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A descriptive study of the yearly activities of instructional technology support personnel in selected public school systems of Tennessee, academic year 2001-2002

Michael J. Ward

To the Graduate Council:

I am submitting herewith a dissertation written by Michael J. Ward entitled "A descriptive study of the yearly activities of instructional technology support personnel in selected public school systems of Tennessee, academic year 2001-2002." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Education.

Lloyd D. Davis, Major Professor

We have read this dissertation and recommend its acceptance:

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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We have read this dissertation
And recommend its acceptance:

Thomas W. George

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Acceptance for the Council:

Vice Provost and Dean of
Graduate Studies

A DESCRIPTIVE STUDY OF THE YEARLY ACTIVITIES OF INSTRUCTIONAL TECHNOLOGY SUPPORT PERSONNEL IN SELECTED PUBLIC SCHOOL SYSTEMS OF TENNESSEE, ACADEMIC YEAR 2001-2002

A Dissertation

Presented for the

Doctor of Education Degree

The University of Tennessee, Knoxville

Michael J. Ward

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ABSTRACT

This descriptive study involved the exploration of the annual activities of a selected subset of the technical support staff and technical coordinators within the Tennessee public school systems. The study focused on how the technical support personnel's allocation of time for general support and computer-related support varied by the factors of supported student population, experience, education, gender, and salary.

The population of the study was defined by an existing electronic mailing (email) list used to provide an informal method of communication between the participants. The data for this study was obtained through the use of an on-line questionnaire with the participants being notified of its location via email. From the study population of 192 individuals, 136 valid questionnaire responses were received. Once the data had been collected, One-way Analysis of Variance (ANOVA) procedures were used to determine if statistically significant differences existed for each of the independent variables of supported student population, experience, education, gender, and salary. Categorizing the activities within general support, computer-related support, and methods of support provided the dependent variables for the ANOVA procedures. Where statistically significant differences occurred, the Tukey post-hoc was used to determine the amount of difference and its direction. A variety of descriptive statistics were also generated.

The largest portion (43%) of the average participant's time during the school year was spent supporting computer-related technologies, and most of this time was spent supporting existing technologies. Salary and experience have the greatest effect upon the duties of technical support personnel. As salary or years of experience increased, so too did the amount of time per year spent on administrative functions. Conversely, the lower one's salary or years of experience, the greater the chance of performing computer-related support. Gender had little impact upon the allocation of time spent providing support though minor differences existed in the methods of providing that support. While support via email was almost as important as support via telephone, in most instances, the participant visited the area in which support was needed.

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CHAPTER 1

INTRODUCTION

Background of the Problem

For the past twenty years, society's dependence upon the computer and its related technologies has steadily increased. Today, almost every facet of life is in some way dependent upon a computer. For example, automobiles produced in the last five years will not work without the aid of a computer. Our economy is vitally dependent upon computers to deliver information in a timely and predictable fashion. The twenty first century brings with it the future of commerce, the Internet. The Internet continues to grow, nearly doubling in size from July 1999 to July 2001 with the number of hosts online increasing from 56 million to nearly 126 million (Internet Software Consortium, 2001). It is likely that an increasing amount of commerce will occur via the Internet, and that computer-based companies will drive a major portion of those transactions. Microsoft, Oracle, and other computer-oriented companies have had a noticeable influence on the health of the American economy.

Also during this time, the computer has gained a massive increase in raw computational power. This increase in power has allowed for advances in the science of the graphical user interface so that computers have, theoretically, become easier to use. In addition, technological discoveries and advancements in manufacturing techniques have decreased the costs of computer technologies. This decrease has occurred to such an extent that these technologies are now affordable to the average consumer.

As computers have become cheaper, the number of homes with computers has greatly increased. Nearly half of all American households have a personal computer with a connection to the Internet (Office of the Press Secretary, White House. 2000). A survey conducted just a year later found that 72.3% of the households in America were connected to the Internet (UCLA Center for Communication Policy, 2001). Entertainment, education, business, and personal finance management are the major reasons most consumers buy a personal computer. The computer has moved from being a rare research tool in the hands of scientists to becoming so commonplace that some now view it as a household appliance.

This increased dependence upon computer technologies has been accompanied by an increase in the numbers of computer support personnel (US Department of Labor, 2001). The demand for qualified technical support staff, specifically those individuals who can install, support, and maintain computers, continues to steadily increase (US Department of Labor). While the available amount of support personnel is increasing, the majority of these professionals are employed within the business world. A recent study by the International Data Corporation placed the ratio at 1 support person per 50 employees in the business arena; in the world of education; the ratio was 1 support person per 500 students (International Data Corporation, 1997).

The duties of technical support staff are numerous and varied in school settings. Helping students achieve technological proficiency is one of the main goals of the support staff. The importance of a student's technological proficiency is growing. Thirty-five

states have incorporated technology standards into their academic standards in 2001 as compared to only nineteen states in 1997 (Education Week. 2001).

Carter (2000) compared the basic responsibilities of educational technical support staff in 1997 and 2000. In 1997, those responsibilities could be summarized as computer maintenance and user instruction. By 2000, the following responsibilities were added: administrative leadership; network management; system and server management; teacher training, and web page development. Not only are most technical support personnel responsible for meeting the needs of students, administrators, and educators, they are often educators and administrators themselves. In short, computer support personnel have to distribute and allocate their time to a variety of tasks.

An accurate description of how technicians in the public school systems of Tennessee allocate their time could be a valuable tool to school administrators. This study would detail which activities, such as computer support and office management, require the most time. It would also cover which computer-dependent support activities, such as installing hardware and software, require the most time. The study would also provide demographic information about the technical support staff within the state of Tennessee.

Statement of the Problem

In the field of education, technical coordinators and their support staff are expected to support a variety of technologies. These individuals are also often responsible for supporting the users of these technologies. In many schools, the number of computers and related equipment has increased without an accompanying increase in support

personnel. Within the business world, research has been done on the daily routine of technical staff responsible for supporting technology and its users, however studies specifically detailing the work routine of educational technical staff do not seem to exist.

Purpose of the Study

This study has three, equally important purposes. They are: to determine how technical support staff within Tennessee public school systems allocate their time to various work tasks such as computer support, instruction, and personnel management; to determine how these same individuals allocate their time toward the support of computer-related technologies; to determine which of the particular types of support, such as telephone or on-site support, are done most often.

Research Questions

Six research questions formed the basis of this inquiry. They are as follows:

1. During the school year, how do the selected technical support personnel distribute their time among the nine general support categories of the questionnaire?
2. Within the general support categories of the questionnaire, how do the technical support personnel's allocation of time vary by the factors of student population, experience, education, gender, and salary?
3. During the school year, how do the selected technical support personnel distribute their time among the seven computer-related support categories of the questionnaire?
4. Within the computer-related support categories of the questionnaire, how do the technical support personnel's allocation of time vary by the factors of student population, experience, education, gender, and salary?

5. When providing technical support, which of the four methods of support from the questionnaire are used most often?
6. How do the factors of student population, experience, education, gender, and salary affect the amount of each method of support?

Significance of the Study

An improved understanding of how technical support staff personnel work may help these individuals improve how they work. By revealing unproductive habits, repetitive tasks, and generalized difficulties, the results of this study could help improve efficiency and productivity.

The descriptive model created by this study should improve the overall understanding of the requirements and responsibilities of technical support staff in the educational setting. This increased understanding and awareness can be applied by the school administration to improve the educational experience within each school by altering existing technology policies as needed. Dependent upon each school's situation, technological policies may require significant modification. The allocation of funds toward new technologies could be accompanied by a relative increase in the number of technical support staff.

Some of the descriptive data collected may provide direct insight into which technologies, or aspects of technology, currently occupy a majority of the time within a technician's daily routine. Armed with these insights, specialized training programs can be developed and implemented to insure that new technicians are trained and can support these technologies.

Limitations and Delimitations

Limitations include:

1. This study relied upon the individual's perceptions of time and responsibility. Therefore, the accuracy of these perceptions varied according to the individual.
2. Given the rapid evolution of computer-related technologies, the duties of support staff may change over time.
3. The ratio of the number of support staff to student population may vary widely between school systems and this may affect the perceptions of technicians.

Delimitations include:

1. The study surveyed the technical support staff found within Tennessee public school systems. This sample may not be representative of support staff found in other states.
2. This study utilized an on-line questionnaire that was accessible for a period of four weeks. Four weeks was considered to be a sufficient response time. This method facilitated a quick collection of data.

Assumptions

It is assumed that:

1. The importance of and dependence upon computer technologies will continue to increase in the future.
2. The technical professionals surveyed were honest and truthful in their responses to the questionnaire.
3. Technical staff had the knowledge and information required to complete the on-line questionnaire.

4. The number of respondents to successfully complete the questionnaire was large enough to represent the general support population of the public school system within Tennessee.
5. The questions used during the survey adequately and accurately measured the categories and methods of support.
6. When responding to the questions involving percentages, respondents considered their activities during the year as a whole, not a particular time of the year.

Definition of Terms

Computer-related Technologies – Technologies, such as word processor or spreadsheet applications, that are dependent upon the existence of a computer. This category also includes physical devices and peripherals such as printers, monitors, and the personal computer itself.

Hardware – Hardware referred to electrical or electronic devices, particularly computers and their components, used by a technician or supported by a technician.

Information Technologies – Electronic technologies are used for the acquisition and dissemination of information. Computer-related technologies are a subset of information technologies.

Internet Address – In order for a computer to access the Internet, it must be assigned a unique identifier called an Internet Address. This address is similar to a household address and insures that information gets routed to and from the computers on the Internet. This address can also be called an Internet Protocol number or IP number.

Listserv – Listserv is technical slang for "list server." A listserv sends email from a single user to all other users contained in its list of users. In most cases, any user can send email

to the listserv for replication and every user gets a copy of every email sent. Listservs are most often used for a specific topic or a specific group of individuals.

Network Protocol – TCP/IP is a network protocol, or a means of transportation for data between computers connected on a network. TCP/IP is the primary means of transportation of data on the Internet.

PDA – Personal Digital Assistant. A small hand held computer used to store email, addresses, and calendar information.

Server – A computer dedicated to one or more tasks, programs, or functions. Examples are email servers and web servers.

Software – Software was defined as any program that runs on a computer, or any operating system that is required for the computer to function.

Support – Providing verbal and/or physical help to another in order to resolve some difficulty. Support refers to the assistance provided by technical personnel to the staff and students within the school system. Support also refers to the effort to maintain computer hardware and software in a working and reliable state.

TCP/IP – See Network Protocol.

Technical Support Staff – Individuals who are knowledgeable in the field of technology and who provided support for this technology. The support can be physical maintenance or setup of the technology and/or instruction on how to use the technology. Individually, technical support staff personnel are often called technology specialists or technicians.

Technical Coordinator – The person responsible for coordinating technical resources and personnel within a school system or district.

Technology – Technology was defined as being electronic in nature and included computers, network equipment, audio/visual equipment, and software.

Walk-in User – Any person who enters the work area unscheduled and asks the technician for assistance.

Workstation – Usually a computer used by a single individual as their primary computer to accomplish part of their job such as word processing.

URL – Uniform Resource Locator, such as http://www.microsoft.com.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

The computer has become a mainstay tool of American life during the past two decades. The increasing affordability of personal computers, combined with an ever-increasing level of computational power, has allowed for the proliferation of computers within America. The American economy depends upon the computer to facilitate business transactions of all types and the computer provides a means of entertainment, communication, and learning within the average American home. Computers can be found within the American educational system as both a tool of learning and administration. Our society, as well as our school systems, would be hard pressed to function without the computer.

Modern computers, while powerful and useful, still require maintenance. Users of these computers require training and support when they encounter difficulties. The demand for technical support professionals continues to increase. According to the US Department of Labor, "these occupations are projected to be the fastest growing and rank among the top 20 in the number of new jobs created over the 1998-2008 period" (US Department of Labor, 2001). American businesses meet this demand for support by employing technicians within their own companies or contracting to an outside company to provide this support. The public school systems within America do not have the

financial resources found within the business world and are often forced to provide the same level of technical support with fewer personnel.

The pressure upon the technical support staff within the field of education to provide adequate support may produce behaviors and activities that are not analogous to their commercial counterparts. A plethora of studies have been conducted upon almost every facet of the yearly routine and activities of teachers. A lesser number of similar studies have been conducted with educational administrators. These studies have given insight and understanding into their respective fields. However, studies about the activities of technical support staff within the field of education are rare. It follows that, with the increased dependence upon computer technologies within the public school systems, a greater number of studies upon technical support staff would be beneficial.

Importance of Computer-Based Technologies to Education

In a 1991 study of 5th grade students led by Dale Mann, the impact of West Virginia's ten-year-old Basic Skills/Computer Education (BS/CE) program was measured (Mann, Shakeshaft, Becker, & Kottkamp, 1999). The program provided every classroom with at least four computers, a printer, and a networked file server. The study found that "significant gains in reading, writing, and math were achieved" and that "the BS/CE technology regression model accounts for 11% of the total variance in the basic skills achievement gain scores of the 5th grade students." In simpler terms, the basic skills scores for these students improved by 11% due to the Basic Skills/Computer Education

program. The measured improvement was upon basic skills score of the Stanford-9 test. (Mann, 1999)

In a meta-analysis of studies on computer-based instruction, James Kulik (1994) found that students learned more in less time when receiving computer-based instruction. Kulik also found that computer-based instructions help foster positive attitudes toward learning in students. These studies contribute to the belief that computer-based technologies have had a positive impact upon the American education system. As the number of computers within the school grows, so too will their impact

Proliferation of Computers

The proliferation of computers in America within the past ten years has peaked and slightly subsided. A study conducted by Silvers and Smulders (2001) forecasted that personal computer sales would decrease by 13.2% between the fourth quarters of 2000 and 2001. Two factors, the economic downturn and market saturation, were determined to be the primary cause in the decline in sales of personal computers (PCs). The economic downturn was caused by many factors, not the least of which was the failing of the "dot.coms," or Internet-based businesses. According to Coursey (2001), the primary failing of these businesses was not realizing that "The Internet is not as much a new way of doing business as it is an extension of your existing business." Market saturation has been exacerbated by the increasing life cycle of the PC, which should reach 4 years by 2005 (Smulders, 2001).

Even with the decrease of PC sales in the US, the number of computers within public schools continues to grow. The computer to student ratio in public schools decreased from 6 to 1 in 1999 to 5 to 1 in 2000, according to the National Center for Educational Statistics (2001). The ratio of computers with Internet access to students within public schools also declined from 9 to 1 in 1999 to 7 to 1 in 2000 (NCES, 2001). The proliferation of school computers was spurred by government initiatives such as the 21st Century Classroom Act. This Act, sponsored in 1997 by Representative Randy Cunningham of California, provided tax incentives for businesses that donate computer equipment to school systems (House Republican Conference, 1998).

Lack of Technical Support Personnel

Unfortunately, this increase in personal computers has not been accompanied by a proportional increase in the amount of technical support personnel. In 2001, the United States needed to hire an additional 900,000 personnel to add to the existing 10.4 million workers in Information Technology fields (Information Technology Association of America, 2001). Of this number, there was a projected shortfall of approximately 425,000 from the required 900,000. This shortfall was caused by lack of qualified applicants (ITAA, 2001). Another study by the Meta Group (2001), a research and consulting firm, placed the shortfall of required information technology (IT) workers in the year 2001 at 600,000. In 1997, the ratio of users to technical support personnel in the educational world was approximately 500 to 1 while the corresponding ratio of users to technical support personnel in the business world was approximately 50 to 1 (International Data

Corporation, 1997). Pruitt-Mentle (2000) indicated that the shortage also extended to technology coordinators by stating that only 30 percent of schools have full-time technology coordinators.

These shortages have forced schools to be creative. One solution was to actively employ knowledgeable students as technicians. In his article, *Students as Technology Support Staff*, Rob Reilly (2000) presents both the benefits and liabilities of students as technical support staff. Reilly indicated that this practice does not relieve the need for full time staff though "it would appear that utilizing students as technology support staff is an effective and viable option that will dramatically improve the situation." While Dr. Reilly appeared to be very much in favor of student technicians, he also pointed out that "the major obstacle to utilizing students will be the argument that the students are not in school to teach anyone how to use computers or to fix computers."

The use of technically oriented students to assist teachers with computer-based difficulties may alleviate some support problems, but any such gains are offset by the limited number of such students and those students' available time. In the case of hardware support, there is also the question of safety for the student and the school system. As computer technology is dependent upon electricity, an element of danger is present when dealing with physical maintenance. A student technician may not understand this danger. Any hardware maintenance done by a student, if done improperly, could pose a danger to future users of the technology. Finally, it is unlikely that a student will understand all of the requirements and responsibilities of the technical support staff.

Responsibilities of the Technical Support Staff

Carter (2000) found that the primary responsibilities of technical support staff in education were: computer maintenance; user instruction; administrative leadership; network management; system and server management; teacher training, and Web page development. While this list was fairly comprehensive, there are other technologies that require support, such as audio-visual equipment. The list was also lacking another important category of responsibility: paperwork.

Paperwork takes many forms for support personnel including inventories, warrantee registration, maintenance scheduling, and documentation. Documentation is possibly the best means of solving recurring problems, or preventing the escalation of a problem into a catastrophe. The most basic form of documentation is writing down how the problem was solved, when it was solved, and who solved it. Active documentation can range from the use of a simple notebook to a full-fledged helpdesk trouble ticket software package. Paperwork, as well as the number of responsibilities, often increases when one moves into the realm of technology administration.

Technology coordinators have additional responsibilities due to their position. Moursund (1992) stated that the responsibilities for school-based technology coordinators were:

1. Providing immediate help to teachers and students.
2. Planning for long-range school and district technology integration.
3. Addressing technology-related curriculum articulation questions.
4. Developing short and long-range plans for implementation goals.
5. Helping teachers develop technology-related materials and lessons.
6. Providing computer-related in-service education and training.
7. Responsible for school hardware, software and other materials.
8. Technology budget responsibilities.

9. Acting as a resource for a wide range of technology questions.
10. Assisting in the teaching of computer-based subjects.
11. Developing and implementing evaluation procedures.
12. Assisting school non-teaching personnel with technology use.
13. Maintain personal professional growth to keep up with the field.

As can be seen, the amount and variety of responsibilities are numerous for both technical support staff and technology coordinators. The fulfillment of these responsibilities requires varying amounts of time, depending upon the level of difficulty, the individual, and the working environment. For technical support staff, an adequate amount of time is not always available during the school year to fulfill these responsibilities.

Time During the School Year

The start of a new school day brings with it a limited number of opportunities to increase student understanding. In 1984, the typical school day was found to last six hours with the school year lasting 180 days (Ellis, 1984). This means that a student was in school a total of 1080 hours per year. However, only a portion of this time was allocated for sessions in which an educator can teach. Ellis (1984) suggested extending the school year to 220 days, which was the number of school days for children in England. The cost of such an extension would have been approximately twenty billion dollars annually.

Due to the cost, it would appear that extending the school year to increase educational opportunities is not an option. Given the current limitations in resources; specifically those of money, time, and teachers, efforts to improve the educational

situation must be made with care. One way of potentially improving the situation without a major increase in resource demand is to improve a teacher's "time on task."

Educator's "Time on Task"

While it is certain that differences exist on how teachers plan and execute their daily activities, each teacher should make a concerted effort to utilize their time wisely. Once a daily plan has been established, adherence to that plan is vital. A study conducted in 1990 found that teacher's on-task behavior ranged from 75% to 85% (Roney, DeLong, Bloomer, Lindsey, 1990). This range seemed to be adequate considering the amount of time lost by teachers to administrative procedures, student disruptions, personal time, and other interruptions. These high percentages were, in part, due to previous studies involving the daily routine of teachers. By investigating the daily activities and procedures of educators, an improved understanding of the demands placed upon these professionals was achieved. This improved understanding provided insight for both administrators and teachers. Teachers are not the only school employees who have benefited from a study of their daily routine.

Administrator's "Time on Task"

Lindsey (1989) concluded that the average superintendent's day lasted nine hours and forty-eight minutes. The same study revealed that on-task activities of these superintendents consumed eight hours and twenty-two minutes each day. Thus, the superintendent was on-task 85% of the day. This was a very high percentage considering

the complexity of a superintendent's daily schedule. Requiring a superintendent to achieve a higher percentage may be improbable if not impossible. While studies such as this may not provide administrators with the ability to increase their "time on task," they still provide valuable insight into the demands placed upon the administrators.

Studies on the daily schedule of both educators and administrators have proven to be of value. Unfortunately, the number of studies involving the daily routine of technical support staff has not reached the level of similar studies for educators and administrators. A search involving traditional materials, such as libraries and journals, as well as a search of on-line materials, has revealed little in the way of "time on task" studies for the technical staff of educational institutions. Given the advantages and benefits of "time on task" studies, it seemed that further study of the daily routine of technical support staff was required.

Technical Support Staff

In order to conduct this a study, a better understanding of the requirements and responsibilities of technical personnel was required. It was also be helpful to understand what sort of individual would be interested in pursuing a career in this field. Also, what were the most common requirements in terms of education and experience for technical personnel?

Leider (1998) suggested that the primary goal of technical personnel should be to improve student learning. Partial achievement of this goal involved: providing adequate training of faculty in the use of software and hardware; providing tools to help faculty

integrate technology into their courses; maintaining and upgrading technical resources; and insuring that their technical expertise is up to date. This was far from a comprehensive list of responsibilities. Another significant responsibility placed upon technical coordinators was planning for the future.

Predicting future fiscal requirements while being constrained by a limited budget has become a specialty of technical coordinators. While having to "do more with less" is common in the educational arena, those technical coordinators who are lucky enough to have funds allocated toward new technology are faced with another problem. The presence of new computers within a school is often a mixed blessing for support staff and educators. New computers often mean that new software will be installed. This leads to more training and support requirements. Unfortunately, an increase in the amount of new technology available to a school system is not always accompanied by a similar increase in the amount of support staff.

According to Ely (1997), most people entered the field of education technology following an undergraduate program in teacher education. Ely further adds that there were seldom prerequisites for study in the field, but those with skills in psychology and mathematics seem to "have a head start." There are several professional programs offered at various institutions that specialize in instructional technology.

Summary

Though numerous studies have been completed upon the daily routines of both educators and administrators, relatively few exist for their technical counterparts. As

computer based technology becomes an integral part of most educational institutions, so grows the need to have qualified technical support staff. Technical staff levels are not growing at a rate equal to the amount of technologies within schools. As this is unlikely to change in the near future, improving a technician's "time on task" seems to be a logical step to increasing the amount of support available for computer technologies. A study of the daily routine of such personnel would assist in accomplishing this goal.

CHAPTER 3

METHODOLOGY

Introduction

The apparent lack of research involving the daily routine of technical staff within the education field prompted this study. Significant research has been done involving "time on task" for teachers and their supervisors, but not so for the technical support staff in public schools. In general, studies involving educators and their supervisors have improved the understanding of the requirements placed upon educators and in some fashion improved the educational environment. Given that fact, it would follow that a study of the technical staff has a strong chance of positively impacting the same environment.

Selection of the Study Population

During the preliminary research done for this study, contact was made with Mr. Tom Bayersdorfer, Director of Information Systems for the Tennessee Department of Education. One of Mr. Bayersdorfer's responsibilities is to provide guidance for approximately 250 individuals who comprise the technical support staff for K-12 public elementary and secondary schools in Tennessee. In the 2000-2001 school year, these professionals provided technical support for technologies used by the 894,394 students, 55,361 teachers, and 3,808 administrators of the 1,611 public schools of Tennessee (State of Tennessee Department of Education, 2000). Of the approximately 250 technical

support personnel within Tennessee, 192 of these individuals are subscribed to a listserv administered by Mr. Bayersdorfer and receive email from it. In conversations with Mr. Bayersdorfer, he indicated that these individuals would be generally agreeable to participating in this study. Thus, this group of professionals was chosen as the study population.

Instrumentation and Collection of the Data

Data were gathered using an on-line questionnaire. Since there is very little literature or research in the area of the daily routine of technical support staff, the questionnaire had to be original to this study. The questionnaire was created from personal experience and through consultation with a panel of technical personnel. All of these individuals provide technical support as part of their profession and have at least seven years of experience. The questionnaire was also reviewed by several professors in the field of education from the University of Tennessee at Chattanooga (UTC). The comments and suggestions by the professionals working at UTC helped to refine the content and readability of the questionnaire.

A pilot test of the questionnaire also helped to improve its face validity. The pilot test consisted of asking approximately 25 technical support personnel, who work within the public educational systems of Pennsylvania, to take the preliminary on-line version of the questionnaire. Contact to these people was made through Mr. Bayersdorfer.

The computer program that implemented the on-line questionnaire was programmed to help participants avoid simple errors. For example, when a participant

entered percentage scores in Section 1 of the questionnaire, the current total percentage was displayed. The participant was not able to proceed to Section 2 until the percentage total for Section 1 equaled 100%. This also held true for Sections 2 and 3.

After the pilot test participants had completed the questionnaire, they were encouraged to provide feedback via email to the researcher. The researcher then reviewed these comments and suggestions. Several inconsistencies and limitations of the questionnaire, as shown by the pilot test, were corrected. The final version of the questionnaire can be found in Appendix B.

For the actual study, the listserv administered by Mr. Bayersdorfer provided the means for introducing the population to the study and the details of its purpose. The listserv was also used for notification of when and where the on-line form of the questionnaire would be available. A summary of this information will also be distributed electronically via email to the study population at the conclusion of the study. As an added incentive to complete the questionnaire, each participant was entered into a random drawing for a Palm OS Personal Digital Assistant (PDA).

To help prevent any unwanted side effects on the study population, it was critical that the anonymity of the population was maintained. Each participant's answers were not traceable to that participant. To help ensure this condition, several steps were taken. First, each participant's answers and the corresponding email address were inserted in two separate databases. After the insertion, the order of the elements of each database was randomized to prevent any relationship from being established between the elements due to order of entry. Second, the questionnaire was hosted on a server dedicated solely to

the study. The URL of the server was only available during the timeframe of data collection, after which the server was completely erased. Finally, the questionnaire and all of the software required for collecting the data was installed, created, and maintained by one person.

The first step in collecting the data was a short message containing the purpose and method of the study sent to the listserv of the study population on February 5th, 2001. This message also detailed the timeframe for the data collection, which was a period of four weeks beginning on March 1st, 2001. During the month of February, two more messages were sent as reminders before the actual data collection began. Two days before the data collection began, a message was sent containing the URL of the server as well as a few last minute instructions. Before a participant could begin answering the questionnaire, an on-line disclaimer form (see Appendix A) was displayed. The participant had to signify his/her agreement to participate in the study by clicking on an icon that led to the actual questionnaire. During the four weeks, two more reminder emails were sent; one at the beginning of the third week and another two days prior to the end of the four-week period.

At the end of the original timeframe for the study, the completion rate for the questionnaire was approximately 40%. This percentage was not sufficient to allow any statistically significant statements to be made about the study population. A decision was made to extend the timeframe by an additional four weeks and add two randomly awarded $100 cash prizes as incentives. An email detailing the extension of the timeframe and the

prizes was sent to the listserv. These efforts were effective and at the end of the additional four weeks, the completion rate for the questionnaire had exceeded 70%.

Analysis of the Data

The questionnaire was composed of four sections and in the first three sections, respondents were asked to assign percentages to categories of activities. The first section inquired about their general activities during the year, and had nine categories corresponding to these activities. This section of the questionnaire represented Research Questions 1 and 2. The second section of the questionnaire concentrated on support activities of computer-based technologies. There were seven categories for the support of computer-based technologies in this section. This section of the questionnaire represented research Questions 3 and 4. The third section of the questionnaire related to methods of support, such as phone calls and on-site visits. There were six methods of support in this section and they represented Research Questions 5 and 6. The final section asked questions about demographic information such as gender, salary, education, and experience.

Research Question 1

During the school year, how did the selected technical support personnel distribute their time among the nine general activity categories of the questionnaire?

For this research question, simple descriptive statistics, such as mean and standard deviation, were generated for the nine general activity categories. Table 1 contains an

example of the possible values of the raw data. Each row in Table 1 refers to a respondent, while the columns refer to that respondent's answers for the questions in section one. Table 2 shows an example of the simple descriptive statistics that were generated for the categories of section one.

Research Question 2

Within the general activity categories of the questionnaire, how did the technical support personnel's allocation of time vary by the factors of student population, experience, education, gender, and salary?

One-way Analysis of Variance (ANOVA) procedures were used to determine if statistically significant differences existed for each of the independent variables of student population, experience, education, gender, and salary and the nine activity categories that comprise the dependent variables. Table 3 shows an example of how the results of the ANOVA analysis were displayed.

Table 1: Examples of Raw Data Gathered from the Questionnaire

Respondent	s1.1	s1.2	s1.3	s1.4	s1.5	s1.6	s1.7	s1.8	s1.9
1	75	0	0	0	1	1	0	0	23
2	5	5	50	20	0	10	4	1	5
3	83	3	1	1	3	5	2	5	2
4	60	10	0	0	0	0	20	5	5

Table 2: Example of Descriptive Statistics Generated from Questionnaire

General Activities	Min.	Max.	$\bar{x}$
Activity 1	0	100	43.0
Activity 2	0	70	16.2
Activity 3	0	90	11.1

When a statistically significant difference was found when dealing with more than two levels of independent variables, as in the classifications of experience, education, and salary, the Tukey test was used to determine the amount of difference and its direction. This procedure was repeated for each of the five independent variables and the nine dependent general activity categories of section one of the questionnaire.

Table 4 shows an example of how the results of the Tukey test were displayed. For example, the average time spent on "Administrative Tasks" for the participants that support student populations from 14,000 to 50,000 students was found to be just over 20% more than the average for the participants that support student populations of less than 2,000 students. This difference was statistically significant at $\alpha < .01$.

Research Question 3

How did the selected technical support personnel distribute their time among the seven computer-related support categories of the questionnaire?

For this research question, simple descriptive statistics, such as mean and standard deviation, were generated for the computer-related support categories of section two of the questionnaire.

Table 3: Example Results of ANOVA Analysis

Category				
Example Category:	SS	df	MS	F
Between Groups	3142.55	8	392.81	4.25**
Within Groups	11455.24	124	92.38	

** $\alpha < .01$

Table 4: Example Tukey for Administrative Tasks by Student Population Generated

Student Population	$\bar{X}$	$\bar{X}$ Difference
14k to 50k	26.33	-
< 2k	5.75	-20.58**
2k to 4k	7.65	-18.68**
4k to 6k	8.23	-18.10**
> 50k	4.00	-22.33**

k = 1000 Students ** $\alpha < .01$

Research Question 4

Within the computer-related support categories of the questionnaire, how did the technical support personnel's allocation of time vary by the factors of student population, experience, education, gender, and salary?

One-way Analysis of Variance (ANOVA) procedures were used to determine if statistically significant differences existed for each of the independent variables of student population, experience, education, gender, and salary and the seven categories that comprise the dependent variables. When a statistically significant difference was found when dealing with more than two levels of independent variables, as in the classifications of experience, education, and salary, the Tukey test was used to determine the amount of difference and its direction. This procedure was repeated for each of the five independent variables and the seven dependent computer-related support categories of section one of the questionnaire.

Research Question 5

As represented by a percentage of time when providing technical support, which of the six methods of support was used most often?

For this research question, simple descriptive statistics, such as mean and standard deviation, were generated for the types of support categories of section three of the questionnaire.

Research Question 6

How did the factors of student population, experience, education, gender, and salary affect the frequency of each method of support?

One-way Analysis of Variance (ANOVA) procedures were used to determine if statistically significant differences exist for each of the independent variables of student population, experience, education, gender, and salary and the four categories that comprise the dependent variables. When a statistically significant difference was found when dealing with more than two levels of independent variable, as in the classifications of experience, education, and salary, the Tukey test was used to determine the amount of difference and its direction. This procedure will be repeated for each of the five independent variables and the four methods of support categories of section one of the questionnaire.

CHAPTER 4

FINDINGS AND ANALYSIS OF THE DATA

Introduction

Data representing the yearly work habits of technical support personnel and technical coordinators within the K-12 public school systems of the state of Tennessee were gathered between the dates of March 1, 2002, and April 30, 2002. These data did not represent the entire population of technical support staff and technical coordinators within the K-12 public school systems of Tennessee, but rather a subset of the population. This subset was defined by those individuals who were receiving email from a listserv for technical staff and coordinators of Tennessee schools managed by Mr. Tom Bayersdorfer. Contact was made via email using the listserv, and those within this subset were asked to complete an on-line questionnaire (Appendix B). Appendix D contains a copy of the email sent to the listserv. Of the 192 individuals available via the listserv, a total of 147 participants completed or partially completed the on-line questionnaire. Eleven of the completed questionnaire forms had to be discarded due to inconsistent or incomplete data leaving a total of 136 valid questionnaire forms. The on-line questionnaire had a completion percentage of 70.8%.

Subject Demographics

The questionnaire was designed to elicit demographic information from the participants of the study. Mr. Tom Bayersdorfer, Director of Information Systems for the Tennessee Department of Education and the principal contact for the listserv, helped determine the content of these demographic questions.

The variable of "Highest Degree" represented the amount of formal education reported by the participants. Those participants having two-year degrees, technological certifications (such as any Microsoft Certification), or vocational certification were grouped under "Associate's." Participants having a Master's degree and any additional training or coursework were grouped under "Master's+." At 27.9%, the largest percentage was in the "Master's Degree" category. The next largest percentage of 19.1% was in the "Bachelor's Degree" category, followed by "High School Degree" at 16.9%. The categories of "Associate's Degree" and "Master's+" held the next highest percentages at 11% and 14.7%, respectively. The smallest percentage, 1.5%, belonged to the category of "Doctoral."

Related to the category of education, participants were asked about their certifications. In particular, participants were asked if they possessed any form of Teacher or Administrative Certification. Slightly more than half (56.6%) of the participants reported that they held Teacher Certification while only 27.9% reported having an Administrative Certification.

Participants were also asked to report their ethnicity within the categories of African-American, Caucasian, Hispanic, Native American, and Pacific Rim ethnicities.

Caucasians were the overwhelming majority at 94.1% of the respondents. The next largest percentage belonged to African-Americans at 4.4%. Only a single participant reported for each of the ethnicities of Pacific Rim and Native American. There were no Hispanic participants.

Members of the study population were asked some general questions about their employment. Each participant was asked if they were building, state, or district level personnel. The majority of personnel were at the District level (83.1%). Building level personnel, at 12.5%, and State level personnel, at 3.7% comprised the rest of the group. The participants were also asked if they were employed on a twelve-month contract. The majority of participants (75.7%) were employed on a twelve-month contract. Finally, participants were asked to classify their position as either: Technical Support, Technical Training, Administrative, or All of These. The classification of "All of These" held the largest percentage at 45.6%, with Technical Support at 30.1% and Administrative at 18.4%. The Technical Training classification comprised 5.1% of the study population.

Table 5 shows the summary of frequencies and percentages for Gender, Highest Degree, Ethnicity, Teacher Certification, Administrative Certification, Twelve Month Contract, Building/State/District, and Position Description.

ANOVA Factor Categorization

The data for supported student population, experience, and salary, which were ratio in scale, required categorization into intervals to be used as factors for one-way ANOVA analysis. The intervals for student population were categorized in increments of

Table 5: Demographic Statistics of the Study Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Variables	Frequency	Percentage*	Variables	Frequency	Percentage*
Gender			**Administrative Certification**		
Female	54	39.7	No Response	2	1.5
Male	82	60.3	No	98	72.1
Highest Degree			Yes	36	26.5
No Response	12	8.9	Twelve Month Contract		
High School	23	16.9	No	33	24.3
Associate's	15	11	Yes	103	75.7
Bachelor	26	19.1	**Building, State, District**		
Master	38	27.9	No Response	1	0.7
Master+	20	14.7	Building	17	12.5
Doctoral	2	1.5	State	5	3.7
Ethnicity			District	113	83.1
African-American	6	4.4	**Position Description**		
Caucasian	128	94.1	No Response	1	0.7
Hispanic	0	0	Tech Support	41	30.1
Pacific Rim	1	0.7	Administrative	25	18.4
Native American	1	0.7	Technical Training	7	5.1
Teacher Certification			All of These	62	45.6
No	59	43.4			
Yes	77	56.6			

*Percentages may not sum to 100% due to rounding.

2,000, up to a student population of 14,000. Due to the large number of intervals that would have been created and the small number of participants in these categories, participants supporting between 14,000 and 50,000 students were grouped into one interval. One interval was also created for participants supporting greater than 50,000 students. Table 6 shows the categorization for student population.

Due to the difference in the number of participants that occurred between certain intervals, such as intervals 1 and 7, statistical analysis was performed using the original 9 intervals. The same analysis was then performed using 7 intervals. The 7 intervals were created by condensing intervals 5 and 6 into a single interval as well as condensing intervals 7 and 8 into a single interval. No significant differences were found between these analyses, so the original 9 intervals were used.

For the factor of experience, the on-line questionnaire category of "Time in Technical Support" was used. The groups for years of experience were set at intervals of 5 years, up to 25 years of experience. Due to the limited number of participants with

Table 6: Student Population Interval Categorization for ANOVA Factors

Group	Interval	*n*
1	Less than 2000 students	52
2	2000-3999 students	31
3	4000-5999 students	13
4	6000-7999 students	10
5	8000-9999 students	4
6	10000-11999 students	5
7	12000-13999 students	3
8	14000-49999 students	6
9	More than 50000 students	9

greater than 30 years of experience, one interval of greater than 25 years of experience was created. Table 7 shows the categorization for years of experience in technical support.

Groupings for an individual's salary were set at increments of $10,000. Due to the infrequency of an individual's salary being less than $10,000, less than $20,000 per year was used as one interval. Table 8 shows the salary categorization by dollars.

For the factor of education, the on-line questionnaire category of "Highest Degree" was used. The "Master's Degree+" category was created for those individuals with a Master's degree and some post graduate training. Since there were only two individuals with doctoral degrees, these participants were grouped in the "Master's Degree+" category. Table 9 shows the categorization used for the individuals by degrees earned.

To facilitate the presentation of the findings, research questions 1-6, presented in Chapter 3, were reproduced within this chapter.

Table 7: Experience Interval Categorization for ANOVA Factors

Group	Interval	*n*
0	Less than 5 years	43
1	5 to 9 years	49
2	10 to 14 years	24
3	15 to 19 years	9
4	20 to 24 years	4
5	25 or more years	7

Table 8: Salary Interval Categorization for ANOVA Factors

Group	Interval	*n*
1	Less than $20000	5
2	$20000 to $29999	16
3	$30000 to $39999	37
4	$40000 to $49999	33
5	$50000-$59999	32
6	$60000-$69999	7
7	$70000 or More	3

Table 9: Education Interval Categorization for ANOVA Factors

Group	Interval	*n*
1	High School Diploma	23
2	Associate's Degree	15
3	Bachelor's Degree	26
4	Master's Degree	38
5	Master's Degree+	22

Table 10: Yearly Percentages for Allocation of Time to General Support Activities Categories, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

General Activities	Min.	Max.	$\bar{x}$
Computer-Related Technologies	4	100	43.0
Office Management	0	70	16.2
Direct Instruction of Technology	0	90	11.1
Administrative Tasks	0	75	8.2
Curriculum Preparation	0	25	5.0
Transition	0	25	4.9
Other Technologies	0	30	4.8
Other	0	60	4.8
Direct Instruction of Other Subjects	0	80	2.2

Research Question 1

How did the selected technical support personnel distribute their time among the nine general activity categories of the questionnaire?

Of the nine general activity categories, "Computer Related Technologies" occupied almost 43% of the time during the school year for the participants. Further, the amount of time spent supporting computer related technologies was almost three times as great as the next largest consumer of time, "Office Management."

The category of "Computer-Related Technologies" had the largest range of percentages, from 4% to 100%, of the time available during the year. The category of "Direct Instruction of Other Subjects" averaged the smallest yearly percentage at 2.2%. Table 10 presents a summary of the data gathered for Section 1 of the on-line questionnaire.

The following list defines each category within general activities. The categories are listed in the order in which they appeared within the questionnaire.

1. Computer-related Technologies – What percentage of time was spent fulfilling support responsibilities of computer-related technologies? Examples were defined as personal computers, computer software, and operating systems.
2. Other Technologies – Time spent supporting other technologies, which would have included A/V equipment such as cameras, audio receivers, and projectors.
3. Direct Instruction in the Use of Technologies – Time that was devoted to direct instruction of students, teachers, technicians, and administrators about the use of technology or about technological subjects. Examples would have been the use of a word processor and the basics of computer operation.
4. Direct Instruction of Other Subjects – Time that was devoted to direct instruction of students, teachers, technicians, and administrators about non-technological subjects.

That is, subjects that did not involve the use of computer or electronic technologies. Examples would have been biology, chemistry, reading, and algebra.

5. Curriculum Preparation – Time spent during the school year involving the preparation and planning of class curriculum. This would have included planning and preparations for technological and non-technological workshops, courses, and online instruction.
6. Office Management – Completing paperwork and required forms, ordering supplies, authorizing expenditures, making phone calls, and maintaining personal contacts.
7. Administrative Tasks – Specifically those tasks that would have involved administrative functions such as staff meetings, evaluation of employee performance, assignment of responsibilities to staff, and arbitration.
8. Transition – Moving from one work location to the next including driving from one site to another for support purposes.
9. Other – Time spent on tasks, duties, or projects not listed or fitting within the previously defined categories.

Research Question 2

Within the general activity categories of the questionnaire, how did the technical support personnel's allocation of time vary by the factors of student population, experience, education, gender, and salary?

Using the general activity categories as the dependent variables and student population as the independent variable, a one-way ANOVA analysis was performed and the results are presented in Table 11. Examination of the results indicated a statistically significant difference ($\rho < .01$) existed only for the general support category of "Administrative Tasks."

The results of a Tukey multiple comparison post hoc test, presented in Table 12, was conducted to determine which of the student population intervals were statistically

significantly different. A review of the results indicated that statistically significant differences existed between group 8 (14,000 to 49,999 students) and groups 1 (Less than 2,000 students), 2 (2,000 to 3,999 students), 3 (4,000 to 5,999 students) and 9 (More than 50,000 students).

Study participants who supported from 14,000 to 49,999 students spent approximately 20% more time during the school year doing "Administrative Tasks" than those who supported student populations of: less than 2,000 students; 2,000 to 3,999 students; 4,000 to 5,999 students; and more than 50,000 students.

Table 13 shows the results of a one-way ANOVA analysis that was done with the independent variable of experience and the dependent variables of the general activity categories. ANOVA analysis found that statistically significant differences existed for the general activity categories of "Direct Instruction of Other Subjects" and "Administrative Tasks."

The corresponding Tukey analysis, whose results are shown in Table 14, for the category of "Direct Instruction of Other Subjects," found that statistically significant differences existed between group 4 (20 to 24 years experience) and every other experience group. Those participants who possessed 20 to 24 years of experience spent approximately 20% more of the school year on the "Direct Instruction of Other Subjects" than any of the other participants.

A Tukey post hoc analysis was also performed for the category of "Administrative Tasks." The results of this analysis are presented in Table 15. Examination of these results suggested that statistically significant differences existed between group 5 (25 years or

Table 11: Results of ANOVA Analysis for Allocation of Time to General Support Activities Means Categorized by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Administrative Tasks:	SS	df	MS	F
Between Groups	3142.55	8	392.81	4.25**
Within Groups	11455.24	124	92.38	

** $\alpha < .01$

Table 12: Results of Tukey Analysis for Allocation of Time to Means of Administrative Tasks (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
14k to 50k	26.33	-
< 2k	5.75	20.58**
2k to 4k	7.65	18.68**
4k to 6k	8.23	18.10**
> 50k	4.00	22.33**

k = 1000 Students ** $\alpha < .01$

Table 13: Results of ANOVA Analysis for Allocation of Time to General Support Activities Means Categorized by Years of Experience, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Direct Instruction of Other Subjects:	SS	df	MS	F
Between Groups	1633.70	5	326.74	4.88**
Within Groups	8699.29	130	66.92	
Administrative Tasks:				
Between Groups	1433.15	5	286.63	2.80*
Within Groups	13302.60	130	102.33	

* $\alpha < .05$ ** $\alpha < .01$

Table 14: Results of Tukey Analysis for Means of Allocation of Time to Direct Instruction of Other Subjects (in Percentages) by Years of Experience, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Years Of Experience	$\overline{X}$	$\overline{X}$ Difference
20 – 24	21.25	-
< 5	3.02	18.23**
5 to 9	0.86	20.39**
10 to 14	0.63	20.62**
15 to 19	2.56	18.69**
> 25	1.43	19.82**

** $\alpha < .01$

more experience) and group 0 (Less than 5 years experience). A statistically significant difference also existed between group 3 (15 to 19 years experience) and group 5. Those participants with more than 25 years of experience spent approximately 15% more of the school year performing "Administrative Tasks" than did participants with less than 5 years experience or participants with between 15 and 19 years of experience.

The results of a one-way ANOVA analysis of the general activity categories as the dependent variables and gender as the independent variable are given in Table 16. Statistically significant differences existed for the categories of "Direct Instruction in the Use of Technologies" and "Curriculum Preparation." Tables 17 and 18 show the mean differences between genders for the categories "Direct Instruction in the Use of Technologies" and "Curriculum Preparation."

For this study, female participants spent an average of just under 17% of the year on "Direct Instruction in the Use of Technologies" while the male participants spent almost 9.5% of the year on the same task. On average, female participants also spent

Table 15: Results of Tukey Analysis for Means of Allocation of Time to Administrative Tasks (in Percentages) by Years of Experience, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Years Of Experience	$\bar{x}$	$\bar{x}$ Difference
> 25	20.00	-
< 5	5.93	14.07*
15 to 19	4.56	15.44*

* $\alpha < .05$

Table 16: Results of ANOVA Analysis for Allocation of Time to General Support Activities Means Categorized by Gender, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Direct Instruction in the Use of Technologies:	SS	df	MS	F
Between Groups	2891.40	1	2891.40	20.64**
Within Groups	18768.13	134	140.06	
Curriculum Preparation:				
Between Groups	548.35	1	548.35	17.86**
Within Groups	4115.38	134	30.71	

** $\alpha < .01$

Table 17: Mean Difference (in Percentages) for Allocation of Time to Direct Instruction of Technology by Gender, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Group 1	$\bar{x}$	Group 2	$\bar{x}$	$\bar{x}$ Difference
Female	16.74	Male	7.32	9.42

Table 18: Mean Difference (in Percentages) for Allocation of Time to Curriculum Preparation by Gender, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Group 1	$\bar{x}$	Group 2	$\bar{x}$	$\bar{x}$ Difference
Female	7.52	Male	3.41	4.11

more than twice the amount of time (7.5%) on "Curriculum Preparation" than did male participants.

A one-way ANOVA analysis, whose results are presented in Table 19, was done using salary as the independent variable and the general activity categories as the dependent variables. Examination of the results of the analysis indicated that statistically significant differences existed for the categories of "Computer Related Technologies" and "Administrative Tasks."

Table 20 shows the results of a Tukey analysis for the category of "Computer Related Technologies." Observation indicated that a statistically significant difference existed between group 7 ($70,000 or more) and group 1 (Less than $20,000). Those participants with salaries less than $20,000 per year spent an average of almost 70% of the school year supporting "Computer Related Technologies" while those with salaries in excess of $70,000 per year spent an average of 11% of the school year on the same task.

Within the general support category of "Administrative Tasks," the post hoc

Table 19: Results of ANOVA Analysis for Allocation of Time to General Support Activities Means Categorized by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Computer Related Technologies:	SS	df	MS	F
Between Groups	10637.03	6	1772.83	3.19*
Within Groups	69938.00	126	555.06	
Administrative Tasks:				
Between Groups	6376.25	7	1062.71	16.17**
Within Groups	8278.98	128	65.70	

* $\alpha < .05$ ** $\alpha < .01$

Tukey analysis revealed that statistically significant differences existed between group 7 ($70,000 or more) and all other groups. These results are presented in Tables 21 and 22. Statistically significant differences also existed between group 6 ($60,000-$69,999) and groups 1 (Less than $20,000), 2 ($20,000-$29,999), 3 ($30,000-$39,999), and 4 ($40,000-$49,999).

On average, those participants making $70,000 per year spent almost 47% of the the time performing "Administrative Tasks." On average, the amount of time spent on "Administrative Tasks" increased with a participant's salary. As with those participants whose salaries were $70,000 or more per year, those individuals making between $60,000 and $69,999 per year spent a statistically significant amount of time on "Administrative Tasks" compared to the average time spent on the same task by the others in the study.

Research Question 3

How did the selected technical support personnel distribute their time among the seven computer-related activities of the questionnaire?

"Maintaining Existing Software" occupied almost 25% of the time spent on computer-related activities, while "Maintaining Existing Hardware" occupied just over 22% of the time. "Installing New Hardware," at 13.51%, "Installing New Software," at 11.45%, and "Personal Development," at 10.66%, were the next largest time "consumers." Table 23 contains a summary of the data gathered for the seven computer-related activities.

Table 20: Results of Tukey Analysis for Means of Allocation of Time to Computer Related Technologies (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
< $20k	69.00	-
> $70k	11.00	58.00*

* $\alpha < .05$

Table 21: Results of Tukey Analysis for Means of Allocation of Time to Administrative Tasks (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
> $70k	46.67	-
< $20k	1.00	45.67**
$20k to $29k	2.69	43.98**
$30k to $39k	5.41	41.26**
$40k to $49k	7.52	39.15**
$50k to $59k	10.25	36.42**
$60k to $69k	18.57	28.10**

** $\alpha < .01$

Table 22: Results of Tukey Analysis for Means of Allocation of Time to Administrative Tasks (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
$60k to $69k	18.57	-
<$20k	1.00	17.57**
$20k to $29k	2.69	15.88*
$30k to $39k	5.41	13.17**
$40k to $49k	7.52	11.06**

* $\alpha < .05$ ** $\alpha < .01$

Table 23: Time Allocated to Computer Related Activities Percentages, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Computer-Related Activities	Min	Max	$\bar{x}$
Maintaining Existing Software	0	65	24.46
Maintaining Existing Hardware	0	80	22.51
Installing New Hardware	0	60	13.51
Installing New Software	0	60	11.45
Personal Development	0	100	10.66
Evaluating New Technologies	0	50	8.76
Other	0	85	8.64

When performing computer-related support activities, participants of this study spent almost 47% of the time during the school year on the upkeep and maintenance of existing hardware and software. The average amount of time spent on either hardware or software maintenance differed by only 2%. The average percentage of time spent on the installation of new hardware and software was also almost the same.

The following list details each category within the area of computer-related activities. These categories are listed in the order in which they appeared in the survey.

1. Personal Professional Development – Reading technical journals and research papers, attending training sessions on new software or hardware. This is time spent during work hours, not research or reading done during personal times such as weekends or vacation.
2. Evaluating New Technologies – Installing and testing new software and/or hardware, attending vendor presentations.
3. Installing New Software – Installing new software including operating systems and/or applications.
4. Maintaining Existing Software – Troubleshooting existing software including operating systems and applications. Re-installing previously installed software including operating systems and/or applications. This also includes software upgrades.

5. Installing New Hardware – Installing new computer related hardware such as personal computers and/or their components as well as networking components.
6. Maintaining Existing Hardware – Troubleshooting computer related hardware such as personal computers and/or their components as well as networking components. This also includes hardware upgrades.
7. Other – Time spent on tasks, duties, or projects not listed or fitting within the previously defined categories.

Research Question 4

Within the computer-related support categories of the questionnaire, how did the technical support personnel's allocation of time vary by the factors of student population, experience, education, gender, and salary?

Table 24 shows the results of the one-way ANOVA analysis using the computer support categories as the dependent variables and student population as the independent variable. Statistically significant differences existed in the categories of "Personal Professional Development" and "Other Tasks."

Table 24: Results of ANOVA Analysis for Allocation of Time to Computer Related Support Activities Means Categorized by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Personal Professional Development:	SS	df	MS	F
Between Groups	2983.41	8	372.93	2.85*
Within Groups	16228.03	124	130.87	
Other:				
Between Groups	6539.97	8	817.50	4.49**
Within Groups	22598.33	124	182.25	

* $\alpha < .05$ ** $\alpha < .01$

The results of the Tukey post hoc analysis for the category of "Personal Professional Development" are presented in Table 25. Examination of these results suggested that statistically significant differences existed between group 9 (Greater than 50,000 students) and the groups of 1(Less than 2,000 students), 3 (4,000 to 5,999 students), and 4 (6,000 to 7,999 students).

Those participants who supported a student population of more than 50,000 students spent just over 22% of their time dedicated to computer-related support activities on "Personal Professional Development," which is a statistically significant difference from those who supported student populations of less than 2,000 students. It was also statistically significant when compared to those who supported student populations of 4,000 to 5,999 students and 6,000 to 7,999 students.

In Table 26, examination of the Tukey analysis results on the category of "Other," categorized by student population, suggested that statistically significant differences existed between groups 4 (6,000 to 7,999) and 1 (Less than 2,000), 2 (2,000 to 3,999), 3 (4,000 to 5,999), 6 (10,000 to 11,999), 8 (14,000 to 49,999), and 9 (50,000 or more).

Table 25: Results of Tukey Analysis for Means of Allocation of Time to Personal Professional Development (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
> 50k	22.44	-
< 2k	9.06	13.38*
4k to 6k	6.77	15.67*
6k to 8k	7.40	15.04*

k = 1000 students * $\alpha < .05$

Table 26: Results of Tukey Analysis for Means of Time Allocated to Other (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
6k to 8k	31.50	-
< 2k	5.23	26.27**
2k to 4k	9.32	22.18**
4k to 6k	12.62	18.88*
10k to 12k	4.00	27.5*
14k to 50k	4.33	27.17*
> 50k	3.33	28.17**

k = 1000 students

* α <.05

** α < .01

The results for the one-way ANOVA analysis for the "Computer Related Activities" categories and the independent variable of experience are presented in Table 27. Statistically significant differences in the means were found for the "Evaluating New Technologies" category. Further analysis, as shown in Table 28, using the Tukey post hoc test, found that statistically significant differences existed between group 5 (25 years or more) and groups 0 (Less than 5 years), 1 (5 to 9 years), 2 (10 to 14 years), 3 (15 to 19 years), and 4 (20 to 24 years).

For those participants with more than 25 years of experience in technical support, almost 25% of the time dedicated to computer-related support activities was spent on "Evaluating New Technologies." Using the amount of education as the independent variable and the "Computer Related Activities" as the dependent variable, ANOVA analysis indicated no statistically significant differences in the means of the groups.

Table 27: Results of ANOVA Analysis for Allocation of Time to Computer Related Support Activities Means Categorized by Experience, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Evaluating New Technologies:	SS	df	MS	F
Between Groups	1671.14	5	334.23	6.57**
Within Groups	6613.33	130	50.87	

Table 28: Results of Tukey Analysis for Means of Time Allocated to Evaluating New Technologies (in Percentages) by Years of Experience, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Years of Experience	$\bar{x}$	$\bar{x}$ Difference
> 25	23.57	-
< 5	8.65	14.92**
5 to 8	7.55	16.02**
10 to 14	7.92	15.65**
15 to 19	8.11	15.46**
20 to 24	5.50	18.07**

** $\alpha < .01$

Table 29: Results of ANOVA Analysis for Allocation of Time to Computer Related Support Activities Means Categorized by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Evaluating New Technologies:	SS	df	MS	F
Between Groups	957.75	6	159.63	2.76*
Within Groups	7283.24	126	57.80	
Maintaining Software:				
Between Groups	3217.51	6	536.25	3.06*
Within Groups	22072.77	126	175.18	

* $\alpha < .05$

Further, no statistically significant differences were found when gender was used as the independent variable for ANOVA analysis.

One-way ANOVA analysis, whose results are presented in Table 29, was performed using salary as the independent variable and "Computer Related Activities" as the dependent variables. Statistically significant differences existed for the means of the categories of "Evaluating New Technologies" and "Maintaining Software." For "Evaluating New Technologies," examination of the results of Tukey post hoc analysis indicated that differences existed between group 7 ($70,000 or more), and the groups of 1 (Less than $20,000), 2 ($20,000-$29,999), 3 ($30,000-$39,999), 4 ($40,000-$49,999), and 5 ($50,000-$59,999). These results are presented in Table 30.

Those participants who were paid $70,000 per year or more spent 25% of their computer-related support time on "Evaluating New Technologies." This is almost triple the time spent by other participants. The activity of "Maintaining Software" had one statistically significant difference, shown in Table31, between group 1 (Less than $20,000) and group 7 ($70,000 or more). Those individuals who made less than $20,000 per year

Table 30: Results of Tukey Analysis for Means of Allocation of Time to Evaluating New Technologies (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
> $70k	25.00	-
< $20k	7.00	18.00*
$20k to $30k	8.25	16.75*
$30k to $40k	7.43	17.57**
$40k to $50k	8.67	16.33*
$50k to $60k	9.03	15.97*

* $\alpha < .05$ ** $\alpha < .01$

Table 31: Results of Tukey Analysis for Means of Allocation of Time to Maintaining Software Activity (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
< $20k	39.00	-
> $70k	8.33	30.67*

* $\alpha < .05$

spent 39% of their time dedicated to computer-related support activities on maintaining software, while those who made $70,000 or more spent just over 8% on the same task.

Research Question 5

As represented by a percentage of time when providing technical support, which of the six methods of support was used most often?

At almost 48%, "On Site Support" was the support method used most often by the participants of the survey. "Support by Telephone" was the second most often used method of support at just under 17%. "On-line Support" was the least used method of support at 5.8%. These support type percentages are shown in Table 32.

The following list defines the categories for support types and is presented in the order in which they presented in the questionnaire.

1. Telephone Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff using the phone. This support refers to the resolution of software and/or hardware problems.
2. Walk In Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff when they visit your office or place of work.

3. On Site Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff by visiting their office or place of work.
4. On-line Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff through the use of video chat, instant messaging, chat room, or software that allows remote control of PCs (PC-Anywhere, VNC, Remote Desktop Sharing).
5. Email Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff by sending email.
6. Other Support – Any other form of support not mentioned in the previous categories.

Research Question 6

How did the factors of student population, experience, education, gender, and salary affect the frequency of each method of support?

Using the six methods of support as the dependent variables and student population as the independent variable, one-way ANOVA analysis indicated that statistically significant differences existed in the support categories of "Telephone Support," "On Site Support," and "Email Support." The results are shown in Table 33.

The Tukey analysis, presented in Table 34, for "Telephone Support" indicated

Table 32: Support Type Percentages, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Types of Support	Min	Max	$\bar{x}$
On Site Support	0	100	47.58
Telephone Support	0	90	16.84
Email Support	0	50	11.78
Walk In Support	0	50	11.10
Other	0	80	6.92
On-line Support	0	30	5.78

Table 33: Results of ANOVA Analysis for Allocation of Time to Methods of Support Means Categorized by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Telephone Support:	SS	df	MS	F
Between Groups	8468.38	8	1058.55	6.32**
Within Groups	20769.58	124	167.50	
On Site Support:				
Between Groups	23435.60	8	2929.45	4.22**
Within Groups	86037.65	124	693.85	
Email Support:				
Between Groups	2934.67	8	366.83	3.56**
Within Groups	12789.86	124	103.14	

** $\alpha < .01$

statistically significant differences between group number 5 (8,000 to 9,999 students) and the groups of 1 (Less than 2,000 students), 2 (2,000 to 3,999 students), 3 (4,000 to 5,999 students), and 9 (Greater than 50,000 students). Similar analysis, shown in Table 35, suggested statistically significant differences between group 4 (6,000 to 7,999 students) and the groups of 1 (Less than 2,000 students) and 9 (Greater than 50,000 students).

For those individuals who supported student populations of 8,000 to 9,999 students, an average of just over 41% of the support was provided via telephone, which is a statistically significant difference when compared to the average times spent by supporters of student populations of 2,000 to 3,999 students, 4,000 to 5,999 students, less than 2,000 students, and more than 50,000 students. Those participants who supported between 6,000 and 7,999 students used the telephone to provide support just over 30% of the time, which is approximately triple the amount of time spent by those who supported student populations of less than 2,000 students and more than 50,000 students.

A statistically significant difference was found between group 1 (Less than 2,000 students) and group 4 (6,000 to 7,999 students), as shown in Table 36. Statistically significant differences, as shown in Table 37, were also found between group 9 (Greater than 50,000 students) and the groups of 4 (6,000 to 7,999 students) and 5 (8,000 to 9,999 students) for the activity of "On Site Support." For participants who supported less than 2,000 students, visiting the location of the problem occurred an average of almost 54% of the time. Those participants who supported more than 50,000 students averaged almost 74% for the same method of support.

The results of the Tukey analysis, shown in Table 38, for "Email Support," suggested differences between group 8 (14,000 to 49,999 students) and the groups of 1 (Less than 2,000 students), 2 (2,000 to 3,999 students), 3 (4,000 to 5,999 students), 6 (10,000 to 11,999 students), and 9 (Greater than 50,000 students). For the individuals who supported 14,000 to 49,999 students, an average of almost 30% of the support provided was done via email. This was statistically significant.

Table 34: Results of Tukey Analysis for Means of Time Allocated to Telephone Support (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
8k to 10k	41.25	-
< 2k	10.48	30.77**
2k to 4k	17.84	23.41*
4k to 6k	17.31	23.94*
> 50k	9.44	31.81**

k = 1000 students

* $\alpha < .05$

** $\alpha < .01$

Table 35: Results of Tukey Analysis for Means of Time Allocated to Telephone Support (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
6k to 8k	30.50	-
< 2k	10.48	20.02**
> 50k	9.44	21.06*

k = 1000 students

* $\alpha < .05$
** $\alpha < .01$

Table 36: Results of Tukey Analysis for Means of Time Allocated to On-site Support (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
< 2k	53.98	-
6k to 8k	17.50	36.38**

k = 1000 students

** $\alpha < .01$

Table 37: Results of Tukey Analysis for Means of Time Allocated to On-site Support (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
> 50k	73.67	-
6k to 8k	17.50	56.17**
8k to 10k	16.50	57.17*

k = 1000 students

* $\alpha < .05$
** $\alpha < .01$

Table 38: Results of Tukey Analysis for Means of Time Allocated to Email Support (in Percentages) by Student Population, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Student Population	$\bar{x}$	$\bar{x}$ Difference
14k to 50k	29.50	-
< 2k	10.62	18.88**
2k to 4k	13.06	16.44*
4k to 6k	9.23	20.27**
10k to 12k	7.00	22.5*
> 50k	4.22	25.28**

k = 1000 students

* $\alpha < .05$

** $\alpha < .01$

Table 39: Results of ANOVA Analysis for Allocation of Time to Methods of Support Means Categorized by Level of Education, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Walk in Support:	SS	df	MS	F
Between Groups	1118.17	4	279.54	2.47
Within Groups	13454.76	119	113.06	
On Site Support:				
Between Groups	16073.88	4	4018.47	5.57**
Within Groups	85937.05	119	722.15	
Email Support:				
Between Groups	1811.72	4	452.93	4.68**
Within Groups	11513.25	119	96.75	

** $\alpha < .01$

Table 40: Results of Tukey Analysis for Means of Time Allocated to Walk In Support (in Percentages) by Level of Education

Degree	$\bar{x}$	$\bar{x}$ Difference
High School	6.04	-
Master's	14.42	-8.38*

* $\alpha < .05$

One-way ANOVA analysis, whose results are presented in Table 39, found no statistically significant differences between groups for the dependent variables of the methods of support and the independent variable of experience. The results of ANOVA analysis for methods of support and level of education suggested differences in the support methods of "Walk In Support," "On Site Support," and "Email Support."

Examination of the Tukey analysis in Table 40, for "Walk In Support," indicated statistically significant differences between group 1 (High School) and group 4 (Master's Degree). Those participants with a Master's degree provided support via "Walk-In" visitation an average of just over 14% of the time, which is just over 8% more for the same type of support provided by participants with a high school diploma.

Further Tukey analysis, presented in Table 41, for "On Site Support" and level of education, found statistically significant differences between group 4 (Master's Degree) and the groups of 1 (High School) and 2 (Associate's Degree). Those participants with an Associate's Degree or only a High School diploma provided approximately 60% of heir support at the location of the problem as compared to almost 36% of the same type of support by participants with a Master's degree.

Table 41: Results of Tukey Analysis for Means of Time Allocated to On-site Support (in Percentages) by Level of Education, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Degree	$\bar{x}$	$\bar{x}$ Difference
Master's	35.55	-
High School	62.65	-27.10**
Associate's	63.60	-28.05*

* $\alpha < .05$ ** $\alpha < .01$

The Tukey post-hoc analysis was performed for "Email Support." The results are presented in Table 42. Statistically significant differences were found between group 4 (Master's Degree) and the groups of 1 (High School) and 2 (Associate's Degree). ANOVA analysis, whose results are presented in Table 43, for the independent variable of gender and the dependent variables of methods of support, found that statistically significant differences existed for the methods of "Walk In Support" and "On-line Support." These differences are presented in Table 44 and Table 45.

When providing support during the school year females spent more time than males when the individual needing support visited the technician, known in this study as "Walk In" support. Conversely, males spent more time per year providing "On- line" support, such as interaction via email, than did their female counterparts.

The results of the ANOVA analysis for methods of support as the dependent variables and salary as the independent variable are shown in Table 46. ANOVA analysis indicated differences in "On-Site Support" and "Email Support." Tukey analysis, whose results are presented in Tables 47 and 48, for "On-Site Support" indicated statistically

Table 42: Results of Tukey Analysis for Means of Time Allocated to Email Support (in Percentages) by Level of Education, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Degree	$\bar{x}$	$\bar{x}$ Difference
Master's	14.68	-
High School	6.30	8.38*
Associate's	5.53	9.15

* $\alpha < .05$

Table 43: Results of ANOVA Analysis for Methods of Time Allocated to Support Means Categorized by Gender, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
Walk in Support:	SS	df	MS	F
Between Groups	713.73	1	713.73	6.45*
Within Groups	14848.83	134	110.74	
On-line Support:				
Between Groups	326.40	1	326.40	6.42*
Within Groups	6816.98	134	50.87	

* $\alpha < .05$

Table 44: Mean Difference for Time Allocated to Walk in Support by Gender, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Group 1	$\bar{x}$	Group 2	$\bar{x}$	$\bar{x}$ Difference
Female	13.93	Male	9.24	4.69

Table 45: Mean Difference for Time Allocated to On-line Support by Gender, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Group 1	$\bar{x}$	Group 2	$\bar{x}$	$\bar{x}$ Difference
Female	3.87	Male	7.04	-3.17

Table 46: Results of ANOVA Analysis for Methods of Time Allocated to Support Means Categorized by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category				
On Site Support:	SS	df	MS	F
Between Groups	15006.69	6	2501.12	3.32*
Within Groups	95032.13	126	754.22	
Email Support:				
Between Groups	2857.69	6	476.28	4.65**
Within Groups	12902.04	126	102.40	

* $\alpha < .05$ ** $\alpha < .01$

Table 47: Results of Tukey Analysis for Means of Time Allocated to On-site Support (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
< $20k	79.20	-
$60k to $70k	27.86	51.34*

* $\alpha < .05$

Table 48: Results of Tukey Analysis for Means of Time Allocated to On-site Support (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
< $20k	79.20	-
> $70k	13.33	65.87*

* $\alpha < .05$

Table 49: Results of Tukey Analysis for Means of Time Allocated to Email Support (in Percentages) by Salary, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Salary	$\bar{x}$	$\bar{x}$ Difference
> $70k	38.33	-
< $20k	8.00	30.33**
$20k to $30k	8.44	29.90**
$30k to $40k	9.84	28.50**
$40k to $50k	11.12	27.21**
$50k to $60k	13.78	24.55**
$60k to $70k	17.29	21.04

** $\alpha < .01$

significant differences existed between group 1 (Less than $20,000) and groups 6 ($60,000-$69,999) and 7 ($70,000 or more). For those participants who made less than $20,000 per year, an average of just over 79% of the support was done "On-Site." This is a statistically significant difference from the percentages for the same method of support provided by those participants making more than $60,000 per year.

Further Tukey analysis, whose results are presented in Table 49, for "Email Support" suggested statistically significant differences between group 7 ($70,000 or more) and all other salary groups except group 6 ($60,000-$69,999). When providing support, participants of the survey who made more than $70,000 per year used email just over 38%of the time. This was a statistically significant difference when compared to the percentages of all other individuals within the survey for the same type of support.

Other Statistics

Table 50 contains the results of descriptive statistics analysis upon other pieces of information gathered by the questionnaire. The following list defines the categories used for this analysis.

1. Months Worked Per Year – This is the reported months the participants worked per year, if they were not on a twelve-month contract.
2. Years in Current Position – This is the amount of years the participant had worked in their current position.
3. Years in Tech Support – This is the total amount of years the participants had worked in the field of Tech Support.
4. Salary – This is the reported salary of the participants.

5. Hours Worked per Week – This is the amount of hours the participants spent meeting the needs of their employment.
6. Hours Contracted to Work – This is the amount of hours per week that the participants were contracted to work.
7. Student Population – This is the number of students enrolled at the participants place or region of employ.
8. Personal Development – This is the amount of hours per week that the participants spent on developing their technical support skills and keeping their knowledge of technology current.

Table 50: Other Statistics, Technical Support Personnel, Tennessee Public Schools K-12, Summer 2002.

Category	Valid N	Min.	Max.	$\bar{x}$
Salary	133	1500	73000	41694*
Student Population	133	5	250000	13614*
Hours Worked per Week	135	3	95	45.01
Hours Contracted to Work	129	0	80	38.17
Months Worked Per Year	31	9	12	10.77
Personal Development	134	0	40	8.64
Years in Tech Support	136	0	33	8.59
Years in Current Position	136	0	26	6.26

* Mean rounded to the nearest whole number

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE STUDY

Introduction

As presented in the review of the literature, the researcher was unable to find any specific studies involving the daily or yearly activities of technical support staff within public schools. This lack of published research, combined with the researcher's own experience within the field of technical support, helped to provide the motivation for this study.

Following example of similar studies (Lindsey, 1989) of teachers and administrators of public school systems, this study sought to categorize the daily routine of the average technical support worker. It was found through conversations with several such workers that using a daily time frame would be inappropriate. The daily duties of the technical support worker in the public school systems vary by season, so the decision was made to shift the time frame to a yearly one.

Through Mr. Tom Bayersdorfer, the Director of Information Technologies for the Tennessee Department of Education, contact was made via email to 192 individuals who provided technical support for the public K-12 school system of Tennessee. These individuals included technicians, technology specialists, and technical coordinators, and were known as technicians for the purpose of this study. During a two-month period, these individuals were asked to complete an on-line questionnaire concerning their yearly

activities. Keeping participants' email addresses separate from their answers to the on-line questionnaire ensured the anonymity of the study. After the successful completion of the questionnaire, the order of the databases containing the email addresses and answers was randomized. Awarding two $100 cash prizes and two Palm PDAs to four randomly selected participants encouraged participation in the study. Of the possible 192 participants, 136 valid responses to the on-line questionnaire were received.

The questionnaire, which is shown in Appendix B, was divided into four sections. The first section dealt with general support activities while the second section dealt with computer-related support activities. The third section dealt with the methods of support and the fourth section asked questions about demographic information such as gender, race, and education. Creation of the questionnaire was guided by the study's research questions.

Summary of the Findings

The largest portion of the average technician's time (43%) during the school year was spent supporting computer-related technologies such as personal computers and software. Those individuals who made less than $20,000 per year spent significantly more of their time (69%) on computer-related support as compared to the time spent (11%) on the same task by individuals who made at least $70,000 per year.

While the activity of "Direct Instruction in the Use of Technology" occupied just over 10% of the average participant's year, women spent more time (16.7%) on that task than did their male counterparts (7.3%). The average female participant also spent more

time (7.5%) on curriculum preparation when compared to the time spent (3.4%) by the average male participant on the same activity. Curriculum preparation accounted for 5% of the average participant's yearly time. These gender differences may be attributed to the larger number of males in administrative positions as opposed to females.

Years of experience in technical support provided the greatest differences in the activity of "Direct Instruction in Other Subjects." Those individuals with 20 to 24 years of experience spent 21.2% of the school year teaching other subjects, which is statistically different from the time spent by all other participants teaching other subjects. This difference may also be due to administrative duties. Instruction of other subjects occupied 2.2% of the average participant's year.

The activity of "Administrative Tasks" had the greatest differences between the factors used as independent variables. The amount of time spent on administrative duties seemed to increase with a participant's salary, years of experience, and the size of the supported student population. Individuals with a yearly salary of more than $70,000 per year spent 46.7% of the school year on "Administrative Tasks." The same activity occupied 20% of the year for participants with 25 years or more experience. For the factor of student population, those individuals supporting 14,000 to 50,000 students spent 26.3% of the year on administrative duties. This generalization varied slightly, as individuals who supported more than 50,000 students only spent 4% of the year on the activity of "Administrative Tasks."

Of the activities dealing with computer-related support that were in Section 2 of the on-line questionnaire, "Maintaining Existing Software" and "Maintaining Existing

Hardware," required the most time at 24.5% and 22.5% of the year, respectively. Only the independent variable of salary had any statistically significant differences for the dependent variable of "Maintaining Existing Software." Individuals making less than $20,000 per year spent, on average, 39% of the year on software support while those participants who made more than $70,000 per year spent 8.3% on the same task.

In the questionnaire, "Personal Professional Development" was defined as "reading technical journals or research papers and attending training sessions on new software or hardware." The individuals that supported over 50,000 students spent 22.4% of the time during the year engaged in that activity, while the next largest percentage went to those who supported less than 2,000 students at 9.1%.

The factors of salary and experience had the only statistically significant differences for the activity of "Evaluating New Technologies." Individuals making more than $70,000 per year spent an average of 25% of their time evaluating new technologies while the next largest percentage of time was 9% for those who made between $50,000 and $60,000 dollars. Those participants with more than 25 years of experience spent an average of 23.6% of their time during the year evaluating new technologies, while the rest of the participants spent less than 9% of the time on the same task.

Section 3 of the questionnaire dealt with how support was provided by the participants. The percentages provided by the participants represented the percentage of time spent performing a specific type of support. When a participant was providing support during the school year, most support was performed "On Site" where the technician visited the location of support (47.6%) or via the telephone. (16.8%) "On Site"

support registered significant differences in the factors of student population, education, and salary.

Those individuals supporting less than 2,000 students and more than 50,000 students performed "On Site" support 54% of the time and 74% of the time, respectively. When providing support, those participants with only a high school diploma provided "On Site" support 62.7% of the time while those participants with an Associate's degree provided "On Site" support 63.6% of the time. This is compared to 35.6% for those participants with a Master's degree. Participants making less than $20,000 per year spent 79.2% of the time dedicated to support performing "On Site" support as compared to 27.9% for those making $60,000 to $70,000 and 13.3% for those making more than $70,000 per year.

Of the time dedicated to providing support during the school year, telephone support was provided most often by individuals supporting 8,000 to 10,000 students at 41.3% of the time and those supporting 6,000 to 8,000 students at 30.5% of the time. The rest of the participants spent less than 18% of their support time utilizing the telephone.

The Average Participant

In an effort to summarize the demographic statistics collected by this study, a picture of the "average" participant was constructed. The average participant was a male Caucasian with a Master's Degree employed on a twelve-month contract. He worked 45 hours per week at $41,693 per year and supported a student population of 13,614

students. This person had 8.6 years experience in technical support and had worked in his current position for 6.3 years. This person had some form of teacher certification but no form of administrative certification and was a "district-level" employee.

Conclusions

During the last part of the twentieth century, as the presence of computers has increased in the public school systems, it is tempting to believe that this new technology will be the panacea for any ills found in the school systems. Administrators and politicians have often cited the levels of computer technology, such as computers per student ratios, as indicators of "success." The need for teacher training in the new technology, as well as the maintenance of the technology, seem to have been forgotten in the rush to embrace the new mindset that "computers will revolutionize the way we teach." In fact, computers have "revolutionized the requirements of support," thus, the rationale for this study. The researcher would suggest, based on the findings of this study, these conclusions:

- Average technical support personnel spend most of their time during the school year on the support of computer related technologies. Of the time spent supporting computer related technologies, most of it was used maintaining existing technologies. The maintenance of existing computer-related technologies occupied almost twice the amount of time as compared to the installation of new computer-related technologies.
- Salary and experience have the greatest effect upon the duties of technical support personnel. As one's salary or years of experience increase, so too does the amount of time per year spent on administrative tasks, personal development, and evaluating new

technologies. Conversely, the lower one's salary or years of experience, the greater the chance of performing computer related support during the majority of the year.

- Technical Support Personnel in Tennessee are well educated and well paid. The average participant in this study made $41,693 per year, while the average teacher in Tennessee made $37,413 per year and the average private sector worker in Tennessee made $30,352 per year. (American Federation of Teachers, 2001). It should be noted that this survey was conducted in 2002, whereas the salary figures for teachers were collected in 2001. At the time of this writing, no salary figures for Tennessee teachers were available for 2002.
- Among Technical Support Personnel, gender has little impact upon the allocation of time spent providing support during the school year though minor differences exist in the methods of providing that support.
- The majority of support during the school year involved the technician visiting the location in need of support.
- For providing support, email is almost as important as the telephone.

Recommendations for Future Study

The yearly activities of the technical support staff for Tennessee's K-12 public school systems are complex. Given the lack of studies on these individuals, as well as their counterparts in the other 49 states, it would be reasonable to pursue further investigations. The following are suggestions for possible expansions or modifications to the scope of this study.

The population sample for the study could be extended to the national level. The questionnaire of this study was available through the Internet and the participants were contacted via email. It is quite likely that a listserv, similar to the one used in this study, exists for other states. Contact could be made with other administrators asking their technical support personnel to complete a modified form of the questionnaire. If the modified questionnaire asked for a participant's state, comparisons between states and regions could be made.

The results of the analysis for this study indicated that almost no significant differences existed in the support provided by either gender. From an intuitive standpoint such differences should exist. A new study could focus specifically on establishing the existence of such differences and clarifying the extent of these differences. The results of such a study could be compared to the results of similar studies in other fields of employment, such as technical support providers for large corporations, to determine if any gender-based traits exist.

An important demographic overlooked by this study was participants' ages. It would be interesting to see how a participant's age corresponds to their salary and education. Such a study should also have to look at how an individual's age affected the distribution of tasks and methods of support.

A future study could have some means of identifying those individuals who entered employment with schools systems as a teacher and then "acquired" the duties and responsibilities of technical support. The study should also identify technical support

personnel that eventually began teaching. These two groups could then be compared to determine if any differences existed.

The data gathered by this study were based entirely on self-perception. Each individual was responsible for providing information about their perceptions of their duties during the year, which in some cases may not be accurate. A future study could involve a researcher spending time with selected technical support staff and recording their activities. The results of such a study could be compared to the results found in this study.

Finally, as examination of the results of this study suggested that maintenance of existing computer technologies occupied the most time during the year of the average technical support personnel, a future study could focus on the details of software and hardware support. Brand names and manufacturers of software and hardware could be identified in an attempt to determine which require the most support and why.

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APPENDICES

APPENDIX A

On-line Disclaimer

A study is currently being conducted at the University of Tennessee at Knoxville to investigate the daily activities of technical support staff in the educational arena. The primary motivation for this study is the hope that the results of this research will provide a greater insight into the ever-increasing responsibilities of the technical support staff within the public school systems of Tennessee.

Participants of this study will be asked questions about sensitive topics such as education level and salary. To help ensure the accuracy of the answers to the questionnaire, as well as protect the privacy of the participants, several measures will be taken to maintain the anonymity of the participants. These measures are:

1. Using the existing listserv for this group of technical personnel, an email will be sent to each participant asking for an email to the author of the study. The email will contain a URL that will link to the on-line questionnaire and a password to access the questionnaire.
2. Upon successful completion of the on-line questionnaire, each participant's questionnaire answers will be placed in a database. The order of the contents of the database will be automatically randomized every 24 hours.
3. Only the researcher will have access to raw data contained within the database. This information will be stored for 3 years and then destroyed.
4. After completing the questionnaire, participants will be asked to provide their email addresses. A PDA will be given to a random participant and that individual will be notified via their email address. The list of email address will be not be used for any other purpose. A participant's answers to the questionnaire will not be linked to their email address.
5. No information will be written to a user's computer during their completion of the online questionnaire for the survey.
6. The statistics generated for this study from the "raw" data collected will be generalized with no means of identifying any participant.

Please understand that by clicking on the link below and completing the online questionnaire constitutes informed consent of participation in this study.

Michael Ward
UTK Doctoral Student

APPENDIX B

Questionnaire

General Instructions: Sections 1, 2, and 3 of this questionnaire use percentages and for each of these sections, these percentages should total to 100%. The timeframe for Sections 1 and 2 corresponds to the length of your employment during the year and the term "School Year" is used to represent this period of time.

Section 1. – General activities. Please respond to the following questions regarding your general overall responsibilities during a school year. **For this section, the combined estimations should total 100%.**

1. Computer-related Technologies – During the school year, what percentage of time is spent fulfilling support responsibilities of computer-related technologies?

   _____% of School Year

2. Other Technologies – Time spent supporting those technologies that are not dependent upon a computer.

   _____% of School Year

3. Direct Instruction of Technological Subjects – Time that is devoted to direct instruction of students, teachers, technicians, and administrators about technological subjects.

   _____% of School Year

4. Direct Instruction of Non-Technological Subjects – Time that is devoted to direct instruction of students, teachers, technicians, and administrators about non-technological subjects.

   _____% of School Year

5. Curriculum Preparation – Time spent during the school year involving the preparation and planning of class curriculum.

   _____% of School Year

5. Office Management – Completing paperwork and required forms; ordering supplies; authorizing expenditures; making phone calls and maintaining personal contacts.

   _____% of School Year.

6. Administrative Tasks – Specifically those tasks that involve administrative functions such as staff meetings; evaluating employee performance; assigning responsibilities to staff; and arbitrating.

   _____% of School Year

7. Transition – Moving from one work location to the next including driving from one site to another for support purposes.

   _____% of School Year.

8. Other – Time spent on tasks, duties, or projects not listed or fitting within the previously defined categories.

   _____% of School Year

Section 2. – Activities involving computer-related technologies. For the time during the school year involving the support of computer-related technologies, please estimate the percentage of time for each category. **For this section, the combined estimations should total 100%.**

1. Keeping Up to Date – Reading technical journals and research papers; attending training sessions on new software or hardware. This is time spent during work hours, not research or reading done during personal time such as weekends or vacation.

   _____% of School Year.

2. Evaluating New Technologies – Installing and testing new software and/or hardware; attending vendor presentations.

   _____% of School Year.

3. Installing New Software – Installing new software including operating systems and/or applications.

   _____% of School Year.

4. Maintaining Existing Software – Troubleshooting existing software including operating systems and applications. Re-installing previously installed software including operating systems and/or applications. This should also include software upgrades.

   _____% of School Year.

5. Installing New Hardware – Installing new computer related hardware such as personal computers and/or their components as well as networking components.

   _____% of School Year.

6. Maintaining Existing Hardware – Troubleshooting computer related hardware such as personal computers and/or their components as well as networking components. This also includes hardware upgrades.

   _____% of School Year.

7. Other – Time spent on tasks, duties, or projects not listed or fitting within the previously defined categories.

   _____% of School Year.

Section 3. Support types. Of the time spent during the school year supporting educational staff, please specify the percentage spent on each type of support. **For this section, the percentages should total 100%.**

1. Telephone Support – Providing verbal support for school administrators, teachers, paraprofessionals, and other educational staff using the phone. This support refers to the resolution of software and/or hardware problems.

   ____% of Support.

2. Walk In Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff when they visit your office or place of work.

   ____% of Support.

3. On Site Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff by visiting their office or place of work.

   ____% of Support.

4. Email Support – Providing technical support for school administrators, teachers, paraprofessionals, and other educational staff by sending email.

_____% of Support.

5. Other Support – Any other form of support not mentioned in the previous categories.

_____% of Support.

Section 4. -Please respond to the following questions regarding your background:

1. What is the highest degree you have received? _____

2. Do you have or have you held a Teaching Certificate? Yes ___ No ___

3. Do you have an Administrative Certificate? Yes ___ No ___

4. Are you on a 12-month contract? Yes ___ No ___

5. Please indicate your gender. Male___ Female___

6. Please indicate your ethnicity.
   African-American_____
   Caucasian___
   Hispanic____
   Native American___
   Pacific Rim___

7. Are you district or building level personnel? District ___ Building ___

8. Time in current technical related position: (years) _____

9. Total time in educational technical support field: _____

10. What best describes your position?
    Administrative ___
    Technical Support ___
    Technical Training ___
    All of these ___

11. Indicate your yearly salary:

Less than $15000___
$15000-$20000____
$20001-$25000____
$25001-$30000____
$30001-$35000____
$35001-$40000____
$40001-$45000____
$45001-$50000____
$50000-$55000____
$55000-$60000____
$60000-$65000____
$70000 or more____

12. Please indicate the number of hours you work per week:_____

13. Please indicate the number of hours you are contracted to work per week:_____

14. Please indicate the number of months per year you work:_____

15. Please indicate the size of the student population you support:_____

16. Please specify the title (not the name) of your supervisor_____

APPENDIX C

Data from Cleveland School Systems

Respondent	s1.1	s1.2	s1.3	s1.4	s1.5	s1.6	s1.7	s1.8	s1.9	s1.T	s2.1	s2.2	S2.3	s2.4	s2.5	s2.6	s2.7	s2.T	s3.1	s3.2	s3.3	s3.4	s3.T	s4.1	s4.2	s4.3	s4.4	s4.5	s4.6	s4.7	s4.8	s4.9	s4.10	s4.11
1	75	0	0	0	1	1	0	0	23	100	10	0	0	0	50	30	10	100	0	0	100	0	100	1	1	0	0	2	2	1	1	2	1	1
2	5	5	50	20	0	10	4	1	5	100	10	0	0	0	75	10	5	100	0	50	50	0	100	0	0	0	1	2	2	1	1	1,2	1	1
3	83	3	1	1	3	5	2	5	2	105	5	1	5	10	5	69	5	100	5	0	93	2	100	1	1	0	1	2			1	4	1	2
4	60	10	0	0	0	0	20	5	5	100	10	10	10	5	30	30	5	100	30	30	30	10	100	1	1	1	1	1	1	2	3	4	3	4
5	5	0	0	0	0	0	0	0	90	95	0	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	1	2	1	1	1		1	2
6	5	0	0	0	0	0	0	0	90	95	0	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	1	2	2	1	1		1	1
7	5	0	0	0	0	0	0	0	90	95	0	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	1	2	2	1	1	3	1	1
8	50	10	5	5	0	10	0	0	20	100	15	10	5	5	5	50	10	100	0	0	90	10	100	0	0	0	0	2	2	1	3	2	1	1
9	50	10	5	0	0	10	0	0	25	100	10	10	5	10	5	50	10	100	0	0	90	10	100	0	0	0	0	2	2	1	3	2	1	1
10	90	3	0	0	0	5	0	2	0	100	5	5	10	10	50	5	15	100	10	20	50	20	100	0	0	0	0	2	2	2	1	2	1	1
11	10	5	0	0	10	30	0	2	43	100	0	0	0	0	50	50	0	100	10	5	10	75	100	1	0	0	0	2	2	1	1	2	1	1
12	75	0	0	0	5	5	5	5	5	100	10	10	5	20	10	40	5	100	25	20	25	30	100	1	1	0	0	1	1	1	1	3	2	1
AVG	43	3.8	5.1	2.2	1.6	6.3	2.6	1.7	33		6.3	3.8	3.3	5	23	28	5.4		6.7	12	45	13												
MED	50	3	0	0	0	5	0	0.5	22		7.5	0.5	2.5	2.5	7.5	30	5		0	5	40	6												
MODE	5	0	0	0	0	0	0	0	5		10	0	0	0	50	0	5		0	0	0	0												
STD DEV	35	4.2	14	5.8	3.1	8.5	5.8	2.1	36		5.3	4.8	3.9	6.4	26	24	5		11	16	40	22												

APPENDIX D

Questionnaire Reviewers

Ms. Charity Trillet, UTC Helpdesk Manager– Information Technology Division
Dr. Lloyd Davis, UTC Professor-College of Education & Applied Professional Studies
Dr. Clinton W. Smullen III, UTC Professor-Computer Science, Acting Director-Center of Excellence for Computer Applications
Dr. Dan Quarles, UTC Professor, Director– UTK/UTC Graduate Center, Assistant Associate Provost
Dr. Deborah Mcallister, UTC Professor– Teacher Preparation Academy, Technology Coordinator-21st Century Classroom
Dr. Gene Bartoo, UTC Professor and Head of Graduate Studies-College of Education & Applied Professional Studies
Mr. Tony Parsley, UTC Network Systems Analyst– Systems and Networks
Ms. Joan Bradburn, Technology Coordinator-Cleveland City School
Mr. Rodger Ling, UTC Helpdesk Director– Information Technology Division
Mr. Rusty Leutz, UTC Network Operations Manager– Systems and Networks

VITA

Michael Ward was born in Reed City, Michigan on September 19th, 1967. He graduated from Pine River High School in 1985 and received a B.S. in Computer Science from Michigan Technical University in 1989. After several adventures, including meeting and marrying his wife Cindy, he moved to Chattanooga, TN. In 1994, he received a M.S. in Computer Science from the University of Tennessee at Chattanooga. In the spring of 2003, Michael received his Ed.D. in Education from the University of Tennessee at Knoxville. He still lives in Chattanooga with his wife and two sons, Brennan and Quinlan, and works as the Manager of Advanced Technologies for the Center for Excellence in Computer Applications at the University of Tennessee at Chattanooga.