Availability, Effectiveness and Utilization of Computer Technology among High School Mathematic Teachers in the Instructional Process

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ABSTRACT

This study examined the levels of availability, effectiveness, and utilization of computer technology by high school mathematic teachers. The design for this study was descriptive-comparative. First, it sought to provide a demographic profile of the participants. Second, it sought to determine significant differences among teachers with different years of experience on the levels of availability, effectiveness, and utilization of computer technology. It also sought to determine significant differences among teachers in different size school districts on the levels of availability, effectiveness, and utilization of computer technology. The survey instrument was developed and administered to 74 math teachers. Results showed that teachers are having problems accessing computers and a strong need for more curricular-based software exists. Data showed that computer technology is helpful in instructional procedures and in the student learning process.

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Introduction

As the twenty-first century unfolds, one of the top issues in education is the use of computer technology in the classroom. Although in many instances, important strides are being made to integrate computer technology into the various school subjects, concern exists among educators that computers are still underutilized by a large segment of the teachers (Bogwell & Stetson, 1999).

Over the span of one decade, the number of computers and related classroom technologies have increased substantially. In 1989, there was one computer for every 37 students in America. By 1999 the ratio was one to seven (Technology Counts, 1999). While more than half of the computers were located outside of computer laboratories, only 15% of the nation's teachers had at least nine hours of technology training (Technology Counts, 1999).

Currently, schools are adding technological equipment at a high rate, however, contemporary research reveals that the average American school still makes inadequate use of computers and substantial numbers of schools have very restricted access to technology of any kind (Flores, 2000).

In addition, there is a growing concern that teachers, especially in the area of mathematics, are not taking advantage of the technological equipment that is available (Bogwell and Stetson, 1999). Many mathematics teachers still cling to traditional methods of teaching and make little use of the computer except for reward activities or events outside of the prescribed curriculum (Logan and Scheffler, 1999). Finally, quality in-service programs offered to all teachers have not kept pace with the technological advances available and teacher training has also fallen behind in this area (Logan and Schelffler, 1999).

Purpose and Significance of the Study

The purpose of the study was to examine the levels of availability, effectiveness, and utilization in the instructional process among high school mathematics teachers in Region II, located in South Texas. Information gathered in the study may help administrators and technology coordinators better understand the perceptions of teachers on the levels of availability, effectiveness, and utilization of computer technology in the instructional process. In this study, the teachers defined the problems and recommendations for proper solutions to

using computer technology in the instructional process. Knowing this information should make it easier for technology coordinators to better design high quality and successful technology plans. Effective technology plans will further help teachers and most importantly the students.

Subjects of the Study

The target population consists of all Texas high school mathematics teachers currently working in a Region II regular instructional high school. There are currently ten Texas counties in the Region II area. Region II has 35 Independent School Districts with 39 regular instructional high schools. Region II consists of five, 5A regular instructional high schools, nine 4A, regular instructional high schools, twelve 3A, regular instructional high schools, nine 2A, regular instructional high schools, and four 1A, regular instructional high schools.

All mathematics teachers working in a regular instructional high school were surveyed on the levels of availability, effectiveness, and utilization of computer technology in the instructional process. The predicted return rate of the surveys was 60%.

The Problem

The problem analyzed was the actual use of computer technology by teachers of mathematics in ten counties of South Texas. It was believed that a "snapshot" of the availability, and use of this technology was necessary in order that a possible generalization to other Texas districts could be applied.

Instrumentation

A five-part survey questionnaire was developed based on a review of relevant literature. Each part utilized a Likert-type scale to record the teachers' responses to statements on levels of availability, effectiveness and utilization of

computer technology in the classroom. There were five possible responses: strongly agree, agree, no opinion, disagree, and strongly agree. Each of these responses were numerically coded for analysis, such as strongly agree = 5, agree = 4, undecided = 3, disagree = 2 and strongly disagree = 1.

Several measures were used to insure the validity and reliability of the research instrument. The validity of the instrument was examined by a panel of selected experts (N=6). Each panelist examined the instrument for content, clarity and appropriateness. In order to insure the reliability of the instrument, a pilot study was conducted and the Cronbach alpha statistical procedure was used to determine internal consistency and item by item reliability (Borg and Gall, 1996).

Research Design

This research was concerned with determining the levels associated with the availability, effectiveness, and utilization of computer technology as a teaching tool. A questionnaire was utilized to gather the data for the study. The design for this study was a descriptive-comparative design. This research involved making careful descriptions of an educational phenomenon. Descriptive statistics, such as mean and standard deviations were utilized to analyze the levels of availability, effectiveness, and utilization among mathematics high school teachers. Descriptive statistics were also utilized to analyze the demographics data of the high school mathematics teachers in Region II. The descriptive part of the research provided descriptions in the form of statistics such as frequencies, ranking, means and percents. For the causal comparative part of the research, the mathematic teachers were categorized into two groups based on the school size. The first group consisted of teachers in a regular instruction high school with enrollment of 844 and below. Comparisons were then made on the levels of availability, effectiveness and utilization of computer technology. In addition, the mathematic teachers were also categorized into four groups based on the years of experience. Groups then were categorized by years of experience: 0 – 4, 5 – 9, 10 – 14, and 15 and above. Comparisons were made between the four groups on the levels of availability, effectiveness, and utilization of computer technology.

Data Collection

A letter of permission to conduct the study was sent to each superintendent of the participating regular instructional high schools. A letter of permission was then sent to each principal. After permission was granted from the principal, the survey instrument, a stamped self-addressed envelope, and a letter of introduction explaining the study was mailed to the survey participants. Return envelopes and the surveys were coded for follow-up purposes. Two weeks after the initial mailing, a follow-up was made to the non-respondents. Data were collected and organized to facilitate analysis. All returned surveys were examined for completeness and accuracy and an ID number was assigned to every individual from whom data were collected.

Data Analysis

Data were transferred into the Statistical Package for Social Science (SPSS). SPSS is a comprehensive and flexible statistical analysis and data management software program that allows for simple creation of frequency tables, descriptive statistics, exploratory statistics and cross-tabulation tables. Statistical measures of central tendency such as the mean, median, and the mode were investigated. The statistical measure of variability – the range, standard deviation, and variance were recorded and descriptive statistics were calculated for each section of the survey.

The analysis of variance (ANOVA), a statistical method of testing for significant differences between the means of two or more groups, was used to test the six hypotheses. For the first hypothesis the ANOVA tested the significant differences between the groups of participants with years of experience on the levels of availability of computer technology. Levels of availability were the dependent variable and the years of experience were the independent variable. For the second hypothesis, the ANOVA tested significant differences between the groups of participants with years of experience on the levels of effectiveness of computer technology. The levels of effectiveness category were the dependent variable and the years of experience the independent variable. For the third hypothesis the ANOVA tested for significant differences between the groups of participants with years of experience on the levels of utilization of computer technology. Levels of utilization category were the dependent variable and the years of experience portion the independent variable. For the next three

hypotheses, the data was divided into two groups. The first group consisted of data from teachers in a 5A and 4A schools. The second group consisted of data from teachers in a 3A, 2A, and 1A schools. For the fourth hypothesis the ANOVA tested for significant differences among the teachers in 5A and 4A with those who were in a 3A, 2A and 1A school on the levels of availability of computer technology. The levels of availability section was the dependent variable and the school size was the independent variable. For the fifth hypothesis the ANOVA tested for significant differences among the teachers in 5A and 4A with those who were in a 3A, 2A, and 1A school on the levels of effectiveness of computer technology. The levels of effectiveness category was the dependent variable and the school size was the independent variable. For the sixth hypothesis the ANOVA tested for significant differences among the teachers in 5A and 4A with those who are in a 3A, 2A, and 1A school on the levels of utilization of computer technology. The levels of utilization category was the dependent variable and the school size was the independent variable.

Analysis of Data Summary

Availability of Computer Technology

According to the participants' responses some schools have not developed a listing of local individuals who may provide service and support for computer hardware, operating systems and software applications. Majority of the teachers believed that more curricular-based software that is desired. Data showed that teachers with 1-8 years of experience felt a little more strongly for the need of more curricular-based software. The ANOVA showed that there were no statistical significant differences among the three groups of years of experience regarding the levels of availability of computer technology in the instructional process. The ANOVA showed that there were statistically significant differences between the two groups of school size regarding the levels of availability of computer technology in the instructional process. The following availability scales items had significant differences between the two groups: "My school in-services all staff members in how to most easily receive service and support"; "My school has designed a plan for incorporating additional technology (e.g. Internet in every classroom, distance learning, and so on) in our existing facility"; and "My school has completed an inventory of what hardware and software exists

and what is needed in the near future to best serve students learning needs". This data showed that 1A-3A districts provided more training for teachers in how to most easily receive service and support. Participants from 1A-3A districts concurred that their school has designed a plan for incorporating additional technology (e.g. Internet in every classroom, distance learning, and so on) in their existing facility. Participants from 1A-3A districts agreed that their school has completed an inventory of what hardware and software exists and what is needed in the near future to best serve students learning needs.

Effectiveness of Computer Technology

Data showed that the participants felt that computer technology is helpful in their daily tasks, instructional procedures, and in the student learning process. Teachers are using computer technology to help them keep accurate classroom records. All indicators showed that the majority of the teachers believed that computer technology does enhance the students understanding of course content. However, the participants have not determined if the use of computer technology has made a difference in their students learning. This indicates that teachers are using computer technology more for their administrative tasks rather than for the instructional process for the advancement of student learning.

Regarding the levels of effectiveness of computer technology among teachers with different years of experience, the ANOVA showed that there were no statistically significant differences between the three groups of years of experience regarding the levels of effectiveness of computer technology in the instructional process. However, it appears that more teachers from the 1-8 years of experience group felt that using technology does not add to their responsibilities more than it benefits their students.

Regarding the levels of effectiveness of computer technology among teachers by school size, the ANOVA showed that there were no statistically significant differences between the groups of school size regarding the levels of effectiveness of computer technology in the instructional process.

Utilization of Computer Technology

The participants' interest in computer technology is as follows: 28 (39%) high interest, 41 (58%) medium interest, and 2 (3%) low interest. Majority of the teachers have a medium or high interest in computer technology. The greater part of high interest of computers came from teachers with 1-8 years and 9-17 years of experience. Only five (7%) participants have their own web page for student use.

Results showed that the teachers are using computers on a regular basis to help them on their classroom management. Data also revealed that the teachers are not using software to create lessons nor to create and score exams. Data does indicate that teachers are interested in learning new ways to integrate technology into their classes. Teachers desire to do more with computer technology than just daily administrative tasks because they believe it would be helpful with their instruction and student understanding of mathematics.

Regarding the levels of utilization of computer technology among teachers with different years of experience, the ANOVA showed that there were significant differences between the three groups of years of experience regarding the levels of utilization of computer technology in the instructional process. The following utilization scale items had significant differences between the three groups: "I use the computer to access information sources for my work", "I utilize a word processor to prepare lesson plans, class notes, correspondence, course syllabi and other written documents"; and "I use electronic mail as a personal and professional tool".

The data noted that teachers with 1-8 years of experience utilize the computer to access information sources for their work more than the teachers with 18+ experience. Participants with 18+ years of experience believe that Email or chat sessions do not necessarily help in becoming a better teacher. Therefore, it was found that those in the 1-8 years of experience group utilize a word processor to prepare lesson plans, class notes, correspondence, course syllabi and other written documents more than those in the 18+ group.

Regarding the levels of utilization of computer technology among teachers by school size, the ANOVA showed that there were no significant differences between the two groups of school size regarding the levels of utilization of computer technology in the instructional process.

Conclusions

Availability of Computer Technology

Results from this study demonstrated that high school mathematics teachers are having a problem accessing computers or software for their instructional needs. There is a strong need for more curricular-based software.

This study also indicates that the teachers know whom to go to when technical problems occur, but they desire more computer training on how to utilize computer technology more effectively in the instructional process. The review of literature revealed that teacher use of technology is an effective means of increasing student interest in their learning experience. However, a major concern by the teachers was the need for greater assortment of software products for their classrooms (Clark, 2000). This also corresponds to the research conducted by Hardy (1998), in which teachers have many concerns about using computer technology such as: lack of hardware and software; low quality hardware and software; how to effectively integrate computers into the curriculum; and lack of adequate training to build their confidence and computer skills to use computer technology effectively. The literature further reflects that some teachers are dissatisfied with the inadequate quality of educational software available to them, or dissatisfied with results of using computers in their classes. Literature additionally demonstrates that training, time, access, and cost are some issues in the implementation and integration of technology into classroom instruction (Fabry & Higgs, 1997).

Effectiveness of Computer Technology

Participants in this study felt that computer technology is helpful in their daily tasks, instructional procedures, and in the student learning process. Teachers are using computer technology to help them keep accurate classroom records.

All indicators showed that the majority of the teachers believed that computer technology does enhance the students understanding of course content. According to student perceptions, high levels of technology does help them to remember facts along the way to better performance on tests (George & Sleeth, 1996). David Skimmer also concluded that on average, students who used computer-based instruction scored at the 64th percentile on tests of achievement compared to students in the control conditions without computers who scored at the 50th percentile and that students learn more in less time when they receive computer-based instruction (Skinner, 1997). This also corresponds to research by Blanton, Mayer and Schustack (1999) in which they provided evidence that appropriate experience with computer technology can promote significant psychological changes in students, including strategies for comprehending written instructions, strategies for devising problem solving plans, and even in basic academic skills.

Utilization of Computer Technology

Data showed that the participants have not determined if the utilization of computer technology has made a difference in their students learning. This further indicates that teachers are using computer technology more for their administrative tasks rather than for the instructional process in the advancement of student learning. The literature notes that educators are essential to the effectiveness of technology (Kemp, 1997).

As Vanfossen (2001) expresses, computers alone do not automatically transform the nature of teaching and learning; instead, it is the means in which teachers integrate computers into classrooms, the substance of technology-aided lessons, and the quality of software programs chosen that reveal whether and how computers in schools really assist and benefit students.

Majority of the teachers have a medium or high interest in computer technology. Data showed that the teachers are using computers on a regular basis to help them on their classroom management. The data also revealed that the math teachers are not using software to create lessons nor to create and score exams. However, it does indicate that teachers are interested in learning new ways to integrate technology into their classes.

Teachers wish to do more with computer technology than just for daily administrative tasks. Participants indicated that they want to use computer technology in the classes because they believe that it would be helpful with their instruction and beneficial in the student learning process. This corresponds to the review of literature that although many teachers believe that computers are an important component of a student's education, their lack of knowledge and experience lead to a lack of confidence to attempt to introduce them into their instruction (Pelton & Pelton, 1996).

It can be concluded that the majority of the participants are using word processing tools to type lesson plans, class notes, correspondence, course syllabi and other written documents. This is in parallel with the review of literature that reveals the majority of computer usage involves word processing, email, and basic test creation (Bell & Fidishum, 2000). At the same time, however, there was a lack of computer use in actual lesson instruction, lesson research and individualized planning. General reasons for this non-use ranged from lack of proper equipment, in-service, and lack of administration support.

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