Factors Correlating with Teachers' Use of Computers in the Classroom

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Dissertation.com
Boca Raton, Florida
USA • 2008

ISBN-10: 1-59942-704-4
ISBN-13: 978-1-59942-704-1

Abstract

This study examined several factors relating to the use of computers in the classroom by teachers. The factors examined in this study included teacher attitudes, emotions, beliefs and outside influences. This was done by a review of past studies, administering two surveys (demographics questionnaire and Computer Attitude Scale) and analyzing the survey data. Questionnaires were distributed to faculty at five randomly selected schools in the Chicagoland area participating in the study. Data from the surveys were then examined by principle components analysis, multiple correlation and multiple regression analyses to determine which factors correlate with teacher computer use in the classroom.

This study found that a greater amount of computer experience fostered more positive attitudes towards computers. Teachers with greater years of computer experience were more comfortable with computers. The study also found that usefulness is correlated with grade level taught, teaching experience and classroom use and that computer liking is correlated with grade level taught and teaching experience.

The main goal of this study was to examine the relationship between teachers' attitudes, emotions, beliefs, outside influences and teachers use of computers. The results should help administrators and teachers understand why faculty embrace or resist technology. The findings suggest that training professionals should consider many of the correlations between factors found in this study when designing professional development programs for teachers.

Table of Contents

List of Tables

Acknowledgements

I would like to express my sincere gratitude to everyone who contributed to the completion of this dissertation. There were many people who made this project possible.

Special appreciation goes to my dissertation committee chair, Christopher Murray, whose guidance and direction were most helpful at every step of the research process. His understanding, support and patience were essential in completing this dissertation. I am eternally grateful to Chris for his role in this project. Special thanks goes to my committee members, Roxanne Owens and Jeffrey Kuzmic, whose suggestions and comments were always helpful and insightful. I would also like to thank all of my professors at DePaul University for their guidance through both my masters and doctoral work.

My study could not have been possible without the participation of the teachers who took the time to complete and return the survey. Their willingness to share is greatly appreciated.

I wish to acknowledge my family and friends for their continued support. They never failed to motivate me. Most of all, I am grateful to my loving husband, Naveed, who encouraged and supported me through the entire research process. His love, compassion and understanding has helped me to come this far.

S.A.W.

We are on the front porch of the 21st century, and public education in the U.S. is facing both enormous changes and tremendous challenges. Our world is evolving faster than at any time in our history, and we are literally rocketing out of the Industrial Age into the Information Age.

Delaine Eastin, 1999

CHAPTER I

Introduction

Technology is becoming increasingly common in today's fast-paced society. Employers expect schools to prepare students for the modern workplace (Eastin, 1999). Jobs of the future will require higher order thinking and technology skills (Berliner & Biddle, 1995; Bradley & Russell, 1997; Chou, 2001; Davis, 1997; Fary, 1988; Fuller, 2000; Glennan & Melmed, 1996; Llorens, Salanova & Grau, 2002-2003; Necessary & Parish, 1996). "Some researchers have claimed that computer literacy, however defined, pays off in higher wages, further strengthening the educational rationale for using computers in schools" (Cuban, 2001, p. 178).

In an effort to prepare students for the future, teachers are being pressured to use computers in classrooms (Clark, 2000). Much of this pressure is coming from the business community and federal government (Besser, 1993; Cochran-Smith, 2000; Cuban, 2001; Decker, 1999; Kinslow, Newcombe & Goss, 2002; Nash & Moroz, 1997; Painter, 2001; Pinkston, 2000). According to the National Center for Educational Statistics (1995), implementing technology in schools is a national, state and local educational goal. Unqualified workers cost corporations billions in training each year (Campbell, 1998; McCune, 1999). Due to the lack of qualified workers in the United States, forty percent of human resource firms have already set up overseas recruiting operations (Eastin, 1999). Companies are searching for employees that are able to understand, interpret and apply concepts, analyze information, solve problems and use higher order

problem-solving skills (Berliner & Biddle, 1995). Delaine Eastin, the California Superintendent of Public Instruction, states, “So it is no surprise to me that when I advocate for a more rigorous curriculum, the constituency that I have always been able to count on – without exception – has been the business leadership community” (p.19).

“Despite this rapid growth [of technology] surveys suggest that the average school still makes limited use of computers” (Glennan & Melmed, 1996, p. xv). Despite increased pressure to include technology in the classroom, not all teachers have integrated technology into their curricula (Bielefeldt, 2001; Brush et al., 2001; Clark, 2000; Ertmer, Addison & Lane, 1999; Kumar & Kumar, 2003; MacKenzie & Clay, 1995; Rosen & Weil, 1995). Research also shows that teachers are struggling to effectively use technology in the classroom (Clark, 2000; Cuban, 2001; Sandholtz, Ringstaff & Dwyer, 1997). Some research shows teachers view computers as a valuable educational tool but that they lack the time and skills to integrate computers in their curricula (Dupagne & Krendl, 1992; Hong & Koh, 2002). However, only a limited number of researchers have examined why teachers use or do not use computers in their teaching (Jaber & Moore, 1999; Kumar & Kumar, 2003; Lawless & Smith, 1997; Norton, McRobbie & Cooper, 2000; Office of Technology Assessment (OTA), 1995; Sandholtz, Ringstaff & Dwyer, 1997). Instead, researchers primarily have focused on examining how technology relates to student achievement, teacher training, resources, support staff and administration (Hoffman, 1996; Mittelstet, 1992; OTA, 1995).

A great deal of research has been devoted to understanding the effectiveness and disadvantages of technology in the classroom but the results are conflicting and unclear (Glennan & Melmed, 1996). The advantages and long-term effects of technology have yet to be determined. There is little research correlating student use of computers and increased achievement (Cuban, 2001). "The contribution that school courses and experiences have made to computer literacy and competitiveness in the workplace remains, at best, murky" (p. 178).

Other factors that may contribute to instructional computer use among faculty have been neglected by researchers. Such factors include teachers' attitudes, anxiety levels, self-efficacy, time commitment, competency, beliefs, perceptions, relevance and knowledge (Delcourt & Kinzie, 1993; Dusick & Yildirim, 1998; Fulton, 1998; Hadley & Sheingold, 1993; Hoffman, 1996; OTA, 1995; Rademacher et al., 2001; Willis & Sujo de Montes, 2002; Zhao et al., 2001). These factors are important because attitudes and beliefs may impact teachers' use of computers in classrooms.

The current investigation examined the correlation between teachers' instructional uses for computers and teacher attitudes, emotions, beliefs and outside influences. Teachers' computer use in the context of this study specifically examined teachers' instructional or pedagogical uses of computers when working with students. Teacher attitudes in this study examined teachers' thoughts and feelings towards educational computer use and teacher emotions to both positive or negative feelings about computers (i.e., confidence or anxiety).

Teacher beliefs about educational technology included beliefs about computer liking and usefulness. Outside influences that were studied include demographic data and access to computers.

Surveys were distributed at five urban schools. Teachers were asked to complete surveys related to their attitudes, emotions, beliefs, outside influences and computer usage. The resulting data were analyzed to examine correlations between these factors and teacher computer use. Principle components factor analysis with varimax rotation was performed on the survey data. The following five components emerged: Comfort with Computers, Usefulness of Computers, Instructional Computer Use, Computer Liking and Outside Influences. Correlation analysis and multiple regression analyses were conducted to determine any correlations among the five factors and the demographic variables.

The main goal of this study was to examine the relationship between teachers' attitudes, emotions, beliefs, outside influences and teacher computer usage. By better understanding why teachers use, or do not use, technology in their classrooms, administrators and faculty can better understand teachers' computer use in schools.

CHAPTER II

Review of Literature

During the past three decades, schools have devoted considerable resources to technology. All too often, this technology has been ignored and underutilized (Glennan & Melmed, 1996). At the same time, the importance of technology in society has increased dramatically. It has now become vital for students to learn how to use technology in order to be prepared for the increasingly technological workplace (Bybee & Loucks-Horsley, 2000; Bradley & Russell, 1997; Campbell, 1998; Chou, 2001; Cuban, 2001; Eastin, 1999; Fuller, 2000; Kozma & Schank, 1998; Necessary & Parish, 1996; Niederhauser, 2001; North & Noyes, 2002; Thomas & Cooper, 2000). "The demand for unskilled labor has almost disappeared in advanced economies as they have experienced the full impact of globalization and the technological revolution" (Hill & Crevola, 1999, p. 117). Educational reform and computers in the classroom have become bandwagons in the field of education today (Means, 1994).

Ninety-eight percent of American public schools now have Internet access (Kumar & Kumar, 2003). The ratio of students to computers in schools has steadily decreased from 125 students per computer in 1981 to 5 students per computer in 2000 (Cuban, 2001). Ninety-eight percent of schools and 15% of classrooms now have computers (Cadiero-Kaplan, 1999). Furthermore, the tasks that can be performed by computers have become almost limitless (Breithaupt, 1997). Despite this influx of technology in schools, many teachers avoid using computers in their classrooms (OTA, 1995; Rosen & Weil, 1995;

Wetzel, Zambo & Padgett, 2001). As noted by Paprzycki and Vidakovic (1994), " . . . teachers are more hesitant and less likely to embrace computer technology than other professionals" (p. 74). Further, as Bybee and Loucks-Horsley (2000) point out, "Because the technological literacy standards call for students to acquire deep understanding of important, fundamental, technology concepts and processes, teachers need to know technology as deeply – in fact, more so" (p. 2).

In a literature review conducted by Dusick (1998), several social-cognitive factors were examined that may influence teachers' use of technology. Some of the factors listed by Dusick were faculty attitudes, anxiety, self-efficacy, time commitments, risks involved in using technology, competencies, beliefs, and lack of knowledge (Dusick & Yildirim, 1998; Fulton, 1998; Hoffman, 1996; OTA, 1995).

Educational technology has been the subject of much debate over the past two decades (Cuban, 2001). Proponents suggest that computers are necessary in schools in order to prepare students for the future. Critics emphasize that there is no substantial evidence to support continued use of computers in the classroom. "The link between test score improvements and computer availability and use is even more contested" (Cuban, 2001, p. 178). Some educators have even referred to the computer as an expensive or glorified typewriter (Cuban, 2001; Sandholtz et al., 1997).

In this literature review, some of the factors that correlate with teachers' instructional use of computers in the classroom are examined. The factors in this

study are teacher attitudes, emotions, beliefs and outside influences. Past studies show that these factors correlate with teachers' instructional computer use.

Teachers' Attitudes towards Technology

Studies of attitudes towards computers have spanned the past four decades. During the 1960's, Lee (1970) administered a 20 item scale to over 3000 Americans. Two perspectives that Lee examined were the "beneficial tool of man perspective" and an "awesome thinking machine" perspective. Attitude scales no longer focus on these science fiction types of items. The definition of attitude has evolved. Presently, attitudes are described as evaluative dispositions based on cognitions, affective reactions, behavioral intentions and past behaviors (Zimbardo & Leippe, 1991). Those dispositions can influence future cognitions, affective responses, intentions and behaviors. A number of reasons account for the minimal usage of technology by teachers but attitudes are the most influential (Francis, 1994). "The growth of technology as an instrumental tool will depend on teachers' attitudes about these technologies and their ability to use them for instruction and administrative purposes" (Clark, 2000, p. 181).

Attitudes and Experience. Many studies have concluded that enthusiasm increases as computer experience increases (DuPagne & Krendl, 1992). For instance, Yildirim (1997, 2000) concluded that there is a significant correlation between prior training and attitude and that competence is significantly related to prior training. In another study, Dusick and Yildirim (1998) found that computer

competence and prior training predicted university faculty use computers in the classroom.

Rosen and MacGuire (1990) conducted a meta-analysis of 81 studies that contrary to other research found, " computer experience does not eliminate technophobia" (p.12). The purpose of their study was to examine many of the common myths about computer anxiety. The 81 studies were selected from nearly 200 studies. Sixty-five studies were published after 1980 and only 16 were published before. Half of the 81 studies examined college students. There were a total of 66 different measurement instruments used in the studies. As a result, a series of steps were taken in order to compare all of the studies. First, the effect sizes from each study were converted to Pearson Product Moment Correlation (r). Second, r's were combined using a weighted mean in those studies with more than one r. Third, a Q statistic was calculated to test the homogeneity of the r effect sizes. Fourth, effect sizes were converted from r to z statistics and combined to yield a weighted mean effect size. The final step was to use the weighted mean to test the hypothesis that the true population effect size was significantly greater than zero.

Rosen and MacGuire's findings note that up to one-half of college students, business people and school students may be computerphobic. Of that group, approximately 10% exhibit signs of severe anxiety disorders. In the meta-analysis, the authors examine many types of computerphobia and surrounding myths. For instance, when examining gender differences, the authors found that computerphobia is correlated with sex-role identity. They also found that there

was little to support the myth that older adults are more computerphobic. There was also a lack of evidence to prove any correlation between math anxiety and computerphobia. Finally, Rosen and MacGuire discuss the computerphobic personality. They state, “most research has been unable to establish consistently any characteristics as comprising the computerphobic’s personality style” (Rosen & MacGuire, 1990, p. 186). Rosen and MacGuire concluded that most of the common myths about computers are not true. The authors did state that in persons displaying computerphobia additional computer experience may only exacerbate the problem resulting in more computer avoidance.

Responding to Rosen & MacGuire (1990), Bradley and Russell (1997) investigated the role of experience on the development of computer competencies and attitudes. Their study differed from many past studies in that they made a distinction between quantity and quality of past experiences. Bradley and Russell found that if the quality of the experience was good, then the attitudes towards technology were more favorable. Even if a teacher were to have substantial but bad experiences with technology, he or she may have unfavorable attitudes.

"Fundamental to the study of computer-related attitudes is the notion that understanding what these attitudes are and how they are formulated will help us predict actual behavior" (Pancer, George & Gebotys, 1992, p. 212). It is with this thought in mind, that many researchers have examined pre-service teachers' attitudes about technology (Balli, Wright & Foster, 1997; Bielefeldt, 2001; Dawson & Norris, 2000; Laffey & Musser, 1998; Paprzycki & Vidakovic, 1994;

Rademacher et al., 2001; Ropp, 1999; Rovai & Childress, 2002-2003; Thomas & Cooper, 2000; Wetzel, Zambo & Padgett, 2001; Willis & Sujos de Montes, 2002).

When comparing prospective teachers with students of other majors, Paprzycki and Vidakovic (1998) found no differences in overall attitudes towards computers. This may be because pre-service teachers' images of the classroom are derived from their own experiences as students (Balli, Wright & Foster, 1997). "One difficulty in changing the way teachers do things may be that our educational system self-replicates: a new generation of teachers inherits the last generation's classroom practices" (Willis & Sujos de Montes, 2002). Yet technology has progressed so quickly that the classroom of today is much more advanced that the classroom 10 years ago or even five years ago.

Attitudes and Gender. Research has found that females have less favorable attitudes towards technology than males (Bromfield, Clarke & Lynch, 2001; North & Noyes, 2002; Shashaani & Khalili, 2001; Siann et al., 1990; Brosnan & Davidson, 1994; Rosen & MacGuire, 1990). Female enrollment continues to be significantly lower than their male counterparts in high school and university computer classes (Shashaani & Khalili, 2001). "Some research has even traced attitudinal differences in Mathematics, Science and Computer Science as far back as early childhood. Mathematics and science are male dominated and subject to stereotypes that depict females as less able than males" (Bromfield et al, 2001, p. 286).

> Gender may be particularly salient to technophobia since computing is perceived as a 'masculinised' activity by both adults and children.

> Evidence for this includes the initial linkage between 'masculine' subjects such as mathematics with computing as well as male dominance in the industry combined with 'computer culture' which implies a 'technological gender gap'. (North & Noyes, 2002, p. 137)

In studies by Hess and Miura (1983, 1985), noticeable differences were seen in kindergarten summer technology camps. They found that the ratio of boys to girls was about three to one. Many women possess a dual perspective which means women strongly feel they can do just as well as men in the field of computer science but they feel uncomfortable using computers (Shashaani & Khalili, 2001)

Attitudes and Self-efficacy. Research has found that self-efficacy is correlated with computer use (Compeau, Higgins & Huff, 1999; Coffin & MacIntyre, 1999; Compeau & Higgins, 1995; Christoph, Schoenfeld & Tansky, 1998). For instance, Coffin & MacIntyre (1999) found that self-efficacy had a significant effect on learning in a programming course and Compeau and Higgins (1995) found a similar effect of self-efficacy on learning particular computer applications (i.e., WordPerfect, Lotus). Delcourt and Kinzie (1993) investigated teacher attitudes and self-efficacy in relation to computer technologies. They described the development and validation of two survey instruments, Attitudes Toward Computer Technologies (ACT) and Self-Efficacy for Computer Technologies (SCT), that were to be used with education students. The ACT consisted of 19 items and the SCT consisted of 25 items. Both instruments were designed with four-point Likert scales as the response format.

The instruments were given to 207 undergraduate and 97 graduate education students at six universities across the nation. Demographic data such as age, gender and educational level for the students were also collected. The mean age of the participants was 25 years. There were 67 males and 259 female students. Thirty-six percent of the participants used word processoring software at least once a week and 15% indicated that they had never used this type of software. Fifty-three percent of the students never used email and 45% never used CD-ROM databases. More than one-third of the students never used all three of the above applications. The survey data were used to perform a Principal Component Analysis (PCA) and to study the internal consistency reliability of each instrument. Additionally, exploratory hierarchical regression analyses were performed to examine the relationships between demographic variables, experiences in using technology, attitudes and self-efficacy feelings.

The PCA was calculated for both the ACT and the SCT. For the ACT, the PCA demonstrated a three-factor solution for 52.3% of the variance in the set of 19 items. Varimax and oblique rotations revealed similar results. For the SCT, the PCA showed 84.4% of the variance in the 25 items. Again, varimax and oblique rotations showed similar results.

Results of the study, " . . . suggest that experience with computer technologies, either through a course or through frequent use, is a critical area for examination in the study of attitudes and self-efficacy" (Delcourt & Kinzie, 1993, p. 40). The results further suggest enhancing teacher experience with technology can contribute to the formation of positive attitudes and self-efficacy.

Computer Attitude Scale. Loyd and Gressard (1984a, 1984b, 1985) developed the Computer Attitude Scale (CAS) to measure teacher and student attitudes as computers were introduced to schools in the early 1980's. The original CAS had three subscales, computer liking, computer confidence and computer anxiety. Each subscale had 10 questions totaling 30 questions for the survey instrument.

Loyd and Gressard (1984a) performed a study involving 155 students in grades 8 to 12 in order to examine the reliability and factorial validity of the CAS. All participants were students enrolled in a computer-based education program in a large school district. Once the surveys were administered, the data were analyzed for the means, standard deviations and estimates of internal consistency for each of the three subscales. The data were also examined for correlations among the subscales. In order to do this, a 30 x 30 matrix of item correlation was constructed. Factor analysis and principal-component analyses of the data were performed. Finally, coefficient alpha reliabilities for each of the subscales and the total were calculated. The reliabilities were 0.86, 0.91, 0.91 and 0.95 for the computer anxiety, computer liking, computer confidence subscales and the total score, respectively. Fifty-five percent of the total variation was accounted for by the three-factor solution and the first three eigenvalues were 1.30, 1.98 and 1.38. Loyd and Gressard concluded that the subscale scores may be used separately as suggested by the subscale reliability coefficients and factor analysis.

In another study, Loyd and Loyd (1985) administered a new form of the CAS to teachers and examined the reliability and validity of this new instrument. One hundred and fourteen K-12 teachers enrolled in professional development computer courses participated in the study. One additional subscale, computer usefulness, was added the original CAS creating a 40 item measure. The CAS was administered to participants by their computer course instructors. Means, standard deviations and internal-consistency coefficients were calculated for each of the subscales and a 40 x 40 correlation matrix was devised. The data were then subjected to principal-component analysis, factor analysis by varimax rotation and analysis of variance (ANOVA) for differential validity. Four one-way ANOVA's were performed for each of the subscales. The independent variable considered in each ANOVA was level of experience. The coefficient alpha reliabilities were 0.9, 0.89, 0.89, 0.89 and 0.95 for the subscales, computer anxiety, computer confidence, computer liking, computer usefulness, and the total score. A significant correlation of 0.83 was found between the computer anxiety and computer confidence subscales. This suggests that the two subscales of computer anxiety and confidence measure the same trait among teachers. The other two subscales, computer liking and usefulness, demonstrated correlation but were unique enough to be used as separate scores. Loyd and Loyd conclude that the CAS is both reliable and valid in assessing computer attitudes of adults similar to the teachers participating in this study.

Massoud (1990) performed a validation study of the Computer Attitude Scale. The study participants included 59 low-literate adults enrolled in GED programs in Texas. There were 23 male and 36 female participants. Their ages ranged from 16 to 45 and over. The participants were administered a Participant Inventory requesting demographic information and the Computer Attitude Scale. The instruments were completed during a GED session. The sample was found to be representative of the state of Texas when compared to a statewide survey performed by the Texas Education Agency.

The data were first used to test the reliability of the instrument's data. Coefficient alpha reliabilities were calculated for the Computer Attitude Scale and its subscales. The coefficients were very high proving that the scales were highly reliable. Next, factor analysis was performed to find examine the construct validity of the Computer Attitude Scale. "A test's construct validity is the degree to which it measures the theoretical construct or trait that is was designed to measure" (Massoud, 1990, p. 294). Analysis of the data revealed that a three-factor solution accounted for 47.2% of the variation as compared to 54% found by Gressard and Loyd (1986). The factors were then rotated by varimax rotation. Similar varimax rotated factor loadings to Gressard and Loyd were found. All of the factor loadings were at least 0.40 which is the minimum significant value.

Massoud found that the three subscale reliability coefficients and the factor analysis values suggested that the scores of the three subscales were sufficiently defined to be used as independent scores. This study supports the findings of Gressard and Loyd (1986) and Loyd and Gressard (1984a). In