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An Assessment of Past NASA Program Sponsored Pre-service and In-service Teachers to Determine the Impact of Their Training and Preparation for the Computer Technology Standards of Learning for Virginia Public School Educators

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AN ASSESSMENT OF PAST NASA PROGRAM SPONSORED PRE-SERVICE AND IN-SERVICE TEACHERS TO DETERMINE THE IMPACT OF THEIR TRAINING AND PREPARATION FOR THE COMPUTER TECHNOLOGY STANDARDS OF LEARNING FOR VIRGINIA PUBLIC SCHOOL EDUCATORS

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CHAPTER I

INTRODUCTION

The focus of this study is on pre-service and in-service teachers that have participated in NASA Langley Research Center's instructional computer technology education programs. Program participants from the Pre-Service Teacher Education Conference and the In-Service Summer Teacher Enhancement Institute will provide the data for this study. The study will determine if the past program participants have developed the computer technology proficiencies required by the State of Virginia and to what extent they are using these proficiencies. The study will assess the computer proficiency levels of surveyed teachers. Additionally, it will determine if their proficiency meets or exceeds the State of Virginia's Standard of Learning for teachers.

Many groups have proposed that national education competence can best be achieved through the school systems. This is where every student can gain access to the knowledge and skills required to be competitive in the 21st Century. However, every student does not have access to the same level of learning resources and environments. This is especially true for computer technology education programs. Vice President Gore's article for The Washington Post stated that, "We're forced to deal not only with information, but also with "exformation," data existing outside our conscious awareness which nevertheless keeps us slightly off balance because we know it exists, even if we don't know where or how to use it" (p.141). That notion, coupled with the implementation of new science, math and technology education reform initiatives, and with the rapid advance of technology, requires that training be provided to ensure that educators using computers to enhance instruction are competent.

The Advisory Board on Teacher Education and Licensure (ABTEL) in their 1995 Annual Report to the Board of Education reported serious inequalities existing in the ability of schools to provide instruction to enable students to use technology for effective problem solving and productivity. A lack of training for teachers was identified as one of the inequalities (p. 2). In this report, the International Society for Technology in Education noted, "If technology is to become an integrated component of the education process of our schools, it must first become an essential part of America's teacher preparation programs" (p. 3). Recently, in the Concluding Report of the Carnegie Commission on Science, Technology, and Government, the National Center for Improving Science Education issued a report that not only calls for educational technology, but also describes who should teach this technology and sets forth a number of vignettes that describe how technology can be taught in the classroom (p. 49). Educational technology as envisioned by these groups is not only training in the use of computers, but hands-on, problem solving based programs that enable students to gain experience working with a spectrum of technological devices and processes.

STATEMENT OF THE PROBLEM

On May 23, 1996, the State of Virginia's Board of Education adopted eight standards of computer technology proficiencies for middle school teachers (Appendix A). The primary purposes of this study are to access the impact of computer technology proficiency requirements for the following:

1. Fourth-year pre-service teachers at Historically Black Colleges and Universities (HBCU's) in the State of Virginia.

2. The in-service teachers that have attended NASA Langley Research Center's educational technology programs.

This study will determine if they have obtained and are using the eight standards of computer technology proficiency required by the State of Virginia.

RESEARCH GOALS

To assist in solving these problems, the following objectives have been established:

1. To measure how well prepared the pre-service teachers are to use and teach instructional computer technology.

2. To measure in-service teachers' computer technology skills.

3. Assess teachers' integration of computer technology into the core curriculum.

4. Conduct a diminutive program evaluation of NASA computer technology education programs.

BACKGROUND AND SIGNIFICANCE OF THE STUDY

Since the importance of educational technology is recognized by national agencies, education reformers must begin to examine ways to improve the technology delivery process for pre-service and in-service teachers. This calls for technology competence by our graduating students so that our nation can grow stronger each year. The success of tomorrow's graduates as citizens, workers, and consumers will depend upon their technological abilities. Any job paying a good wage, from farming to medicine, will require technological knowledge and skill. The nation's pre-service and in-service teachers are the key players for implementation of educational technology reform. The recent

implementation of the Computer/Technology Standards of Learning for Virginia Public Middle School Educators makes it extremely important to have an assessment tool to measure if these standards are being met. This study, to the researcher's knowledge, is the first to measure the degree of compliance with the Standards of Learning (SOL). Computer technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines. Mathematics, science, and other core education teachers must integrate computer technology learning into their classrooms in order for students to obtain the specific learning goals as cited in the SOL for Virginia Public Middle Schools (Appendix B).

Too few teachers are properly trained in computer technology; however, the State of Virginia SOL identified eight Computer/Technology Proficiency Standards required for teacher licensure. These standards will be used to measure some of the study objectives. It is equally, if not more, important for our in-service teachers to have and use computer technology instruction.

Computer technology in education is rapidly changing each day. New types of software, hardware, and computer capabilities are placed on the market daily. These new forms of computer technology will significantly enhance an in-service teacher's ability to prepare students for the future. In-service teachers that exhibit technophobia are putting our students in a serious non-competitive position for career opportunities in the future. The Middle School: A Look Ahead states, "Thousands upon thousands of teachers who currently teach in the nation's middle schools feel no special need to pursue graduate degrees or obtain additional computer skills. How can these teachers be equipped with the necessary

skills? Only through intensive, comprehensive, and meaningful systematic in-service activities will significant numbers of these educators be enabled to make real contributions to the improvement of instructional practices in middle schools" (p. 63). Virginia's computer technology Standards of Learning for teachers will not only require many of our in-service teachers to learn computer skills, they will have to be in a continuous computer technology training posture because of new technology developments.

LIMITATIONS

This study will be conducted utilizing questionnaires. The researcher will conduct a pre-survey test of the questionnaire to identify inadequacies. The pre-service teacher's limited years of experience is another limitation. It will also be difficult to check on the reliability of the responses. Therefore, replies may or may not be objective. Another limitation is not knowing exactly who completed the questionnaire. If someone other than the intended teacher completes the questionnaire, the data may or may not be of value. The study will be limited to:

1. Dr. Elaine P. Witty, Dean, School of Education at Norfolk State University provided the names of forty-one pre-service teachers from five Historically Black Colleges and Universities in the State of Virginia. Thirty pre-service teachers from these rosters were randomly selected to participate. (Appendix C)

2. Sixty in-service teachers that attended the NASA Teacher Enhancement Institute's educational technology program.

3. Targeted pre-service and in-service teachers may complete the questionnaire although they may no longer be employed in the teaching profession.

ASSUMPTIONS

This study will be conducted with the following assumptions:

1. As a result of the numerous informative workshops and presentations held during both the 1995 and 1996 NASA Pre-Service Education Conference, the attendees will seek other forms of information transfer to increase their computer technology knowledge and skills.

2. The enthusiasm displayed after each session of the NASA Teacher Enhancement Institute will result in more in-service teachers integrating computer technology training in their classroom.

3. By directly going to the pre-service and in-service teachers that are directly effected by the SOL, this study will provide NASA with data that will improve the value of pre-service and in-service teacher educational technology programs.

4. Due to the excellent rapport established between the Historically Black Colleges and Universities (HBCU's) in the State of Virginia and the Office of Education at NASA Langley Research Center, this researcher expects complete support from the HBCU's.

5. This questionnaire will serve as an effective program assessment instrument.

PROCEDURES FOR COLLECTING DATA

The current address of past participants in the Pre-Service Teacher Education Conference was obtained from Dr. Elaine P. Witty, Dean, School of Education, Norfolk State University. The address of the NASA Teacher Enhancement Institute participants was obtained from the NASA Langley Research Center's Office of Education database of participants. The questionnaire was mailed to the pre-service participants using the addresses provided by Norfolk State University. The in-service teachers that attended NASA Educational Technology programs were sent their questionnaire using the permanent address indicated on their application. All questionnaire packages included a cover letter, the questionnaire, and a postage-paid return envelope. Appendix D contains a copy of the questionnaire and Appendix E contains a copy of the cover letter.

DEFINITION OF TERMS

This section will assist the reader with the identification of possible unknown terms and enhance the understanding of the researcher's writing.

1. Core education course - Refer to Mathematics, Science, English, and History.

2. Educational computer technology - Refer to the State of Virginia's Standard of Learning Objectives.

3. Technophobia - Fear of using equipment due to little or no knowledge of operating procedures.

4. Pre-service teacher - Student enrolled as a senior in a Historically Black College or University in the State of Virginia that

is majoring in Education who may or may not have completed student teaching.

5. In-service teacher - A State of Virginia Certified Public Middle School Teacher with more than one-year of experience.

6. K-8 - Elementary and secondary schools.

7. NASA Langley's five-state service region - Kentucky, North Carolina, South Carolina, Virginia, and West Virginia.

OVERVIEW OF CHAPTER

Chapter I has discussed the computer technology education instructional responsibilities of teachers. It recognized that national education competence can best be achieved through the school systems and that educational computer technology training must be part of that process if students are to be successful in the future. Examined was the importance of instructional technology becoming an integral component of the educational process and our teacher preparation programs. The statement of the problem was presented along with the eight State of Virginia Computer Technology Standards of Learning proficiencies that teachers are required to master before being licensed. Presented were the objectives and the goals that will be used to answer the research problem. The Background and Significant section identified this study as possibly the first to examine compliance with the educational computer technology proficiency for the State of Virginia's SOL for public middle school educators. In this chapter, the study's limitations and assumptions were documented. Additionally, the procedures for collecting data were outlined.

The following chapters will consist of a Review of Literature that will provide supporting and background data. It will briefly identify sources of information and tell how the sources were categorized. The Methods of Procedures section will begin with a short overview statement that describes the purpose and method of the study. It will provide an overview of how the information was obtained. Included will be a section devoted to techniques of analysis, synthesis and a tentative outline of contents. The Findings section will follow these. Finally, Chapter V will contain the Summary, Conclusions, and Recommendations.

CHAPTER II

REVIEW OF LITERATURE

In this chapter the researcher will briefly examine the historical and theoretical background to education reform in our nation and discuss the importance of computer education technology training. The appropriate use of the Internet as a resource in our middle schools will be discussed. This chapter will review pre-service and in-service teacher training, proficiency in technology standards, distance learning, and the reconstitution of control mechanisms in teacher education.

Education Reform

Our education system, whether real or perceived, has experienced many reform movements. In Changing American Education, a plethora of commission reports initiated in the late 1970s and made public in the early 1980s (the best known of which is the National Commission of Excellence in Education's 1983 Report, A Nation at Risk) looked to education as both the cause and the cure of American economic ills. The wave metaphor may have originated in observations by the United States Department of Education that the commission reports had initiated a tidal wave of school reforms, which promises to renew American education. The first-wave reform did not question the basic structure of education nor the system of which it is a part. Instead, the players (limited here to teachers and students) and the way they played the game of education were considered to be at fault. "More is better twice" was the battle cry of first-wave reform: Legislators, on the advice of business leaders and administrators, mandated and legislated longer hours, more work, and stiffer requirements (p. 8). The key variable in the second-wave reform was thought to be more structure in education. The second-wave grew out of the realization that something was wrong with the first type of

initiative for change: nothing was really changing. Scholars identified problems in the culture of the school and the process of change, and the rhetoric changed from talk of reform to talk of restructuring (p. 9).

In the State of Virginia, reforms in educational technology began in September 1995. The Annual Report to the Board of Education from the State of Virginia Advisory Board on Teacher Education and Licensure requested the Advisory Board on Teacher Education and Licensure (ABTEL) to address the issue of computer technology proficiencies as a requirement for licensure of instructional personnel. These proficiencies should be based on the revised Standards of Learning which require technology standards that are incorporated in each core discipline to be measured by students by the end of the fifth-and eight-grade levels as well as local school division standards and national efforts (p. 1).

Importance of Educational Computer Technology

The importance of educational technology training has never before in history received so much attention. The State of Virginia's Excellence in Education Plan for Virginia's Future states, "Educational technology, still a novelty, must take a central place in public school education. This will not happen statewide without state leadership and commitment. For Virginia's educational system to be among the nation's best, it must operate on the cutting edge. Today that cutting edge is educational technology. Technology can be used to provide programs for schools with vast differences in student achievement and in educational opportunities. Electronic classrooms, computer instruction, satellite communications, and videodisks are not experimental ideas (p. 17). The Virginia Board of Education had expressed concerns about computer technology proficiency of pre-service and in-service teachers late in 1995.

In March 1996, the Board of Education realized that there was a problem and formally requested the ABTEL to "address the issue of technology proficiencies as a requirement for licensure of instructional personnel". A task force was organized to develop a proposal for technology standards and training of instructional personnel. The task force included representatives from ABTEL, The Association of Teacher Educators in Virginia, Virginia Association of Colleges for Teachers Education, Virginia Educational Technology Advisory Committee, and Virginia Department of Education staff members.

They concluded in the 1996 Annual Report to the Board of Education that inequities exist in the ability of schools to provide instruction to enable students to use technology for effective problem solving and productivity. These inequities can be traced to two main causes:

1. The lack of access to adequate equipment
2. The lack of training for pre-service teachers (p. 2)

To over come these inequities, the Board of Education is recommending the Schools of Education develop implementation plans for pre-service training of instructional personnel (Advisory Board on Teacher Education and Licensure, p. 2). Classroom modeling is a concept that helps overcome these inequities. It can bring pre-service teachers up-to-speed with technology, help them overcome technology anxieties, and guide them as they attempt to adopt technologies in their classroom. Those entering the profession must have the most up-to-date technology skills. Training in instructional technology usage should be a part of the preparation of every entry-level teacher. It is imperative that pre-service teachers and in-service teachers have the opportunity to acquire educational computer technology training prior to classroom integration.

Internet

The Internet, sometimes referred to as the "Super Highway", has a simply inexhaustible supply of information that can be extremely valuable to teachers and the education of students. Maddux (1994) points out that "*far too many educators seemed concerned only with making the Internet accessible to students, and far too few seemed concerned that teachers and students can and will use it in educationally appropriate ways*" (Italics in original, p. 38). He defines educational access as "the practical availability to something educationally beneficial" (p. 38) and not just the fact that a tool is available. Maddux points out the schools will need both technical support and curricula support to use the technology effectively (p. 38). Educators must acknowledge that technology can be a means to new educational ends, but technology itself should not be the issue. Instead, the focus should be on new definitions of what it means to produce knowledge. Maddux implies that the Internet is just a medium, not an end in itself, and concludes his pessimistic vision by declaring that "If these and other problems can be successfully addressed, the internet may yet fulfill its considerable potential and become one of the most useful teaching and learning tool" (p. 42).

Rowe (1994) concurs with Maddux and urges educators to see that although technology can be a means to new educational ends, technology itself should not be the issue. Instead, the focus should be on the definitions of what it means to produce knowledge. Historical records indicate that it was not the scribes who lost to history because of the printing press, it was the king's (p. 58)! While there was no doubt fewer scribes, the most significant changes came over ideas of authority, divinity, individualism, and the availability, control, and use of information. Up to now, information has been under the control of the experts who produced it. Society is moving into the post print world where non-linear

thinking will mesh with right-brain functions, and everyone will become a producer of knowledge. The Gutenberg model of education is confining. It limits the learner to a primarily passive role. Instead, the bandwidth of information technologies will allow learners to become authors of information, taking on an active role in the learning process. "Many will resist the media democracy for it will be a true test of our sense of individual worth, our regard for others, our respect for those who share the resources of the community with us, and our place in the global village itself. Citizenship in this media democracy will require a new consciousness that is sensitive to the changes sweeping over us...if we are open to redefining the ways we learn and open to the powerful new resources we have for the enterprise of learning, we may be wise enough to adopt the common sense of the children around us" (p. 58).

Rile and Leaven (1990) studied early electronic communities and found that computer access had to be very convenient and that users had to have an intrinsic interest in the value of the communications for a community to develop. They found that "computer telecommunications can facilitate group interaction in ways that are qualitatively different than that provided by other media" (p. 147). The high quality of these on-line open forum discussions is valuable and a resource that pre-service and in-service teachers must be exposed to and actively participate in.

Hunter (1992) estimates what must happen prior to Internet acceptance in schools. She cites the need for on-going research, teacher development, as well as faculty and pre-service teachers to know how to build and manage the new on-line communications. The computer is becoming an instrument of knowledge, communication, and sharing in all learning communities; it is a tool to break the paradigm of schools today. One of the ultimate ideals is that, "With the use of technology, there's an opportunity to radically change the nature of schooling" (Bruder, 1991).

Pre-Service and In-Service Teacher Training

Maddux, Johnson, and Harlow (1993) suggest that educators and professional publications discuss and demonstrate materials designed not to show the state of the art, but to show what can be done using technology that is actually found in most public schools. They also suggest that there is very little agreement about why technology should be integrated into schooling, how it should be integrated, and then what should be taught to pre-service teachers (p. 227). While overseeing a state-by-state assessment of educational telecommunications as part of the Clinton Administration's National Information Infrastructure Initiative, Withrow stated in the Concluding Report of the Carnegie Commission on Science, Technology, and Government, "The reality is that probably no one really understands the training needs. The vast resources of the Internet are nearly impossible for pre-service and in-service teachers to use effectively, largely because they have not received training and a handbook to help users find the information they need" (p. 49). As reported in the American School Board Journal, an excellent educational computer technology resource for teachers is "Pathway", an interactive World Wide Web site designed and managed by the North Central Regional Education Laboratory, a non-profit educational research organization. Pathway provides the latest research in 19 critical school improvement issues- science, math, literacy, goals and standards, curriculum, governance and organizational management, school-to-work, parent and family involvement, community support systems, and many other areas that will enhance the teacher's abilities (p. 23). Teachers that do not have total command of educational computer technology skills required to successfully navigate the Pathway System are not providing the best learning environment for their students.

According to the Pre-Service Teacher Education Innovative Applications of Interactive Television article written by Herring, Smaldino, and Thompson: "Teachers must be trained to use technology effectively." Few pre-service programs focus on how to incorporate technology into instruction (Office of Technology Assessment [OTA], p. 88, 1989), and even fewer explore available teacher on-line resources. For technology to take hold in the schools, OTA insists that teachers need both training and education. Pre-service teachers need to know how to work the technology and how to use it in their instructional practices (p. 18). Research indicates that most pre-service teachers actually wanted to use technology for job enlargement, to learn the newest tool of the trade, and to develop professionally. But despite the fact that nearly every school now has computers, only half of all teachers reported using them in instruction due to inaccessibility, technophobia, and not understanding its curriculum value (p. 98).

Distance Learning

In school systems turning increasingly to distance learning, electronic classroom discussions and various World Wide Web applications, students are expected to have some degree of comfort with such technologies. Similarly, teachers are expected to be able to teach the same technologies. A survey of pre-service instructors at Iowa teacher preparation institutions " identified a lack of distance learning training within pre-service programs. The survey results further spoke to the need for training of pre-service faculty about the use of...[technology] in their own classes" (Herring, Smaldino, and Thompson, p. 16). The vast majority of today's reports suggest that only about one-third of all K-12 teachers have had even 10-hours of computer training" (OTA, p. 98).

Most of that training focused on general computer literacy issues instead of curriculum integration. Schools of Education were often at loss when trying to decide how to prepare teachers for technologies that did not even exist yet (p. 98).

Control Mechanisms in Teacher Education

Implementation of SOL for computer technology is a first step towards moving from teacher certification to teacher credentialing. A crisis of governing has been experienced differently by different U.S. states, yet the tendency to focus on teacher education is common to most. Wisconsin, for example, has a stable population and one of the most rigorous teacher standards according to national comparisons; entry into schools of education in the Wisconsin system is comparable to that in other fields, including engineering and liberal arts. Yet Wisconsin is no less impatient to introduce more certification control in line with public rhetoric than is a state like California-where a severe shortage of qualified teachers, important challenges from people of color, and enormous press coverage of poor service and inappropriate standards are abound (Borman and Greenman, p. 42).

Across many states in the nation in the early 1970s, there was a tendency toward more-uniform certification for teachers (Di Sibrio, 1973). Although the change in teacher certification has been dramatic in the last ten years, the extent of change is not obvious when we examine the publicly released statements of certification requirements from each state authority. From the administrative descriptions of state certification statements, very little appears to have changed over this period. Even the length of the published formalities for each state remains at only a year or two in total (Borman and Greenman, p. 43). The shift in the governing of university teacher education can be viewed as one to move from

certification to credentialing. Previously state education agencies set broad guidelines by which universities proceeded to form teacher education programs. The emphasis was on approval of the university, which granted certificates; in contrast, the new governing strategy details the specific tasks, time elements and relations that are to constitute teaching (Borman and Greenman, p. 44).

NASA is also actively involved in computer technology education for teachers. By Congressional mandate, education in the disciplines of science, engineering, and technology are a part of NASA's mission. NASA sees education as a broad continuum, from kindergarten through postdoctoral study. By their challenging nature, NASA programs are particularly demanding for technological input. Meeting the aeronautical and space goals of the past four decades has necessitated leading edge advancements across a diverse spectrum that embraces virtually every scientific and technological discipline. NASA is seeking innovative ways to enhance their computer technology education programs to meet these requirements. Pre- and in-service teacher computer technology education programs may enhance NASA's future ability to obtain a highly proficient computer technology workforce.

OVERVIEW OF CHAPTER

Chapter II discussed inequities that exist in the ability of schools to provide instruction to enable students to use technology for effective problem solving and productivity. These inequities were traced to the teachers' lack of access to adequate equipment and lack of training. To over come these inequities, the Board of Education is recommending that Schools of Education develop implementation plans for pre-service training of instructional personnel. It stressed that pre-service teachers needed to know how to work with technology and how to use it in their

instructional practices. It identified how knowledge of the Internet is important to the student as well as the teacher. The chapter noted that the vast majority of today's reports suggest that only about one-third of all K-12 teachers have had even 10-hours of computer training. In this chapter the results of an Iowa distance learning survey indicated the need for training of pre-service faculty in the use of technology in their own classes. Chapter III will describe the Methods and Procedures used in this study. It will explain how the data was collected to find a solution to the problem outlined in this study.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to collect and interpret data on four research goals concerning pre-service and in-service teacher computer technology proficiencies. In order to facilitate a high return rate of data, teachers that were sensitive to NASA programs and that could be conveniently contacted were selected as the target population.

Population

The population for this study consists of thirty teachers that had attended the previous Annual NASA Langley Research Center's Pre-Service Teachers Conferences and sixty in-service teachers that have attended the NASA Langley Research Center's two-week Teacher Enhancement Institute. The objective of the Pre-Service Teachers Conference was to increase the pre-service teacher's content knowledge in areas of aeronautics, science, mathematics, and instructional technology. The pre-service teachers attended the following Historically Black College or Universities in the State of Virginia:

1. Hampton University – Hampton, Virginia
2. Norfolk State University – Norfolk, Virginia
3. Saint Paul's College – Lawrenceville, Virginia
4. Virginia State University – Petersburg, Virginia
5. Virginia Union University – Richmond, Virginia

The objectives of the Teacher Enhancement Institute were:

1. To give teachers opportunities to use computer technology so that they can see the value of the computer as a resource for telecommunications with other teachers,

scientists, and researchers; for finding curricular resources on the Internet; and for using electronic technologies to support teaching and learning.

2. To give teachers hands-on activities and experiences they can use with their own students to teach science and mathematics.

3. To model and promote the use of scientific inquiry through problem-based learning.

Demographics

The demographic and test data populations for the Teacher Enhancement Institute (TEI) are certified teachers that teach K-8 schools in NASA Langley's five-state service region. The total population for the TEI was 341 teachers. However, the test data population will be the first 60 names listed alphabetically in the database for past participants. The total participation of both groups was 90.

Instrument

For the purpose of this study a questionnaire was used to gather data. The questionnaire was mailed to program participants with postage paid envelopes included. The questionnaire will request data in the form of 33 questions with multiple choice responses and two questions requiring a written response for the following major areas:

1. Personal Data
2. Standards of Learning
3. Pre-Service Computer Technology Training
4. Educational Computer Technology Resources

5. Educational Computer Technology Used in the Classroom
6. Impact of NASA Program Participation

Pilot Study

A pilot study of the questionnaire was conducted using education instruction professionals at NASA Langley Research Center. The first study determined the questionnaire was too long and contained an excessive amount of essay questions. Additionally, the study group recommended that the purpose of the questionnaire be added as the first item the reader reads. As a result of this study, the six major sections of the questionnaire were developed. A rewrite of questionnaire required the Personal Data Section to be reduced to four questions. These questions could be answered by just checking a box. The pilot study group strongly encouraged questions that only require a check of a box. They felt that questionnaires that required extensive writing might not be completed. Therefore, the first 33 questions of the 35 total questions were designed to be answered by checking a box. Listing similar skills in an individual question also reduced the Standards of Learning Section to ten questions. The pilot group recommendations resulted in the questionnaire being reduced from 50 questions to 35 with only two questions requiring a definite written response.

Data Collection

The initial questionnaire and cover letter was mailed to the selected teachers on July 8, 1997. Due to an extremely low return rate, a follow-up reminder requesting support of the project was mailed (Appendix F). This was accomplished on July 29, 1997. All usable instruments returned within five-weeks of the initial mailing were included in the study.

Statistical Analysis

A questionnaire-recording sheet was developed to record by subject area information reported by the questionnaire. Each question in the questionnaire had four possible responses. Each response was recorded on the recording sheet in the applicable area. The areas were then summed to indicate the total representative scores. Computation of scores of each major area produced statistical analysis data that could be presented in the form of percentages and measures of central tendencies. When appropriate and understanding of the data was enhanced, the data was presented in the form of charts or tables.

Summary

Chapter III contained the Methods and Procedures used in this study. It described the purpose of the study, population targeted, instrument used, data gathering techniques, and statistical analysis. Chapter IV will present the Findings.

CHAPTER IV

FINDINGS

The findings that are presented in this chapter were compiled from a questionnaire entitled, "Computer Technology Proficiency." The purpose of this study was to answer four research goals: (1) To measure how well prepared the pre-service teachers are to use and teach instructional computer technology, (2) To measure in-service teachers' computer technology skills, (3) To assess teachers' integration of computer technology into the core curriculum and (4) Conduct a diminutive program evaluation of NASA computer technology education programs.

Report of the Findings

A total of 90 questionnaires were sent to pre- and in-service teachers. The pre-service teachers returned ten completed questionnaires and the in-service teachers returned 32 questionnaires. Partial data was collected from two in-service questionnaires because they listed their occupation as sabbatical leave and retired. The number of questionnaires completed and returned was 42, or 46.6 percent. Six questionnaires were returned due to incorrect address or no forwarding address. Table I is an explanation of the distribution of the questionnaire and data reported on the survey:

Table I

Distribution of Questionnaire	
Distributed	90
Returned	42
Returned for Incorrect Address	6
Not Returned	42
Percentage Returned	46.6%

Personal Data Questions

The first questionnaire item asked, "What is your current occupation status?" Thirty (71%) of the 42 replies listed their current occupation as a licensed teacher. Ten (24%) of the 42 replies listed their occupation as a pre-service teacher. Two replies (5%) of the 42 received did not record information for this questionnaire item. Table II provides descriptive information regarding the current occupation status.

TABLE II

Current Occupation Status		
Status	***Frequency***	***Percentage***
Licensed Teacher	30	71%
Pre-Service Teacher	10	24%
Substitute Teacher	0	0%
Other	0	0%
No Response	2	5%

Questionnaire item number two asked, "How many years of teaching experience do you have?" Twenty-five (60%) of the replies returned indicated more than five-years of teaching experience. Three replies (7%) indicated more that three years of teaching experience. Four

replies (10%) indicated more than one-year of teaching experience. The ten pre-service replies (23%) indicated their teaching experience as pre-service teachers. Table III provides descriptive information regarding the teachers' years of experience. The majority of the licensed teachers indicated more than 5-years experience.

TABLE III

Years of Experience		
Status	***Frequency***	***Percentage***
More than 5-years	25	60%
More than 3-years	3	7%
More than 1-year	4	10%
Pre-Service	10	23%

Questionnaire item number three asked, "What is your highest academic degree?" No replies were returned indicating a Ph.D. Fourteen (33%) indicated they had completed an MS Degree. Twenty-six (62%) indicated they had completed an undergraduate degree and two surveys did not respond to this question. Table IV provides descriptive information regarding the teacher's highest academic degree.

TABLE IV

Highest Academic Degree		
Status	***Frequency***	***Percentage***
Ph.D.	0	0%
MS Degree	14	33%
Undergraduate	26	62%
EDS/ MBA	0	0%
No Response	2	5%

Questionnaire item number four asked, "How many computer technology professional enhancement courses have you completed?" Six (14%) replies indicated that they had completed five or more professional enhancement courses. Twenty-six replies (62%) indicated that they had completed two or more courses. Seven replies (17%) indicated they had completed one course. Three replies (7%) indicated that they have not completed any courses. Table V provides descriptive information regarding the teacher's completion of professional computer technology courses.

TABLE V

Professional Enhancement Courses		
Status	***Frequency***	***Percentage***
More than Five	6	14%
Two or More	26	62%
One	7	17%
None	3	7%

Seventy-one percent (30) of the questionnaire participants were licensed teachers and sixty-six percent (28) of them had more than 3-years teaching experience. One-third (14) of the questionnaire participants have completed graduate degrees. Seventy-six percent (32) of the teachers have completed two or more computer technology enhancement courses. Only seven percent (3) reported that they have not taken any computer technology professional enhancement courses.

Standard of Learning Questions

Questionnaire item numbers five – twelve focused on the Board of Education's Computer Technology Standards of Learning and the proficiency requirements for pre- and in-service teachers. These questions asked the study

participants to indicate their proficiency levels for eight computer technology skills. Questionnaire item number five asked, "What is your level of proficiency for operating a computer system and utilizing software?" Seven replies (17%) rated their ability to operate a computer and software as highly proficient. Twenty-three replies (55%) rated their proficiency as skilled and twelve (28%) rated their proficiency level as an amateur.

Questionnaire item number six asked, "What is your level of proficiency concerning applying knowledge of terms associated with educational computing and technology?" Applying the knowledge of terms associated with educational computing and technology had results that indicated five (12%) were highly proficient, twenty-four (57%) were skilled, and thirteen (31%) were amateurs.

Questionnaire item number seven asked, "What is your level of proficiency concerning applying productivity tools for professional use?" The level of proficiency reported for applying productivity tools for professional use was five (12%) that rated their proficiency as highly proficient, sixteen (38%) rated their proficiency as skilled, nineteen (45%) rated their proficiency as an amateur, and two (5%) indicated they were not proficient.

Questionnaire item number eight asked, "What is your level of proficiency concerning the use of electronic technologies to access and exchange information?" The level of proficiency concerning the use of electronic technologies to access and exchange information found nine (21%) replies that rated their proficiency as highly proficient and twenty (48%) rated their proficiency as skilled. Nine (21%) rated their proficiency as amateur and four (10%) indicated they had no proficiency.

Questionnaire item number nine asked, "What is your level of proficiency concerning the ability to identify, locate, evaluate, and use appropriate instructional technology-based resources to support Standards of Learning and

other instruction objectives? Seven replies (17%) reported they were highly proficient. Twenty-one (50%) reported they were skilled and fourteen (33%) indicated they were amateurs.

Questionnaire item number ten asked, "What is your level of proficiency concerning the use of educational technologies for data collection, information management, problem solving, decision making, communications, and presentations within the curriculum?" Only five (12%) were highly proficient, twenty (48%) were skilled, and fifteen (35%) reported as being an amateur. Two replies (5%) indicated they were not proficient.

Questionnaire item number eleven asked, "What is your level of proficiency concerning your ability to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learning in a variety of educational settings?" Nine replies (21%) indicated highly proficient and eighteen (43%) reported skilled. Thirteen (31%) rated their proficiency as amateur and two (5%) indicated that they were not proficient in this area.

Questionnaire item number twelve asked, "What is your level of proficiency concerning the ability to demonstrate knowledge of ethical and legal issues relating to the use of technology?" Four responses (10%) reported that they were highly proficient, seventeen (40%) indicated that they were skilled, and thirteen (31%) indicated that they were on an amateur's level of proficiency. Only eight (19%) indicated that they were not proficient in this area. Table VI provides descriptive information regarding the pre-service and in-service proficiencies in these requirements.

TABLE VI

Standard of Learning Proficiencies Pre-Service

Status	*Frequency*	*Percentage*
5. Operating Computer/Software		
Highly Proficient	7	17%
Skilled	23	55%
Amateur	12	28%
Not Proficient	0	0%
6. Applying Educational Computing		
Highly Proficient	5	12%
Skilled	24	57%
Amateur	13	31%
Not Proficient	0	0%
7. Applying Professional Productivity		
Highly Proficient	5	12%
Skilled	16	38%
Amateur	19	45%
Not Proficient	2	5%
8. Access and Exchange Information		
Highly Proficient	9	21%
Skilled	20	48%
Amateur	9	21%
Not Proficient	4	10%
9. Ability to Use Appropriate Technologies		
Highly Proficient	7	17%
Skilled	21	50%
Amateur	14	33%
Not Proficient	0	0%
10. Data Collection, Information Management Problems Solving, and Decision Making Skills		
Highly Proficient	5	12%
Skilled	20	48%
Amateur	15	35%
Not Proficient	2	5%
11. Plan and implement Lessons and Strategies		
Highly Proficient	9	21%
Skilled	18	43%
Amateur	13	31%
Not Proficient	2	5%
12. Demonstrate Knowledge of Ethical and Legal Issues		
Highly Proficient	4	10%
Skilled	17	40%
Amateur	13	31%
Not Proficient	8	19%

Questionnaire item number thirteen asked, "How were you introduced to the required Computer Technology Standards of Learning for Virginia Public Schools?" Six replies (15%) indicated they were introduced to computer technology standards by the Board of Education, nineteen (45%) by their school administrator, and eight (19%) were introduced by their peers. Six (15%) indicated their individual preference introduced them to computer technology standards. One reply (2%) was not aware of the computer technology standards and two replies indicated they were from out of state. Table VII provides descriptive information regarding the manner in which the teachers were introduced to the Computer Technology Standards.

TABLE VII

How Introduced to Computer Technology Standards

Status	***Frequency***	***Percentage***
Board of Education	6	15%
School Administrator	19	45%
Peers	8	19%
Individual Preference	6	15%
Not Aware	1	2%
Out of State	2	5%

Questionnaire item number fourteen asked, "What is the driving force that requires you to use computer technology in your classroom?" No replies indicated the Board of Education as the driving force that requires computer technology in their classroom. Individual preference was indicated on thirty-four (81%) of the responses. Three (7%) indicated the school administrator and another three (7%) indicated peers. Two responses (5%) indicated that they were from out of state. Table VIII provides descriptive information regarding the driving force that requires the teacher to use computer technology in the classroom.

TABLE VIII

Driving Force That Requires Technology		
Status	***Frequency***	***Percentage***
Board of Education	0	0%
School Administrator	3	7%
Peers	3	7%
Individual Preference	34	81%
Out of State	2	5%

Pre-Service Computer Technology Training

Questionnaire item number fifteen asked, "How extensive was your exposure to education computer technology training as a pre-service teacher?" Three pre-service teachers (7%) indicated they received extensive exposure, ten (24%) indicated they were occasionally exposed to computer technology training, and eighteen (43%) indicated they received very little exposure. Eleven of the pre-service teachers indicated they received no exposure. Table IX provides descriptive information regarding the pre-service computer technology training.

TABLE IX

Pre-Service Computer Technology Training		
Status	***Frequency***	***Percentage***
Extensive	3	7%
Occasionally	10	24%
Very Little	18	43%
None	11	26%

Questionnaire item number sixteen asked, "What type of computer technology exposure did you receive as a pre-service teacher?" Fourteen (33%) indicated their exposure was in the form of presentations, eight (19%) indicated class assignments provided their exposure, and seven (17%) indicated that problem solving exercises provided their exposure. Two pre-service teachers (5%) indicated their exposure was in the form of research. Eleven (26%) indicated they received no form of exposure to computer technology. Table X provides descriptive information regarding the pre-service computer technology exposure.

TABLE X

Pre-Service Computer Technology Exposure

Status	*Frequency*	*Percentage*
Presentations	14	33%
Class Assignments	8	19%
Problem Solving	7	17%
Research	2	5%
None	11	26%

Education Computer Technology Resources

Questionnaire item numbers 17 – 21 evaluates the computer technology resources available to teachers. Questionnaire item number seventeen asked, "Where do you have access to a computer?" Eight (19%) indicated that access was only available in the school, twenty-four replies (57%) indicated they had access both in the classroom and at their home, and ten (23%) indicated that the computers at home were the only access available. Table XI provides descriptive information regarding access to computer systems.

TABLE XI

Access to Computer System		
Status	***Frequency***	***Percentage***
School	8	19%
Classroom and Home	24	57%
Home	10	23%
Other	0	

Questionnaire item number eighteen asked, "What is your level of proficiency concerning the use of the Internet?" Pre-service teachers reported two (4%) as skilled, four (9%) as an amateur, and four (9%) as not proficient. Teachers with more than one-year of experience reported four (9%) as skilled and two (4%) as amateurs. Teachers with more that three-years of experience reported only one (2%) with skilled proficiency. Teachers with more than five-years experience reported four (9%) as highly proficient, ten (24%) as skilled, and four (9%) with the proficiency of an amateur. Only two (4%) reported they were not proficient concerning the Internet. Table XII provides descriptive information regarding proficiency concerning the use of the Internet.

TABLE XII

Proficiency Concerning the Internet		
Status	***Frequency***	***Percentage***
Pre-Service		
Skilled	2	4%
Amateur	4	9%
Not Proficient	4	9%
More Than 1-Year Experience		
Skilled	4	9%
Amateur	2	4%

TABLE XII Cont.

Proficiency Concerning the Internet		
Status	***Frequency***	***Percentage***
More Than 3-Years Experience		
Skilled	1	2%
More Than 5-Years Experience		
Highly Proficient	9	21%
Skilled	10	24%
Amateur	4	9%
Not Proficient	2	4%

Questionnaire item number nineteen asked, "To what extent do you use the Internet?" Sixteen (38%) replies indicated they used the Internet for research, curriculum development, and to obtain information. Eleven replies (26%) indicated they used the Internet for research and to obtain information. Eight (19%) replies indicated they use the Internet for information only, two replies (4%) indicated it is used for curriculum use only, and one reply indicated research as the only use. Four replies (9%) indicated they did not use the Internet. Table XIII provides descriptive information regarding to what extent the Internet is used.

Table XIII

Extent of Internet Use		
Status	***Frequency***	***Percentage***
Research, Curriculum Development, And Information	16	38%
Research and Information	11	26%
Information	8	19%
Curriculum Only	2	4%
Research Only	1	2%
Do Not Use	4	9%

Questionnaire item number twenty asked, "What is your level of proficiency concerning the use of E-Mail?" Ten replies (24%) indicated they were highly proficient, twenty-two replies (52%) indicated they were skilled, and eight (19%) rated their skills at using the E-Mail system as amateurs. Only two (5%) replies indicated that they were not proficient. Table XIV provides descriptive information regarding the proficiency using the E-Mail system.

TABLE XIV

Proficiency In Using E-Mail

Status	*Frequency*	*Percentage*
Highly Proficient	10	24%
Skilled	22	52%
Amateur	8	19%
Not Proficient	2	5%

Questionnaire item number twenty-one asked, "What is the status of your education computer technology software?" Thirteen replies (31%) rated their computer technology software as current, twenty replies (48%) indicated the software was slightly behind, nine replies (21%) thought their software was not current. Table XV provides descriptive information regarding the status of computer software.

TABLE XV

Status of Education Computer Technology Software

Status	*Frequency*	*Percentage*
Current	13	31%
Slightly Behind	20	48%
Not Current	9	21%
None Available	0	0

Education Computer Technology Used in the Classroom

Questionnaire item numbers 22 – 25 measures the usage and frequency of Education Computer Technology and how education computer technology is used in the classroom. Questionnaire item number twenty-two was designed to access to what degree did teachers make changes in the content of their curriculum due to information obtained on the Internet. Eighteen (43%) indicated they changed their curriculum frequently, eleven (26%) indicated they changed regularly, and six (14%) replied when possible, they changed. Only one reply (2%) indicated that they never changed their curriculum due to information found on the Internet. Table XVI provides descriptive information regarding this question.

TABLE XVI

Changed Curriculum Content

Status	*Frequency*	*Percentage*
Frequently	18	43%
Regularly	11	26%
When Possible	6	14%
Never	1	2%

Questionnaire item number 23 wanted to determine how often teachers integrated computer technology into their classroom delivery of materials. Eight replies (19%) indicated frequently, thirty-three (79%) indicated regularly, and one reply (2%) indicated when possible. Table XVII provides descriptive information regarding this question.

TABLE XVII

Integration of Computer Technology into Classroom Materials		
Status	***Frequency***	***Percentage***
Frequently	8	19%
Regularly	33	79%
When Possible	1	2%

Questionnaire item number 24 determines how often the teacher uses new explanations and examples in their teaching based on knowledge learned on the Internet. Eleven replies (26%) indicated that they frequency use new explanations and examples in their teaching based on knowledge learned on the Internet, fifteen (36%) indicated they routinely do, and eleven (26%) replied as very little use. Five replies (12%) indicated they never use the Internet. Table XVIII provides descriptive information regarding this question.

TABLE XVIII

Use of Explanations and Examples from the Internet		
Status	***Frequency***	***Percentage***
Frequency	11	26%
Routinely	15	36%
Very Little	11	26%
Never	5	12%

Questionnaire item number 25 determines the frequency in which teachers obtain new ideas for student hands-on activities from education computer technology resources. Fifteen replies (36%) indicated they frequently obtain hands-on activities from education computer technology

resources. Thirteen replies (31%) indicated they routinely do, twelve (28%) indicated very little, and two (5%) indicated they never used education computer technology resources for new hands-on student activities. Table XIX provides descriptive information regarding this question.

TABLE XIX

Student Hands-On Activities		
Status	***Frequency***	***Percentage***
Frequently	15	36%
Routinely	13	31%
Very Little	12	28%
Never	2	5%

Impact of NASA Program Participation

Questionnaire item numbers 26 – 35 measures the impact of participating in NASA Education Programs. Questionnaire item number 26 asked, "To what extent do you feel that your professional development was enhanced by your participation in NASA Education programs?" Twenty-three replies (55%) indicated their professional development was enhanced to a great extent. Three (7%) indicated the participation was helpful, five (12%) indicated the involvement slightly enhanced their professional development, and three (7%) indicated the programs had no effect. Eight replies (19%) did not response to this questionnaire item. Table XIX provides descriptive information regarding this question.

TABLE XX

Enhanced Professional Development		
Status	***Frequency***	***Percentage***
Great Extent	23	55%
Helpful	3	7%
Slightly	5	12%
Not at All	3	7%
No Response	8	19%

Questionnaire item number 27 asked, "To what extent have you been able to integrate computer technology in your math instruction?" Ten replies (24%) indicated they have fully integrated computer technology into their math program. Twelve replies (28%) indicated that they were partially able, thirteen (31%) had very little integration, and seven (17%) did not integrate computer technology into their math program. Table XXI provides descriptive information regarding this question.

Table XXI

Integration of Computer Technology into Math Program		
Status	***Frequency***	***Percentage***
Fully	10	24%
Partially	12	28%
Very Little	13	31%
Not at All	7	17%

Questionnaire item number 28 asked, "To what extent have you been able to integrate computer technology in your science instruction?" Four replies (10%) indicated they have fully integrated computer

technology into their science program. Twenty-three replies (55%) indicated that they were partially able, nine (21%) had very little integration, and six (14%) did not integrate computer technology into their science program. Table XXII provides descriptive information regarding this question.

Table XXII

Integration of Computer Technology into Science Program		
Status	***Frequency***	***Percentage***
Fully	4	10%
Partially	23	55%
Very Little	9	21%
Not at All	6	14%

Questionnaire item number 29 asked, "To what extent have you been able to integrate the teaching of an interdisciplinary unit using aeronautics as the topic?" Twelve replies (28%) indicated they have fully integrated the teaching of an interdisciplinary unit using aeronautics as the topic. Ten replies (23%) indicated that they were partially able, twelve (28%) had very little integration, and eight (19%) were not able to integrate the teaching of an interdisciplinary unit using aeronautics as the topic. Table XXIII provides descriptive information regarding this question.

Table XXIII

Integration of Teaching an Interdisciplinary Using Aeronautics		
Status	***Frequency***	***Percentage***
Fully	12	28%
Partially	10	25%
Very Little	12	28%
Not at All	8	19%

Questionnaire item number 30 asked, "To what extent have you been able to integrate computer technology with problem based learning?" Five replies (12%) indicated they have fully integrated computer technology with problem-based learning. Twenty replies (48%) indicated that they were partially able, twelve (28%) had very little integration, and five (12%) were not able to integrate computer technology with problem-based learning. Table XXIV provides descriptive information regarding this question.

Table XXIV

Integration of Computer Technology with Problem Solving

Status	***Frequency***	***Percentage***
Fully	5	12%
Partially	20	48%
Very Little	12	28%
Not at All	5	12%

Questionnaire item number 31 asked, "To what extent have you been able to integrate computer computer-based presentation software in your instruction?" Twelve replies (28%) indicated they have fully integrated computer-based presentation software in their instruction. Sixteen replies (38%) indicated that they were partially able, twelve (28%) had very little integration, and two (4%) were not able to integrate computer-based presentation software in their instruction. Table XXV provides descriptive information regarding this question.

Table XXV

Integration of Computer- Based Presentation Software		
Status	***Frequency***	***Percentage***
Fully	12	28%
Partially	16	38%
Very Little	12	28%
Not at All	2	4%

Questionnaire item number 32 asked, "To what extent have you been able to share and disseminate to other teachers the knowledge you obtained from participation in NASA programs?" Seventeen replies (40%) indicated they have been able to fully share and disseminate to other teachers the knowledge they obtained from participation in NASA programs. Eight replies (19%) indicated that they were partially able, nine (21%) had very little sharing and dissemination of information, and eight (19%) were not able to share and disseminate information. Table XXVI provides descriptive information regarding this question.

Table XXVI

The Sharing and Dissemination of Knowledge Obtained		
Status	***Frequency***	***Percentage***
Fully	17	40%
Partially	8	19%
Very Little	9	22%
Not at All	8	19%

Questionnaire item number 33 asked, "How did you share and disseminate to other teachers the knowledge you obtained from participation in NASA programs?" Twenty-six replies (62%) indicated they used workshops and video presentations to disseminate knowledge to

other teachers. Ten replies (24%) indicated they electronically disseminated information, four (9%) used a demonstration method, and two (4%) did not share and disseminate information. Table XXVII provides descriptive information regarding this question.

Table XXVII

How Knowledge was Shared and Disseminated

Status	*Frequency*	*Percentage*
Workshop and Video Presentations	26	62%
Electronically	10	24%
Demonstration	4	9%
Did Not	2	4%

Verbatim Written Comments

Questionnaire items number 34 and 35 were written comments that will be provided in their verbatim form. Questionnaire item numbers 34 asked, "What are the strengths of the NASA program that you were a participant? Please be specific". The following is a sampling from the first ten questionnaires received:

- The hands-on approach taken was encouraging and motivating. It was more interesting doing the activities then just listening to the ideas. (Chesapeake, VA)

- The network of resources, ability to see technologies being used to solve current problems, and the cooperation with local universities. (Gloucester, VA)

- It was well done! (Portsmouth, VA)

- The planning, demonstration, hands-on activities, and course content were excellent. The hands-on experiences promoted faster understanding of the technology. (Norfolk, VA)

- Hands-on, collegially shared, information based instruction. Time provided to accomplish tasks. (Hampton, VA)

- Organization and tours. (Newport News, VA)

- Instruction/lectures, hands-on activities, and introduction to the Internet. (West Point, VA)

- Slow moving, up-to-date, and geared to everyone's level. (Virginia Beach, VA)

- Excellent instructors, wealth of materials, and computer education. (Raleigh, NC)

- Exposure to Internet and computer instruction. Hands-on demonstrations of lessons for children. Interesting presentations by guest speakers. Plenty of written materials/posters/pictures, etc. for the classroom. (Norfolk, VA)

Questionnaire item number 35 asked, "What suggestions do you have to improve NASA education programs?" Verbatim comments were selected from the next group of ten questionnaires received. The following are the responses received:

- Offer more programs that are geared to teachers of young children. (Chesapeake, VA)

- Integrate students and teaches in the learning process. (Gloucester County, VA)

- More, more, more, education programs. (Norfolk, VA)

- Thanks to all the instructors, program coordinators, department/agency leaders who helped make my time with TEI so wonderful. (Virginia Beach, VA)

- Programs involving Post-Doc projects. (Newport News, VA)

- Keep-up your good work, by choosing teachers whom have a basic computer background and want to learn more. I used what I learned – Excel, tables, PowerPoint and the Internet for my unit. I use my new knowledge and skills everyday for information gathering in all areas of the curriculum. I am happy and excited to have these skills. (West Point, VA)

- Excellent Presentation. (Sussex County, VA)

- More computer time – many teachers have little or no experience. (Raleigh, NC)

- Demonstrate state-of-the-art learning software to teachers that children will enjoy. Even if NASA does not develop it on their own – at least teachers can see it and push school districts to buy it. There may be good stuff out there that we don't know about – NASA could help the software industry too! (Norfolk, VA)

Summary

Chapter IV contained the Findings of this study. It reported the findings on computer technology proficiency questions for pre- and in-service teachers. Chapter IV contained the presentation of data in narrative and tabular form. Chapter V contains the Summary, Conclusions, and Recommendations.

Chapter V

Summary, Conclusions, and Recommendations

Summary

The importance of educational technology training has never before in history received so much attention. Many people believe that national education competence can best be achieved through school systems and that educational computer technology training must be part of that process if students are to be successful in the future. The 1996 Annual Report to the State of Virginia Board of Education reported that inequities exist in the ability of schools to provide instruction to enable students to use computer technology for effective problem solving and productivity. These inequities can be traced to two main causes:

1. The lack of access to adequate equipment.
2. The lack of training for pre-service teachers.

On May 23, 1996, the State of Virginia Board of Education adopted eight standards of computer technology proficiencies for teachers to correct these inequities. A little over a year has passed and the researcher feels that there is a need to conduct an assessment of pre- and in-service teachers' computer technology proficiencies. A questionnaire was developed to obtain an assessment of the computer technology proficiency of pre- and in-service teachers. A pilot study of the questionnaire was accomplished and resulted in a reduction of the questionnaire from 50 to 35 questions. Thirty pre-service teachers from five Historically Black Colleges and Universities in the State of Virginia and sixty in-service teachers that attended a NASA Teacher

Enhancement Institute's educational technology program were selected to participate in the assessment. On July 8, 1997, the questionnaire was mailed to the targeted population and a follow-up letter was sent to participants that did not response on July 21, 1997. Ninety questionnaires were mailed and 42 (46%) questionnaires were returned. Data collection required the individual questionnaire responses to be recorded and tabulated. Tables, which provide descriptive information concerning the findings, were generated to enhance the reader's understanding of the data. The purpose of this study was:

1. To measure how well prepared the pre-service teachers are to use and teach instructional computer technology.
2. To measure in-service teachers' computer technology skills,
3. Assess the teachers' integration of computer technology into the core curriculum.
4. Conduct a diminutive program evaluation of NASA computer technology education programs

Conclusions

Computer technology is changing and improving everyday. This technology is extensively used in our nation's communication, transportation, business, and manufacturing systems. In the next millenium, our teachers must have a high level of proficiency in computer technology to properly prepare our students. Many of the in-service teachers that are teaching today will be teaching in the next millennium. Their knowledge of computer technology and ability to give proficient instruction is very important to the learning process of students.

Goal 1. To measure how well prepared the pre-service teachers are to use and teach instructional computer technology.

Thirty-one percent of the pre-service teachers reported they received either extensive or occasional computer technology training. Sixty-nine percent reported receiving very little or no computer technology training as a pre-service teacher. Fifty-two percent of the teachers' reported their pre-service exposure to computer technology consisted of presentations and class assignments. Only seventeen percent indicated they received problem-solving exposure to computer technology. The relationship between pre-service teachers' computer technology training and methods of exposure indicated a significant deficiency in pre-service teachers' computer technology proficiency. The findings for this research goal is that the targeted pre-service teachers are not well prepared to use and teach instructional computer technology.

Goal 2. To measure in-service teachers' computer technology skills.

The questionnaire participants reported sixty-two percent (26) were either skilled or highly proficient in the eight Standards of Learning. However, only seven-percent (3) of the teachers indicated that they were not proficient in six of the SOL's. Seventy-one percent (30) of the questionnaire participants rated their level of proficiency for operating a computer at either highly proficient or skilled with only twenty-eight percent (12) rating themselves with the skills of an amateur. Sixty-nine percent (29) reported a skilled or highly proficient ability to apply knowledge of terms associated with educational computing and technology. They reported that fifty percent (21) were either skilled or highly proficient in applying productivity tools for professional use. The lowest level of proficiency reported was concerning the ability to demonstrate knowledge of ethical and legal issues relating to the use of technology. In this area, fifty percent (21) were skilled or highly proficient, thirty- percent (13) rated themselves as amateurs, and nineteen percent (8) were not proficient.

These high percentages may be a result of the reported emphasis placed on computer technology training by the State Board of Education and school administrators. Fifty-nine percent (25) of the teachers reported that either the Board of Education or their school administrator introduced them to the Computer Technology Standards of Learning. A significant finding is that eighty percent (34) of the teachers reported that the driving force that requires them to use computer technology in the classroom was their individual preference.

Goal 3. Assess the teachers' integration of computer technology into the core curriculum.

Sixty-two percent of the targeted teachers completed two or more computer enhancement courses and fourteen-percent completed more than five courses. With sixty-nine percent (29) of the pre-service teachers' responses indicating that they received very little or no exposure to education computer technology training, the reported data indicated that they have taken actions to improve computer technology skills. This data supports the findings that many of the teachers reported that they had no computer technology training as a pre-service teacher and were currently completing courses to improve their skills. Additionally, this increased computer technology proficiency requirement for teachers was seen as an individual preference by eighty percent of the teachers completing the questionnaire. Sixty-one percent (26) of pre- and in-service teacher rated their computer technology proficiencies as either skilled or highly proficient.

Sixty-four-percent of the questionnaire participants indicated their ability to plan, implement lessons, and strategies using computer technologies as either skilled or highly proficient. Sixty-percent rated their

ability to use computer technology for data collection, information management, problem solving, and decision making as either skilled or highly proficient. Sixty-nine percent either regularly or frequently obtained new ideas for student hands-on activities from education computer technology resources. Nineteen-percent integrate computer technology into their classroom materials frequently and seventy-nine percent indicated they integrate computer technology into their classroom when possible. The findings support the assessment that in-service teachers are integrating computer technology into the core curriculum.

The Education Computer Technology resources findings indicated that sixty-four percent (26) of questioned teachers have access to a computer system at school, in the classroom, or at home. Seventy-one percent (30) indicated a level of proficiency concerning the use of the Internet as either skilled or highly proficient. Seventy-one percent (30) of the teachers used the Internet to gather information, fifty-seven (24) percent used it for research, and forty-five percent (19) used it for curriculum development. Over seventy-five percent (32) of the teachers were either skilled or highly proficient concerning the use of e-mail. The findings in the section of Education Computer Technology Resources indicate that computer systems were available to teachers and that many are able to effectively use the Internet. Seventy-eight percent (33) indicated the status of their education computer technology software as either slightly behind or current. Only three responses indicated that they do not use the Internet. This supports the finding that seventy-one percent indicated a level of proficiency concerning the use of the Internet as either skilled or highly proficient.

Sixty-nine percent of the questionnaire replies indicated that they have made change in the content of their curriculum due to information

obtained on the Internet. Only sixteen percent indicated that the Internet was not available. Approximately ninety-eight percent indicated that they integrate computer technology into the classroom delivery of materials either frequently or whenever possible. Sixty-one percent (26) reported that they used explanations and examples in their teaching based on knowledge learned on the Internet either routinely or frequently. Thirty-eight percent (16) reported very little or no use of the Internet. Forty percent (17) indicated that their level of proficiency concerning the use of educational technologies for data collection, information management, problem solving, decision making, communications, and presentations within the curriculum were rated as not proficient or amateur. These findings indicated that although sixty-nine of the teachers were either skilled or highly proficient in the use of electronic technologies to access and exchange information, they were taking full advantage of the Internet to discover new explanations and examples to be used in their classroom activities. However, seventy-eight percent (33) indicated that they obtained new ideas for student hands-on activities from their education computer technology resources either routinely or frequently.

Goal 4. Conduct a diminutive program evaluation of NASA computer technology education programs.

Fifty-four percent (23) indicated that their professional development was by a great extent enhanced by participation in NASA education programs. Only three teachers felt that participation had no effect on their professional development. Fifty-two percent (22) were able to integrate computer technology in their math instruction after participation. Only sixteen percent (7) reported that they were not able to integrate math into their instruction (five indicated that they do not teach math). Sixty-five percent (36) indicated that they were able to partially or fully integrated computer technology in their science instruction. Only fourteen percent (6)

reported that they were not able to integrate science into their instruction (three indicated that they do not teach science). Eighty percent (34) indicated that they were able to very little, partially or fully integrated the teaching of an interdisciplinary unit using aeronautics as the topic. Only nineteen percent (8) reported that they were not able to integrate the teaching of an interdisciplinary unit using aeronautics as the topic. Sixty-six percent (30) indicated that they were able to partially or fully integrate computer-based presentation software in their classroom instruction. Only four percent (2) reported that they were not able to integrate computer-based presentation software into their classroom instruction.

When teachers share or disseminate new and valuable information to other teacher's, information flow is maximized. Since the number of participants in NASA education programs is limited due to time, resources, and facilities, it is very important that the new computer technology knowledge and skills are disseminated to other teachers. Fifty-nine percent (25) indicated that they were able to partially or fully share and disseminate to other teachers the knowledge and skills obtained from participation in NASA education programs. Only nineteen percent (8) reported that they were not able to share and disseminate to other teachers the knowledge and skills they learned. Some teachers reported using more than one method to transfer information. The most frequently used methods were demonstrations, video presentations, and workshops.

The written comments of the questionnaire reported hands-on activities several times as strengths of NASA computer technology education programs. Suggestions to improve the programs contained comments indicating the participants wanted more programs, programs that integrate students with teachers, and more computer time.

The findings of this diminutive program evaluation indicate the NASA computer technology education programs are highly beneficial to teachers that attend. Over fifty percent of the targeted teachers felt the programs enhanced their professional development. Integration of computer technology into math, science, and interdisciplinary units using aeronautics were either fully or partially accomplished by over fifty percent of the teachers. The adult learners wanted more programs organized in this manner and liked the hands-on activities of the programs. The findings in this section will be provided to NASA for review.

Recommendations

The Board of Education implemented the needed Computer Technology Standards of Learning. Therefore, they should be responsible for the cost of training in-service teachers to the proficiency level required by the SOL objectives. The Computer Technology Standards of Learning are state requirements, which Schools of Education should implement into their curriculum. Based upon the findings, personal observations, and the subsequent conclusions of the study, the researcher submits the following recommendations that require funding to be successfully implemented:

1. Using the objectives of the Standards of Learning, the Board of Education should develop a self-paced computer technology training package. The training package should include all materials required for the teacher to develop a skilled proficiency in computer technology. A 1-800 help-line during peak hours (6:00 p.m. - 11:00 p.m.) should also be provided. The training package could be written by knowledgeable public school teachers on a special assignment or contracted to the business community.

2. Pre-service teacher training programs should be required to include formal computer technology courses with objectives that will develop a skilled proficiency in the Board of Education's Computer Technology Standards of Learning.

3. The Board of Education should provide in-service teachers with financial compensation for the completion of computer technology training that develops a skilled proficiency in the Computer Technology Standards of Learning.

4. A member from the middle school team should be given authorized absence with pay to attend computer technology training that will develop a skilled proficiency in the Board of Education's Computer Technology Standards of Learning. When the training is completed, the member will train the other members of the team. The school administrator will be responsible for assigning a teacher to the duties of computer technology training teacher.

5. Governmental agencies should continue to provide at no-cost training and excess equipment associated with their expertise to public school teachers.

6. Many of the teachers' comments asked for more programs with hand-on activities. NASA should develop computer technology distant learning programs that incorporate hands-on activities that can be broadcast over Public Broadcast Service Television channels. This recommendation is cost-effective and can significantly expand the targeted population.

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APPENDICES

Appendix A

Teacher Standard of Learning

Board of Education Technology Standards for Instructional Personnel:

1. Operate a computer system and utilize software.

2. Apply knowledge of terms associated with educational computing and technology.

3. Apply productivity tools for professional use.

4. Use electronic technologies to access and exchange information.

5. Identify, locate, evaluate, and use appropriate instructional technology-based resources (hardware and software) to support Standards of Learning and other instructional objectives.

6. Use educational technologies for data collection, information management, problem solving, decision making, communications, and presentations within the curriculum.

7. Plan and implement lessons and strategies that integrate technology to meet the diverse needs of learning in a variety of educational settings.

Appendix A Cont.

8. Demonstrate knowledge of ethical and legal issues relating to the use of technology.

Appendix B

Student Standard of Learning

Minimum skills that students should acquire by the end of the eight grade include the following:

1. The student will communicate through application software.

2. Compose and edit a multiple page document at the keyboard, using word processing skills and the writing process steps.

3. Communicate with spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data.

4. Communicate with databases by defining fields and entering data, sorting, and producing reports in various forms.

5. Use advanced publishing software, graphics programs, and scanners to produce page layouts.

6. Integrate databases, graphics, and spreadsheets into word-processed documents.

7. Use local and worldwide network communication systems.

Appendix B Cont.

8. Develop hypermedia "home page" documents that can be accessed by worldwide networks.

9. The student will have a basic understanding of computer processing, storing, retrieval, and transmission technologies and a practical appreciation of the relevant advantages and disadvantages of various processing, storage, retrieval, and transmission technologies.

10. The student will process, store, retrieve, and transmit electronic.

11. Use search strategies to retrieve electronic information.

12. Use electronic encyclopedias, almanacs, indexes, and catalogs to retrieve and select relevant information.

13. Use laser discs with a computer in an interactive mode.

14. Use local and wide-area networks and modem-delivered services to access and retrieve information from electronic databases.

15. Use databases to perform research.

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Computer Technology Proficiency Questionnaire

Purpose: ***To measure pre- and in-service teachers use of instructional computer technology and to assess their integration of computer technology into the core curriculum.***

Directions: ***Please carefully read each question and select an appropriate response. If the question has more than one appropriate response, you may select those responses that are applicable. If the question has no appropriate response, please mark N/A next to the question number.***

Personal Data

Last Name Middle Initial First Name School System Employed

1. What is your current occupation status?

   ☐ Licensed Teacher ☐ Pre-Service Teacher ☐ Substitute Teacher ☐ Other Specify_____

2. How many years of teaching experience do you have?

   ☐ More than 5-years ☐ More than 3-years ☐ More than 1-year ☐ Pre-Service

3. What is your highest academic degree?

   ☐ Ph.D. ☐ MS Degree ☐ Undergraduate ☐ Other Specify _____

4. How many computer technology professional enhancement courses have you completed?

   ☐ More than Five ☐ Two or More ☐ One ☐ None

Standards of Learning

5. What is your level of proficiency for operating a computer system and utilizing software?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

6. What is your level of proficiency concerning applying knowledge of terms associated with educational computing and technology?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

7. What is your level of proficiency concerning applying productivity tools for professional use?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

8. What is your level of proficiency concerning the use of electronic technologies to access and exchange information?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

9. What is your level of proficiency concerning the ability to identify, locate, evaluate, and use appropriate instructional technology-based resources (hardware and software) to support Standards of Learning and other instruction objectives?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

10. What is your level of proficiency concerning the use of educational technologies for data collection, information management, problem solving, decision making, communications, and presentations within the curriculum?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

11. What is your level of proficiency concerning your ability to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learning in a variety of educational settings?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

12. What is your level of proficiency concerning the ability to demonstrate knowledge of ethical and legal issues relating to the use of technology?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

13. How were you introduced to the required Computer Technology Standards of Learning for Virginia Public Schools?

☐ State Board of Ed. ☐ School Administrator ☐ Peers ☐ Individual Preference

14. What is the driving force that requires you to use computer technology in your classroom?

☐ State Board of Ed. ☐ School Administrator ☐ Peers ☐ Individual Preference

Pre-Service Computer Technology Training

15. How extensive was your exposure to education computer technology training as a pre-service teacher?

☐ Extensive ☐ Occasionally ☐ Very Little ☐ None

16. What type of computer technology exposure did you receive as a pre-service teacher?

☐ Presentations ☐ Class Assignments ☐ Problem Solving ☐ Research

Education Computer Technology Resources

17. Where do you have access to a computer system?

☐ School ☐ Classroom ☐ Home ☐ Other Specify _____

18. What is your level of proficiency concerning the use of the Internet?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

19. To what extent do you use the Internet?

☐ Research ☐ Curriculum Development ☐ Information ☐ Other Specify _____

20. What is your level of proficiency concerning the use of E-Mail?

☐ Highly Proficient ☐ Skilled ☐ Amateur ☐ Not Proficient

21. What is the status of your education computer technology software?

☐ Current ☐ Slightly Behind ☐ Not Current ☐ None Available

Education Computer Technology Used in Classroom

22. I have made changes in the content of my curriculum due to information obtained on the Internet.

☐ Frequently ☐ Slightly Behind ☐ Not Current ☐ None Available

23. I integrate computer technology into the classroom delivery of materials.

☐ Frequently ☐ Regularly ☐ When Possible ☐ Never

24. I have used new explanations and examples in my teaching based on knowledge learned on the Internet.

☐ Frequently ☐ Routinely ☐ Very Little ☐ Never

25. I have obtained new ideas for student hands-on activities from my education computer technology resources.

☐ Frequently ☐ Routinely ☐ Very Little ☐ Never

Impact of NASA Program Participation

26. To what extent do you feel that your professional development was enhanced by your participation in NASA Education programs?

☐ Great Extent ☐ Helpful ☐ Slightly ☐ Not at All

27. To what extent have you been able to integrate computer technology in your math instruction?

☐ Fully ☐ Partially ☐ Very Little ☐ Not at All

28. To what extent have you been able to integrate computer technology in your science instruction?

☐ Fully ☐ Partially ☐ Very Little ☐ Not at All

29. To what extent have you been able to integrate the teaching of an interdisciplinary unit using aeronautics as the topic?

☐ Fully ☐ Partially ☐ Very Little ☐ Not at All

30. To what extent have you been able to integrate computer technology with problem-based learning?

☐ Fully ☐ Partially ☐ Very Little ☐ Not at All

31. To what extent have you been able to integrate computer-based presentation software in your instruction?

☐ Fully ☐ Partially ☐ Very Little ☐ Not at All

32. To what extent have you been able to share and disseminate to other teachers the knowledge you obtained from participation in NASA programs?

☐ Fully ☐ Partially ☐ Very Little ☐ Not at All

33. How did you share and disseminate to other teachers the knowledge you obtained from participation in NASA programs?

☐ Workshop ☐ Video Presentation ☐ Demonstrations ☐ Electronically

34. What are the strengths of the NASA program that you were a participant? Please be specific!

35. What suggestions do you have to improve NASA education programs?

Thank you for assisting us with this project . Your inputs are very important for the continued enhancement of NASA teacher education initiatives.

National Aeronautics and
Space Administration
Langley Research Center
Hampton, VA 23681-0001

Reply to Attn of 400

July 8, 1997

Ms. Karen L. Seitz
1221 35th Street PI. NE
Conover, NC 28613

Dear Ms. Seitz:

On May 23, 1996, the State Board of Education adopted eight computer technology standards as a requirement for pre-service and public school teachers. The NASA Langley Research Center's Office of Education is seeking innovative ways to enhance our computer technology education programs to meet these requirements. Curriculum modifications, and in some cases complete changes, are essential to keep pace with new technologies in computer science. To facilitate this modification and change, it is extremely important that your inputs be considered during the development of our new initiatives.

Enclosed is a questionnaire that is designed to provide us with indications on how to better serve educators in the future. Please take a few moments of your valuable time to complete the questionnaire and return it no later than Friday, July 25, 1997, using the enclosed pre-addressed envelope. Thank you for assisting us with this project. If you require additional information, please contact Lloyd Evans at 757-864-5209 or by mail at Mail Stop 400 at this Center.

Sincerely,

Samuel E. Massenberg

Samuel E. Massenberg, Ed.D.
Director, Office of Education

2 Enclosures

National Aeronautics and
Space Administration

Langley Research Center
Hampton, VA 23681-0001

Appendix F

Reply to Attn of 400

July 21, 1997

Ms. Ora Liz Bailey
1410 Hardy Cash Drive
Hampton, VA 23666

Dear Ms. Bailey:

This is a follow-up to our Computer Technology Proficiency Questionnaire mailed to you on July 8, 1997. We have not received your reply and are again, requesting your support of this very important project. If you have not completed the questionnaire, please take a few moments of your valuable time to complete the enclosed questionnaire and return it using the enclosed postage paid pre-addressed envelope. If you have forwarded the questionnaire to our office, please disregard this follow-up.

As an educator, you know how important it is measure the impact of the computer technology standards adopted recently by the State Board of Education as a requirement for pre-service and public school teachers. Only education professionals like you can provide the inputs required for making this assessment.

Please help us to find ways to better serve our educators. If you require additional information, please feel free to contact Lloyd Evans at 757-864-5209 or by mail at Mail Stop 400 at this Center. Thank you.

Sincerely,

Samuel E. Massenberg

Samuel E. Massenberg
Director, Office of Education

2 Enclosures