose of pain-killer like morphine would make her die sooner. She was delirious and almost crazy with pain, and in her calm periods, she would ask the doctor to give her enough morphine to kill her. She said she couldn't stand the pain and that she was going to die in a few months anyway.

Webster

Mr. Webster was the owner and manager of a gas station. He wanted to hire another mechanic to help him, but good mechanics were hard to find. The only person he found who seemed to be a good mechanic was Mr. Lee, but he was Chinese. While Mr. Webster himself didn't have anything against Orientals. His customers might take their business elsewhere if Mr. Lee was working in the gas station. When Mr. Lee asked if he could have the job, Mr. Webster said that he had already hired somebody else. But Mr. Webster really had not hired anybody, because he could not find anybody who was a good mechanic besides Mr. Lee.

Student Take-Over

At Harvard University a group of students, called the Students for a democratic Society (SDS), believe that the University should not have an army ROTC program. SDS students are against the war in Vietnam, and the army training program helps send men to fight in Vietnam. The SDS students demanded that Harvard and the army ROTC training program as a university course. This would mean that Harvard students could not get army training as part of their regular course work and not get credit for it towards their degrees.

Agreeing with the SDS students, the Harvard professors voted to end the ROTC program as a university course. But the President of the University stated that he wanted to keep the army program on campus as a course. The SDS students felt that the President was not going to pay attention to the faculty vote or to their demands.

So, one day last April, two hundred SDS students walked into the university's administration building, and told everyone

else to get out. They said they were doing this to force Harvard to get rid of the army-training program as a course.

Appendix F

Demographic Profile - Pretest

Please circle the appropriate response, or fill in the blank for each of the following questions. Your response will be taken into consideration for updating the curriculum, please answer each question as accurately as possible. Thank you.

1. Last 4-digits of SSN: _____.

2. Gender:

a. Male b. Female

3. Age: _____.

What is your

a. Major _____.

b. Minor(s), if any _____.

Have you received any computer training prior to this course?

a. No b. Yes

If your answer is yes, please tell us:

c. The platform you used (Windows, DOS, or
Macintosh)_____

d. The applications you used (e.g. Microsoft Word, E-mail)

6. Do you have a post bachelor's degree?

a. No b. Yes

If your answer is yes, please list degree(s) you earned (e.g.

Bachelor in

History)

7. What is your professional experience(s)? (e.g. Teacher assistant, clerk...)

Does or Did the job require computer skills?

- a. No b. Yes

Do or Did you operate any electronic equipment at work? (i.e. cash register, computer).

- a. No b. Yes

If your answer is yes, please list types of the equipment:

Did your experience of using electronic devices ever create any anxieties, stress of any kind, please describe

8. Which region of North Carolina do you come from?

- a. Western b. Northern-Midwest c. Southern-Midwest d.
d. Central e. NorthEastern f. SouthEastern
g. I did not come from North Carolina

9. Did you use computers in your middle or high school?

- a. N/A b. Middle school c. High school d. Both

If your answer to 9 is yes, please answer the following questions (Middle/High School):

e. The platform you primarily used (Windows, DOS, or Macintosh)

The approximate # of students per computer

g. The approximate # of hours/per week you spent using computers:

i. in the computer lab _____

ii. in your classroom _____

iii. at home _____

How old were you when you first started using computers?

our initial experience in using computers was at

- a. Home b. Elementary School c. Middle School d. High School e. NCSU f. Other, (explain)

Can you recall your initial experience with computers (i.e. 😊, ☹)? _____

12. Do you own a computer?

- a. No b. Yes

If your answer is yes, please indicate which platform you own:

- a. Mac b. Windows or DOS c. Both

Who purchased your first computer?

What was the main reason for getting the computer?

What do you think the reasons for parents buying computers for their children today?

Which one is the better medium for education?

- a. TV
- b. Computer

What was your reasons?

What is your basic concern for using computers at schools?

13. Have you used the Internet?

- a. No
- b. Yes

If your answer is yes, please answer the following:

- a. Personal Use (Non-academic)
- b. Academic
- c. both: Percentage (%) in Personal Use / % in Academic Use:

14. Have you used E-mail?

- a. No
- b. Yes

What have you experienced or heard from others after working long hours or days in front of computers?

16. What is your self-evaluation of your level of confidence in using computers:

- a. None b. Low c. Moderate d. High

After working long hours on the computers, I often encounter problems in (circle all items that apply):

- a. Head b. Neck d. Shoulder e. Back f. Visual g.
No Problem h. Stopping i. Other: (Explain)
-

18. When encountering computer problems, I feel ... (circle all items that apply):

- a. Frustration b. Impatience d. Irritation e.
Tension f. Fatigue g. Challenge h. Opportunity to
know more g. Other: (Explain)
-

When encountering problems on a computer application, I ...

- a. call for help immediately;
b. try to figure them out first, then call for help;
c. figure them out by myself for as long as it takes;
d. hardly encounter any problems.

What is the most valuable experience you have had so far in your Teacher Education Program or at NCSU?

21. Approximately how often did you use computers prior to this class?

a. Daily and number of hours daily: _____

c. Weekly and number of hours weekly: _____

22. Do you use computers more in homework or in leisure?

a. Homework b. Leisure.

23. Do you like to write your homework using a word processor?

a. No b. Yes

Please explain why:

In general, are you interested in computer technology?

a. No b. Yes

25. Have you used the self-serving automated checkout machine for books in the 1st floor of D.H. Hill Library at NCSU?

a. No b. Yes

If your answer is no, please tell us why?

Appendix G

Demographic Profile - Posttest for Control Group

Please circle, check mark () the appropriate response, or fill in the blank for each of the following questions. Thank you.

Last 4-digits of SSN: _____

Please mark the ones that apply to your experience: (Select items that apply)

_____ At least one of the courses I take this semester **REQUIRES** the use of computers

_____ All of the coursework require the use of computers this semester

_____ I still use computer to type my papers, even though it is not required by my instructors

_____ I tend **NOT** to use a computer when it is not required by instructor

Regardless the questions on social issues, in what ways the selected social issues have enhanced or changed your classroom visit(s) and/or your view(s) as a teacher-to-be?

Any suggestions or comments on social issue assignments?

How do you normally conduct your visitations before paper submission? (Select one only)

_____ I simply memorize everything happens in the classroom and do NOT take notes

_____ I take notes in class whenever I can

_____ I take notes after class when my memory is still fresh

_____ I write my visitation and/or reflection directly on papers to turn in

Please list two aspects that were the most valuable experience you have had in ECI205?

Should technology (e.g. using the Internet technology to submit assignments, read course pack, conduct online discussion, use E-mail and Listserv) be integrated into the eci205 in the future?

If NOT, please tell us your reasons:

If YES, please tell us your reasons:

What kind of integration in technology you would like to see in a course like ECI205? (Select items that apply)

_____ The Internet

_____ Online submission for assignments

_____ Listserv

_____ E-mail

Online discussion

Other,

In your view, what type of cooperating teacher's final assessment in ECI205 should we conduct?

Paper by mail

E-mail via Internet

Additional comments and/or suggestions:

Appendix H

Demographic Profile - Posttest for Experimental Group

Please circle, check mark () the appropriate response, or fill in the blank for each of the following questions. Thank you.

Last 4-digits of SSN: _____.

Please mark the ones that apply to your experience: (Select items that apply)

_____ At least one of the courses I take this semester **REQUIRES** the use of computers

_____ All of the coursework require the use of computers this semester

_____ I use a computer to type my papers, even though it is not required by my instructors

_____ I tend **NOT** to use a computer when it is not required by instructors

Which type of discussion do you prefer the most through your experience in

ECI205? (Select one only)

_____ Classroom Discussion

_____ Online Discussion

_____ Integrate both

Which type of discussion would you like to see more in any classrooms?

_____ Classroom Discussion

_____ Online Discussion

_____ Integrate both

What are the major differences in your view between the classroom discussion and the online discussion?

Based on your experience, which type of discourse would promote more reflective thinking, learning new ideas, new knowledge, beliefs, values, developing attitudes, or emotional traits?

_____ Classroom Discussion

_____ Online Discussion

After experiencing both discussion formats in Listserv and NetForum, which one is better in your view?

_____ Listserv (massive mailing to a group of people who subscribe to the E-mail listing). i.e. eci205@listserv.ncsu.edu

_____ NetForum (Use the Internet to conduct discussion under an assigned URL)

i.e. <http://courses.forum.ncsu.edu/cgi-bin/netforum/eci205/a/1>

Regardless the questions on social issues, in what ways the selected social issues have enhanced or changed your classroom visit(s) and/or your view(s) as a teacher-to-be?

Any suggestions or comments about social issue assignments?

How do you conduct your visitations before online submission?

(Select one only)

_____ I simply memorize everything happens in the classroom and do NOT take notes

_____ I take notes in class whenever I can

_____ I take notes after class when my memory is still fresh

How do you respond to the submission of visitations? (Select one only)

_____ type the response directly on the webpage, then submit.

_____ type the response directly on the webpage, and print it out first, then submit.

_____ type the response on a word processor first, copy and paste the visitation to web page, then submit.

_____ write the response down on paper first, type the response on the webpage, then submit

_____ Other,

Does technology assist/help you in reflecting your visits and thoughts?

_____ Yes, How?

_____ No, Why not?

5. Should technology be integrated into the eci205 in the future?

If NOT, please tell us your reasons:

If YES, based on your experience this semester, which area(s) you think is/are very valuable learning experience(s)? (Select items that apply)

- Internet
- Online submission for assignments
- E-mail
- Online discussion
- Listserv
- Other,

Please list two aspects that were the most valuable experience you have had in ECI205?

In your view, the ECI205 experience in technology is beneficial to you.

Yes,

____ No,

In your view, what type of cooperating teacher's evaluation should we conduct?

____ Paper by mail

____ E-mail via Internet

9. Additional comments and/or suggestions:

Appendix I**Computing Concerns Questionnaire by Dr. J. B. Martin****Instructions:**

The purpose of this questionnaire is to determine what people are concerned about when they think about technology. The items in the questionnaire were developed from statements of concern about technology made by people with varying amounts of technological experience. Some of the questions will closely reflect your own thoughts about technology. Others may be irrelevant to you at this time. For the completely irrelevant items, please circle in the "0" column on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale.

0=Irrelevant

1=Not True of me now

2,3,4=Somewhat true of me now

5,6,7=Very true of me now

1. I am concerned about the quality and accuracy of the computing tasks that I complete.
0...1...2...3...4...5...6...7
2. I would like to revise my current methods of providing information and/or instruction about the use of computers.
0...1...2...3...4...5...6...7
3. I feel apprehensive when introduced to a new program, computer application, or equipment.
0...1...2...3...4...5...6...7
4. I think the world is too saturated with computers; people have become numbers rather than individuals.
0...1...2...3...4...5...6...7
5. I am concerned about the effect I have on others in their use of computers. 0...1...2...3...4...5...6...7
6. I would like to know more about how a computer operates.
0...1...2...3...4...5...6...7
7. I would like to have greater interaction with other users of computers to work on common problems.
0...1...2...3...4...5...6...7

8. I have a fear of pressing the wrong key and messing up what I am working on.
0....1....2....3....4....5....6....7
9. My goal is to provide assistance with computer related work that is beneficial to the recipient.
0....1....2....3....4....5....6....7
10. I would like to know more about the many users and applications of computers.
0....1....2....3....4....5....6....7
11. It is very rewarding to me when my work is successful.
0....1....2....3....4....5....6....7
12. The reliable operation of printers and other devices is of real concern to me.
0....1....2....3....4....5....6....7
13. I am concerned about my ability to do the computing tasks required of me.
0....1....2....3....4....5....6....7
14. I am concerned about the excessive dependence on computers and reemphasis on human skills.
0....1....2....3....4....5....6....7
15. It is important to me that my computer work is efficient.
0....1....2....3....4....5....6....7
16. I am concerned about problems having to do with disks or other file storage equipment.
0....1....2....3....4....5....6....7
17. I want to revise my present methods of providing information about computing in order to include more practical examples.
0....1....2....3....4....5....6....7
18. I would like to excite others about their involvement with computers. 0....1....2....3....4....5....6....7
19. I would like to work with others in the accomplishment of computer task. 0....1....2....3....4....5....6....7
20. I am interested in knowing how computers can process data so rapidly and efficiently.
0....1....2....3....4....5....6....7

21. I am concerned that machines have become more important than people. 0....1....2....3....4....5....6....7
22. The tasks of saving and retrieving my computer work are of real concern to me. 0....1....2....3....4....5....6....7
23. Learning how to use computers provides me with many benefits. 0....1....2....3....4....5....6....7
24. I would like to take part in more frequent discussions about computing issues. 0....1....2....3....4....5....6....7
25. I am concerned about incorporating changes that I can make to increase consideration of people in their use of computers. 0....1....2....3....4....5....6....7
26. I am concerned about what to do next when using a computer. 0....1....2....3....4....5....6....7
27. I would like to coordinate more closely with others whose computer work will be associated with mine. 0....1....2....3....4....5....6....7
28. I see a potential for conflict between the need for computing resources and the availability of funds. 0....1....2....3....4....5....6....7
29. I would like to initiate changes that would make the use of computers more rewarding. 0....1....2....3....4....5....6....7
30. I am concerned about finding out what tasks I can use a computer to do. 0....1....2....3....4....5....6....7
31. I am concerned about how well the computer application I have developed performs when it is used. 0....1....2....3....4....5....6....7
32. I think that playing computer games may limit a child's creativity and imagination. 0....1....2....3....4....5....6....7

Appendix J

Instructions for Using NetForum

<http://courses.forum.ncsu.edu/cgi-bin/netforum/eci999/a/1>

To start the NetForum for a class,
Launch an Internet Browser, such as Netscape or Microsoft
Explorer

Enter the assigned URL

Note: it is a numeric number "1" at the end, not the lower
case for letter "L"

The screenshot shows a Netscape browser window with the address bar containing the URL <http://courses.forum.ncsu.edu/cgi-bin/netforum/eci205/a/1>. The page title is "Forum: Introduction to teaching humanities and social sciences". The owner is listed as Karyn Gloden with contact email kagloden@unity.ncsu.edu. A list of discussion topics is shown, each with a bullet point and details on message counts and reply dates. The topics include "How to create a new topic", "Campus Safety Situation", "A Gender Situation", "A Hate Crime Situation", "Technology! uhhhh!?", "A Situation in Crime", "A Classroom situation in Race", "About Environment", and "Thinking about a classroom...".

Name of the Forum

Owner & Contact -
It can be used to
send E-mail to
instructor who is
also the owner of the
forum

Topics for
Discussion
Some statistical
information about
the topic is listed -
Number of
messages
entered.
Number of
replies.
Date/Time when
last message
was posted

Each topic is listed with a bullet point.
Every topic is a hyper link, so that clicking the link
can access detail information about a topic.

New -
Use it to
respond to the
topic
Responses

The screenshot shows a detailed view of the "Campus Safety Situation" topic. It includes the topic description, the user who posted it (Karyn Gloden), and a list of replies from other users like Barbara Pholey, Julie Lane Katz, and Karyn Gloden, along with their respective dates and times.

All Replies - 
 Before reply, click "All Replies" button to review messages from others.

Message Area - 
 Person who posted reply.
 Date posted.
 Message.

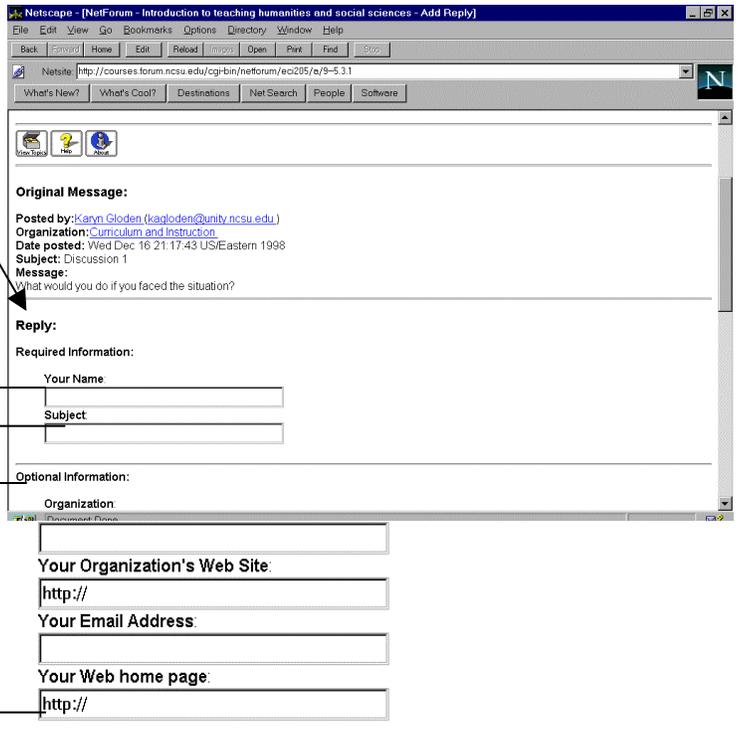
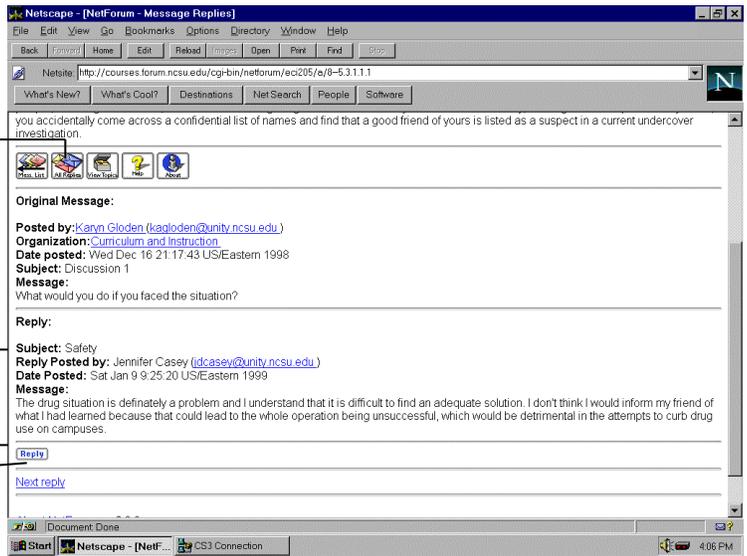
Reply - 
 Once an existing message is selected, the "Reply" button is made available.
 Some information is required before reply:
 Name of the person who posts the message.
 Subject
 Brief description about the content of the message.

Optional Information -
 Organization
 Organization Web Site
 Your E-mail Address
 Your Web home page

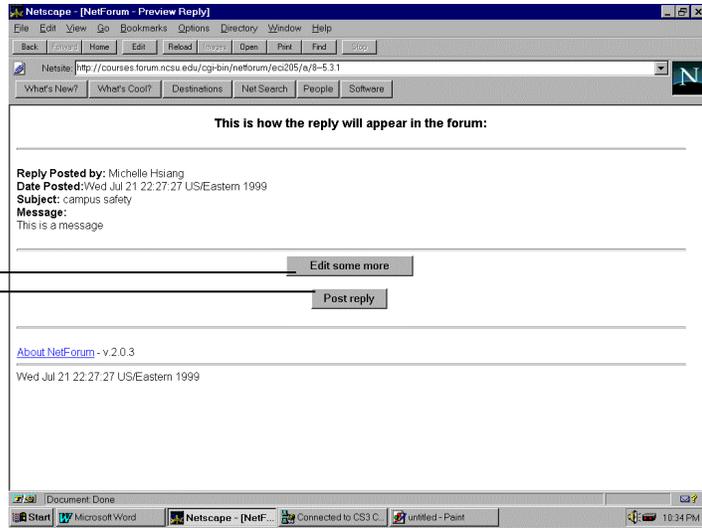
Message - 
 This is the area where you express your opinion about a topic.

Preview Reply - 
 After keying all the information, click the button to review the typed information.

Reset message - 
 This will clear the typed information, so that you can start over.



The typed information can be edited at this point by clicking on "Edit Some More" button, or if review is not necessary or finished, click "Post Reply" button to publish the reply for others to review.



Appendix K**ECI 205 Guided Reflection on Social Issues****About Safety**

Name :

Since 1992, all colleges have been required by federal law to compile annual statistics about crime on their campuses and to provide this information to their students and staff members. The Chronicle of Higher Education reported on May 8th, 1998 that "alcohol arrests on campuses jumped 10% in 1996, and drug arrests increased by 5%." Based on a prior report that the Chronicle published in 1997, the data in the following table were excerpted from colleges or universities with student enrollment over 5,000 in the state of North Carolina.

Universities	Population	Aggravated Assault	Burglary	Liquor-Law Violation	Drug Violation
NC Central	5,555	16	29	0	4
NC A & T	7,947	12	93	2	12
Duke	11,512	15	65	2	3
Appalachian State	12,457	8	4	0	2
East Carolina	17,923	18	14	2	36
UNC-CH	24,439	58	53	109	50
NC State	28,250	10	70	130	86

<http://www.soconline.org/STATS/index.html>

1. What do you think about the data?
2. How did you come to hold that point of view?
3. Can you ever know for sure that your opinion is correct? How or Why not?

A Campus Situation

Some colleges use undercover stings to stop drug sales. A university made headlines last year, when police arrested 42 people, including 31 students, in an undercover drug sting that lasted almost a year and a half. Recently, working in the campus security office, you accidentally come across a confidential list of names and find that a good friend of yours is listed as a suspect in a current undercover investigation.

4. What would you do if you faced the situation?
5. What reasons would you have for the action you took?

6. How would you defend an opposite point of view?

About Gender

Name:

There is evidence that some students receive more opportunities than others when they participate in classroom activities. Teachers are less likely to stay with low achievers when the students make no response. Perceived low achievers receive less praise, and are more likely to be criticized for wrong answers. Students sometimes receive notably different opportunities in classrooms based on their gender and race. Researchers have shown that girls receive more contact from teachers in reading and boys receive more reinforcement in physical sciences (Allington, 1991; Jones & Jones, 1990).

1. What do you think about the statement?

2. How did you come to hold that point of view?

A Classroom Situation

You and two other students are observing a 10th grade English teacher as part of a college project. However, you are the only one who records what you saw during the observation. After the lesson, you review your notes and notice that four female students perceived as high achievers received all the attention and praise from the teacher. Your friends strongly disagree with your findings, stating that gender doesn't matter in teaching.

3. How would you respond to the situation?

4. What reasons would you have for the action you took?

About Hate Crime

Name:

According to National School Boards Association (1993), 28% of school violence is of a racial or ethnic nature. Such actions are sometimes referred to as "hate crime". Yet most classrooms are diverse with students from various racial, religious, cultural and ethnic backgrounds. The Federal Bureau of Investigation (1995) reported that 41% of hate crimes are based on race and 46% are based on sexual orientation. Law enforcement agencies reported that among the 8,433 known offenders associated with hate crime incidents, 59 percent were white, and 27 percent were black. The remaining offenders were of other multi-racial origins.

1. What do you think about the statement?

2. How did you come to hold that point of view?

3. Can you ever know for sure that your opinion is correct? How or Why not?

A Classroom Situation

As a student teacher, one of your migrant students from Mexico, Martin, has been absent frequently. Your record of students shows no trace of problems about Martin. After many phone calls and house visits with the parents of Martin; you discover that a few of your students like to pick on and intimidate Martin. They have Martin get cigarettes, run errands and get other items of value for them. Martin is afraid of going to school to do things against his will. You want to improve Martin's situation. However, you promised Martin and his parents the confidentiality in this matter.

4. How would you respond to the situation?

5. What reasons would you have for the action you took?

About Technology

Name:

The popularity of technology has led to increases in computer-related crime including theft of money, theft of data, software piracy and theft through unauthorized access as hackers. According to Woman's World, 1998, college students and homemakers have a greater chance of becoming an Internet addicts. There are 6.2 million people who spend 38 hours a week of their private time on-line. One university found that a high number of their brightest freshmen were failing to maintain good grades because half of them used the Internet excessively. In the mean time, there are 15.9 million people who use the Internet at work today and the number is expected to rise to 81.2 million by the year of 2000.

1. What do you think about the statement?

2. How did you come to hold that point of view?

3. Can you ever know for sure that your opinion is correct? How or Why not?

A Classroom Situation

One of your professors has just completed a lecture on the problems of computer crime, including software piracy. When you return to your residence hall, your roommate is copying software that is not licensed to him. The university expressly prohibits software piracy in its student code of conduct. You are troubled by what you see. However, from time to time, your roommate has provided help when your computer has malfunctioned and you really count on his assistance.

4. What would you do if you faced this situation?

5. What reasons would you have for the action you take?

6. How would you defend an opposite point of view?

About Crime

Name:

Few school districts report campus crime. Rarely are police called, even when serious crimes occur. Some schools underreport crime. Other schools lower the level of its reported seriousness. Studies of Violent Schools-Safe Schools showed that very few students and faculty members officially report crimes through the criminal justice system. Many do not even report to the school administrators. It is very hard to know the real safety of any campus.

1. What do you think about the statement?

2. How did you come to hold that point of view?

3. Can you ever know for sure that your opinion is correct? How or Why not?

A College Situation

Students of a university were asking university officials to expel student "A". who admitted he did not stop his friend from killing a 9-year-old girl last year. The school has refused to dismiss student A because he did not commit a crime under the state law. Some states have no Good Samaritan law, which would hold bystanders liable if they fail to stop a crime or if they do not turn in offenders. Students have mixed reactions on how much moral authority a university has to dismiss a student.

4. What would you do if you faced the same situation as Student A?

5. Should a university have the moral authority to dismiss students under the same kind of circumstance? Why? Why not?

About Race

Name:

The rapidly changing demographic information in the U.S. society can be represented by the following statistics. Between 1980 and 1992, the total U.S. population increased by 12.5 percent, but the total growth of Whites of European heritage increased by only 5.5 percent, while Latinos increased by over 65 percent and Asian and Pacific Islanders increased by an astounding 123.5 percent. Population projections for the United States predict that by the year 2010, the White population will increase by 9 percent, the Black population by 29 percent, and the Latino population by nearly 80 percent. Teachers who are classified as "minority" are estimated to fall under 5 percent of the teaching population by the end of the century (Nieto, 1996).

1. What do you think about the statement?

2. How did you come to hold that point of view?

3. Can you ever know for sure that your opinion is correct? How or Why not?

A Classroom Situation

You have friends from different ethnic backgrounds in the same classroom with you in one of your college courses. One student made a comment that minorities receive special advantages in college admissions and scholarships and another student friend said that several states are eliminating affirmative action policies. Everybody is actively involved in the discussion and various views have been raised. You are the next person to state your view.

4. How would you respond to the situation?

5. What reasons would you have for the actions you took?

About Environment

Name:

Renowned scientists have used mathematical models to assess the capacity of the earth to support the global population. Estimates range from 4 to 16 billion. The true number will depend on the quality of life that future generations are willing to accept. By 1997, the global population had reached 5.8 billion. If everyone in the world agreed to become a vegetarian today, leaving nothing for livestock, the present available land would support 10 billion people.

1. What do you think about the statement?
2. How did you come to hold that point of view?
3. Can you ever know for sure that your opinion is correct? How or Why not?

A Classroom Situation

You are developing a lesson on population density and our future, which you hope to use in student teaching. However, your instructor points out that some students may be offended, thinking the lesson promotes birth control as an acceptable solution to our population density. As well, a good friend of yours thinks the subject is too controversial.

4. What would you do if you faced the situation?
5. What reasons would you have for the action you took?

6. What reasons would you have for the action you took?

Reference

Evertson, C. & Harris, A. (1992). What We Know about Managing Classrooms. Educational Leadership. v.49. n.7. pp.74-78.

Jones V.F. & Jones, L.S. (1990). Responsible Classroom Discipline. Boston: Allyn & Bacon.

McGill-Franzen, A. & Allington, R. (1991). The Gridlock of Low Reading Achievement: Perspectives on Practice and Policy. Remedial and Special Education. v.12. n.3. pp.20-30

National School Boards Association (1993). Violence in the Schools: How America's School Boards Are Safeguarding Our Children.

Neito, S. (1996). Affirming Diversity: The Sociopolitical Context of Multicultural Education. Longman Publishers USA.

Appendix L

Sample Observation Instruments

Reinforcement

Teachers play a crucial role in defining learning conditions for all of the children. Effective teachers attempt to provide modifications to lessons for children with learning disabilities, varieties of ways to interact with the curriculum for students who have different learning styles, and appropriate positive reinforcement for all students. Behavior that is positively reinforced increases the likelihood that the behavior will reoccur. If a student behaves in a desirable way, immediate positive reinforcement increases the probability of his/her continuing to do so. The difficulty is that the strength and quality of any reinforcer varies with the student to whom it is applied. No teacher can know exactly what will positively reinforce each of the thirty or so students in each of his/her classes. In addition, some students react more positively to certain types of positive reinforcements, such as private appreciation of the work, while others might prefer public acclaim for their work. Therefore, teachers must pay close attention to the types of reinforcers that seem to work with individual students.

Reinforcement can also be an effective means of increasing student participation in classroom activities. Participation, in turn, usually increases learning. When students take part in classroom activities, they are more likely to become involved with the material than when they do not take part. They pay closer attention. An experiment conducted at Stanford University has shown that teachers who often reinforce their students than teacher who reinforce infrequently. If teachers who use few reinforcement techniques, they should significantly increase their students' participation.

Four kinds of positive reinforcement are available to the teacher:

Positive verbal reinforcement occurs when the teacher immediately follows desired student response with such comments as "Good," "Fine," "Excellent," "Correct," or other statements indicating satisfaction with the response.

Positive nonverbal reinforcement occurs when the teacher, in responding to a desired student response, nods his head affirmatively, smiles, moves toward the student, or keeps his eyes on the student while paying close attention to the

student's words. The teacher may write the student's response on the chalkboard or otherwise nonverbally indicate pleasure at the student's response.

Positively qualified reinforcement occurs when the teacher differentially reinforces, whether verbally or nonverbally, the acceptable parts of a response.

Delayed reinforcement occurs when the teacher emphasizes positive aspects of students' responses by redirecting class attention to earlier contributions by a student.

Teachers must pay special attention to the issue of diversity when planning for positive reinforcement. Students should think that the teacher is treating each in fair and equitable ways. By focusing on how the teacher reinforces answers from students from different genders, cultures, and races, more equitable feedback may be given.

Asking Questions

There is substantial evidence to support the importance of questioning as an instructional strategy. This should not come as a shock to anyone. What is surprising is that research is revealing an increasingly complex picture of what effective questioning can include. Walburg (1984) found that higher-order questioning which encourages analysis rather than simple rote answers does promote more student thinking and increases in achievement scores.

How does this research translate into the classroom? One can refer to simple recall questions as 'closed' questions. They usually have a factual answer that is concrete and it can be stated in a few words. The following examples elaborate; "What is the capitol of Iowa?" "How many decimeters in a meter?" Open-ended questions, on the other hand, require the student to understand concepts and/or theories. Answers will require an explanation by the student. Open-ended questions also may not have one single answer. For example: "How were aqueducts constructed during the Roman civilization?" "What does it mean to say, 'history doesn't repeat itself, people do'?"

It is important to note that both styles of questions have a place in the schools. What should be avoided is a heavy preponderance of only closed questioning. Bloom's levels of thinking in the cognitive domain and levels of thinking the affective domain are presented as guides for your understanding of the types of questions that are important to include in class discussions and on evaluations. These levels are also helpful in writing learning objectives and student outcomes. Evaluation instruments should also include investigations of each level of the taxonomy.

The amount of time that a teacher allows a student to give an answer is also important in the effectiveness of questioning. "Wait time", or the amount of time a teacher waits before calling on a student, or the amount of time the teacher waits to acknowledge an answer is also an important factor in producing thoughtfulness in students.

Reference: Walberg, H. (1984). Improving the productivity of America's Schools. Educational Leadership, 41, 19-27.

Curriculum Selection and Lesson Preparation

Curriculum for schools is determined by many factors. Every teacher must determine what will be taught in his/her classroom. As part of your practicum experience, you should begin to understand how to define or describe curriculum, why curricula is written, what forces influence the development of curriculum, what is the difference between curriculum and instruction, and the teacher's role in the curriculum-decision process. You may ask your cooperating teacher to see a copy of the curriculum guide and elicit a discussion about the merits of having a written curriculum. Curricula, whether in the form of guides, textbooks, or manuals, include many different types of knowledge. This knowledge may be represented as facts, concepts, skills, attitudes, or applications. The lessons that a teacher develops should relate to overarching curriculum decisions. During this practicum experience, understanding that the lesson planning relates to a larger scheme and is not episodic is important. It may be easy to see how curriculum selection is controversial, but lesson preparation is also cloaked in debate.

The debate began with an insightful article by M. Hunter and D. Russell called "Planning for Effective Instruction: Lesson Design (1976)." In this article, the authors articulated elements to consider when preparing a lesson. The elements included: anticipatory set (providing initial motivation), objectives (what the students will learn), input (presentation of information), modeling (teaching by demonstration or example), check for understanding, guided practice (checking student work to appraise whether the whole concept is understood), independent practice (application of the already learned concept-homework is often a means to this end), and closure (summarizing the lesson).

Although it is difficult to trace where things went astray, it soon became clear that these elements described by Hunter and Russell became an all-purpose cookbook approach to effective teaching. Further, as states adopted performance appraisal systems of teacher evaluation, the Hunter/Russell lesson paradigm became a regimented "I'd rather die than leave out a step" format. To further complicate matters, principals and novice teacher evaluators who were responsible for evaluating teachers would fault teachers if one step was missing! It was at this juncture that rumblings began to be heard by master teachers.

Their complaint was that good teaching does not necessarily include all of the elements, and when applicable, the components are not always in this order. These dissidents were right.

There were both supporters of a rigid sequence and of course the master teachers and educational elders who were adamant in their

contention that the elements described by Hunter and Russell should illuminate instruction rather than become a fail-proof prescription for teaching. Many educators affirmed that the elements do not represent a rigid sequence and that ultimately, teacher decisions about instruction must be flexible, recognized, and supported. Further they clearly identified how the elements could be adverse to indirect or discovery styles of instruction.

You are encouraged to realize that visible and invisible structures underlie quality instruction. Your mini-lessons should reflect purposeful, intentional choices about how you want the students to work with the concepts, clear understanding of the outcomes and how the outcomes will be appraised.

References: Russell, D., and Hunter, M. "Planning for Effective Instruction: Lesson Design.: Los Angeles, Calif.: Seeds Elementary School, 1976.

Definition of Terms

The purpose of this session is to provide definition or background information for terms used in this study.

Asynchronous communication: it is a static and non-interactive process. i.e. answering machine, NetForum.

CD-ROM: it stands for Compact Disk Read-Only Memory. It provides a storage for data up to 650 MB.

Clinical Experience: Clinical experiences refer to any experience that takes place in a "clinical" setting that is educational, i.e. school. The term clinical also describes a process of professional thought, reflection, and action that has unique problem-solving and problem finding components.

Listserv: It is a program that maintains lists of electronic mailing addresses. All mails are sent to members who subscribe to the list only. Mails can be archived by the list owners. This access can only be provided to people with E-mail addresses.

NetForum: NetForum is a Web based discussion forum system developed by the University of Wisconsin Biomedical Computing Group. It is a website that allow users add or reply messages dynamically for conducting group dialogues. People who have or can access the Internet service will be able to use it.

Perl Script: it is an interpreted programming language. It makes very useful for manipulating textual data. Any text editor can be used to prepare a text file containing the program source. Source file should be compiled and stored in the binary directory of the HTTP server.

Synchronous communication: it is a dynamic and interactive process. i.e. phone calls & real-time video conferencing.

URL: it stands for Uniform Resource Locator. Keying a proper URL can access any website in the World Wide Web.