# The Influence of Principals' Technology Training on the Integration Of Technology into Schools

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**Abstract**

*The purpose of this study was to investigate whether technology training received by principals influences the integration of technology into classrooms. The study examined the levels of technology integration into the schools' curricula with regard to the amounts and types of technology training received by K–12 school principals. The level of technology integration was also examined with regard to the following demographics: age, sex, principal's years of administrative experience, school size, and grade level. Statistical significance was found for amounts and types of technology training principals received, indicating that each can influence levels of integration into a school's curricula. Data showed the age of the principal also influences technology integration into the curriculum. (Keywords: K–12 principals, technology integration, training.)*

## INTRODUCTION

Although increasing numbers of educators, as well as national leaders, promote the use of technology as essential to improving education (Bennett & Gelernter, 2001; CEO Forum on Education and Technology, 1997; Thomas, 1999; Trotter, 1997) and perceive it as the linchpin in any efforts to prepare students for the 21st century, the reality is that technology has not lived up to its potential in schools (Heinich, Molenda, Russell, & Smaldino, 2002; Jaber, 1999). The resistance of teachers to converting from traditional teaching methods to computer-based ones is a fundamental reason for the lack of technological progress in schools. A degree of teacher resistance is understandable and expected because such a conversion represents change. Loucks and Hall (1979) noted that change is a process that takes time, and emphasized that change is a highly personal experience that requires developmental growth in both feelings and skills.

As with other changes, teachers experience varying degrees of discomfort and fear as they use technology; therefore, if teachers are to make the necessary adjustments in their teaching methods to accommodate the employment of technology, they need patience and support from school administrators (Thomas, 1999). Although some teachers will exhibit little resistance to converting from traditional teaching methods to computer-based ones because they are people who "take to computers like ducks to water" (Eastwood, Harmony, & Chamberlain, 1998, p. 1), other teachers will demonstrate differing degrees of resistance corresponding to the stress levels they experience as they adjust to technology. Eastwood et al. noted that one teacher in their school district became physically ill every time she led her students to the computer lab because she feared the students would ask her to help them use the computers. She prepared to leave teaching when the district decided to put technology into classrooms.

Unfortunately, according to Fullan (1991), school administrators often claim to lack the time and other resources to afford the support required by teachers in fully implementing any change process, including the introduction of technology into the curriculum. Although research has shown that technology training for teachers promotes the use of technology as an instructional tool (Atkins, 2000; Casey & Rakes, 2002; Martin & Lundstrom, 1988; Smith, 1998), administrators have often failed to schedule and fund technology training for their teachers (Carabine, 1999; Eastwood et al., 1998; Fitzgerald, Krueger, & Kaczka, 1999; Zehr, 1999). Because the appropriate amount of attention has not been given to individual teacher concerns and readiness to change, technology has not been fully integrated into the fabric of teaching and learning.

The principal is a key facilitator in the effort to infuse technology into the school; therefore, technology training for principals, as well as for teachers, should be a priority (Holland & Moore-Steward, 2000). A study by Merkley, Bosik, and Oakland (1997) supports the literature that claims leadership that promotes change is the missing factor when it comes to merging technology and instruction. No matter how much training teachers receive to prepare them for technology integration, most will not successfully employ that training without the leadership of the principal. Other studies have supported this claim (Awalt & Jolly, 1999; Maxwell, 1997; National Center for Education Statistics, 2000; Sandholtz, Ringstaff, & Dwyer, 1997).

One underlying reason for the lack of attention to the needs of teachers concerning technology is the lack of participation in staff development by school administrators. It is difficult to support an innovation about which one has little knowledge. The principal is a key facilitator in the effort to infuse technology into the school; therefore, technology training for principals, as well as for teachers, should be a priority (Holland & Moore-Steward, 2000; Thomas, 1999).

## THEORETICAL FRAMEWORK

The theoretical framework for this study was derived from the work of Crandall and Loucks (1982) titled *Preparing facilitators for implementation: Mirroring the school improvement process: A study of dissemination efforts supporting school improvement.* In that study, the researchers theorized: (a) generally, an innovation does not fail because the innovation is flawed, but because of flawed management or support by the school's administrators; (b) if teachers are to successfully implement an innovation, they need the support of the principal; (c) if the principal is to support teachers as they attempt to implement the innovation, then the principal must possess appropriate knowledge and skills.

Crandall and Loucks criticized the continuing use of the "Hello, good-bye, God bless you" (p. 4) type of professional development workshops that schools and school districts provide teachers. They cited research that supported their claim that when teachers are provided with one-shot workshops and left to implement an innovation, subsequent evaluations show that no real change takes place in the classrooms and that the primary outcome of the innovation's implementation is frustration and cynicism in both teachers and principal. They posited that research and experience indicate the need for more sustained training for teachers that exceeds one-shot workshops.

According to Crandall and Loucks, the process used in preparing teachers to implement an innovation should be mirrored by the process used in preparing the principal to support those teachers. Because both teachers and principal are expected to adopt new practices, the researchers viewed their preparation for their respective roles as parallel procedures. As teachers are being asked to change certain instructional behaviors, the principal is also being asked to adopt new behaviors that will support teachers in their new roles. Moreover, both teachers and principal are operating in similar social systems, in which they often act as loners. After reflecting on similarities in teachers' and principal's social systems, the researchers concluded that the principal needs training comparable to that of teachers if she or he is to facilitate implementation of an innovation.

Crandall and Loucks investigated factors that should be considered in preparing facilitators for implementation of an innovation. In the study, they gathered data from principals, teachers, and central office staff in 146 school systems where new practices were being implemented. The study found that:

1. The preparation and interventions required by a teacher are determined by how much the innovation's implementation changes the teacher's classroom routine.
2. The teacher's commitment to the innovation is essential to successful implementation.
3. Training received by the teacher needs to address roles and skills that she or he will require in implementation of the innovation. Training should provide opportunities to practice the skills in the classroom as well as in the training environment.
4. Follow-up assistance and coaching for the teacher is imperative. The teacher must be afforded the necessary equipment and supplies, must be helped in solving problems associated with the innovation's implementation, and must be emotionally supported so that commitment is maintained.

The school's principal is expected to act as the instructional leader and see that the necessary preparation and interventions are provided to teachers. Crandall and Loucks reported that principals in facilitator roles "range widely in the skills and understandings needed to be successful. So, preparing facilitators needs to begin with carefully assessing where each is and how far each individual needs to go in changing roles and behaviors" (p. 6). This observation suggests that principals require training that not only prepares them for their tasks as implementation leaders, but is also relevant to their specific needs.

Just as teachers' commitment is essential to the success of an innovation, the principal's commitment is also essential. Crandall and Loucks found that the more committed teachers were to an innovation, the more they practiced behaviors that would promote success of the innovation. They concluded that their finding could be applied in preparing the principal to become a facilitator of the innovation, and noted that the principal's commitment could be fostered if the training she or he received provided strategies, tools, and directed practice that would apply in her or his school setting. Again, the researchers were stressing the need for personalized and individualized training.

In their study, Crandall and Loucks found that teachers who returned to the classroom and routinely practiced the skills they had learned during training experienced more change and became more comfortable with the innovation than those who practiced the skills less often. This finding appears to parallel the finding about students that showed that there is a relationship between the time students spend actively engaged in instructional activities and their achievement. Crandall and Loucks extended the finding to principals by speculating that if principals spent time practicing newly learned behaviors that support teachers' implementation of an innovation, principals would likely become more adept at applying the behaviors. "This necessity to actually practice skills introduced in training underscores the need to expand the training experience's boundaries well beyond the formal training events" (p. 8).

Crandall and Loucks strongly recommended follow-up assistance in the individual's work environment so that she or he could practice the learned behaviors and receive non-threatening feedback. They concluded that the facilitator of an innovation will experience concerns while employing her or his new skills that were not broached in the training sessions. It is at that point that real learning takes place.

## PURPOSE OF THE STUDY

The purpose of this study was to investigate whether technology training received by principals influences the integration of technology into classrooms. The study examined the levels of technology integration into the schools' curricula with regard to the amounts and types of technology training received by K–12 school principals. The level of technology integration was also examined with regard to the following demographics: age, sex, principal's years of administrative experience, school size, and grade level. This information will contribute to a research rationale for developing successful models for administrator technology training.

## PROBLEM STATEMENT

Too many principals are uninformed about and uninvolved in the role technology plays in their schools. Many principals still have little firsthand experience with technology. As a result, they find themselves facing the daunting challenge of guiding their schools through a change process for which they are essentially unprepared as the schools attempt to integrate instructional technology (Thomas, 1999). Little research has investigated specific aspects of technology integration with regard to principal training and demographic variables.

The leadership in a school largely determines the outcome of technology integration; however, administrators cannot fully or effectively support technology if they do not understand it. The chief education officer of the Chicago public schools, Cozette Buckney, explained that a principal who does not understand how to use technology will make very poor decisions, spend a lot of money on unnecessary things, or not provide technology supplies at all (Wisniewski, 1999). Buckney's explanation came 10 years after Mecklenburger (1989) had spelled out the critical need for school leaders to become knowledgeable about technology. Mecklenburger wrote:

> Administrators must understand both the capabilities and limitations of technology. Only then can they plan for, budget for, purchase carefully, install properly, maintain dutifully, schedule adequately, distribute appropriately, and replace systematically the electronic technology best suited for their needs. (p. 7)

## DESIGN

This study investigated one dependent variable, the overall level of integration of technology into the curriculum of schools as measured by the School Technology and Readiness (STaR) Chart Assessment (CEO Forum, 1999). The level of technology integration was investigated by examining the respondents' total scores, which were derived by summing their scores on (a) Connectivity (a school's access to the Internet, the World Wide Web, and e-mail communications), (b) Hardware (presence of computer technology equipment as well as the maintenance of the equipment), (c) Content (regularity of student use of digital content software), (d) Professional Development (any technology-related training received by school personnel), and (e) Integration and Use (the pattern of student and teacher technology use in the majority of the classrooms in a school).

This variable was examined to determine its relationship to seven independent variables. Three of the independent variables—age, sex, and years of administrative experience—represented data about the respondents (i.e., principals) and two of the variables represented data about the school—the sizes and grade levels of the schools. The remaining two independent variables were amounts and types of technology training received by principals in the 12 months preceding the study.

### Instrumentation

In the data-collection process, the study employed the methodology and instrumentation of the School Technology and Readiness (STaR) Chart Assessment. The STaR Chart Assessment is an online data-collection survey instrument that many schools, as well as school districts, use to self-assess the progress they are making in integrating technology into the curriculum. For the past few years, education leaders throughout the country have been using the STaR Chart to assess the needs of schools so that activities can be tailored to their unique needs (CEO Forum, 1999a). The survey instrument is based on Dr. Henry Becker's Quality Education Data's Technology Measure (Felix, 1998). Quality Education Data's information and analysis are frequently used by state and federal agencies to promote educational funding and to advance policy issues.

The STaR Chart Assessment questionnaire is composed of five sections or components: (a) Connectivity, (b) Hardware, (c) Content, (d) Professional Development, and (e) Integration and Use. Each respondent to the questionnaire receives a composite score for the whole questionnaire as well as a score for each component. The composite score was used for purposes of this study.

A point system supplied by the CEO Forum for use with the STaR Chart Assessment was used in assigning scores to the various responses. Each respondent's scores determined whether the school she or he represents is low tech, mid tech, high tech, or target tech on each of the five components and, finally, whether the school overall is low tech, mid tech, high tech, or target tech. (See Table 1.)

**Table 1: STaR Chart Assessment Questionnaire Scoring**

| | Scoring | | | |
|---|---|---|---|---|
| Category | Target Tech | High Tech | Medium Tech | Low Tech |
| Connectivity—a school's access to the Internet, the World Wide Web, and e-mail communications | 13–15 | 8–12 | 3–7 | 0–2 |
| Hardware—presence of computer technology equipment and maintenance of the equipment | 17–20 | 12–16 | 6–11 | 0–5 |
| Content—regularity of student use of digital content software (drill and practice, authoring, simulations, CD-ROM research resources, Web, networked communications) | 13–25 | 9–12 | 5–8 | 0–4 |
| Professional Development—any technology-related training received by school personnel | 21–30 | 15–20 | 8–14 | 0–7 |
| Integration of Use—the pattern of student and teacher technology use in the majority of the classrooms in a school | 9–10 | 7–8 | 4–6 | 0–3 |
| Overall Score | 69–100 | 47–68 | 22–46 | 0–21 |

To ensure that the data collected through the STaR Chart Assessment were appropriate, useful, and meaningful, the CEO Forum supplemented the Quality Education Data's Technology Measure with data from additional sources. In developing the STaR Chart Assessment, the CEO Forum used data collected from 80,000 schools. To obtain the most recent information available at that time regarding the percent of schools connected to the Internet, the Forum used data from a survey of more than 400 schools performed by Quality Education Data in its 1997 study *Internet Usage in Public Schools*. The Forum used data from another survey of more than 400 schools performed by Quality Education Data in its *Cable in the Classroom* study to collect information about how the Internet was being used in the classrooms and what kind of professional development was being provided to teachers.

The present study did not deal with abstract constructs that require clustering to define operational definitions. Moreover, the survey items used in this study were objective (i.e., behavioral). According to Murphy and Davidshofer (1998), scales such as these produce relatively stable and accurate results and are less susceptible to error than are other types of measures.

**Population/Data Collection**

The purposive sample included K–12 public and private school principals who are Internet users. Principals (1,104) were selected from the Web66 International School Web Registry. The URL for the survey was also placed on listservs for the National Association of Secondary School Principals, the National Association of Elementary School Principals, and state departments of education.

The survey instrument, which was a combination of a demographic questionnaire and the STaR Chart Assessment tool, was written in hypertext markup language (html) and placed on the Internet. To ensure anonymity, all completed surveys were returned electronically to the Internet server, where a Common Gateway Interface (CGI) program bin was established to handle the incoming data. The CGI program ensured the anonymity of the respondents, because "There is no authenticated method of verifying the identity of the user submitting information to your CGI. Hence, users remain anonymous unless they voluntarily supply identity information to the survey administrator" (Schmidt, 1997, p. 278). The data were transferred into a prepared spreadsheet for statistical analysis.

The sample selection included only principals who accessed the Internet. The study's purpose was to investigate whether the technology training that principals receive influences levels of technology integration in schools. Because principals who access the Internet are likely to have received at least some basic technology training, selecting the sample from that group is in accordance with the purpose of this study. Three hundred ninety-eight (398) K–12 principals participated.

Because the World Wide Web affords geographically unrestricted access to participants, it appeared well-suited to be used in this exploratory study designed to survey principals across the United States. The validity of employing the Web as a surveying vehicle for this research was strong, because according to

Schmidt (1997), research that targets specific populations is tailored for Web surveying. Further, Coomber (1997) noted that in cases where it is the users of the Web that the research is targeted to reach, the population skews that are peculiar to Internet surveying (i.e., only individuals with Internet access can participate) do not affect the validity of the findings.

The 398 sample size was deemed adequate because according to Hill (1998), "There is seldom justification in behavioral research for sample sizes of less than 30 or larger than 500" (p. 4). Every state in the country was represented.

### Assumption

Where the analysis of variance method was used in this study, it was assumed that the population distribution was normal with equal standard deviations.

### Limitations of the Study

This study was subject to the following limitations:

1. Only principals with Internet access were included in the study.
2. The results of the study must be generalized with caution because purposive sampling was used.
3. The accuracy of principals' responses depended upon their ability to recall their perceptions of past behaviors and current resources.
4. There may exist unexamined factors affecting progress toward integrating instructional technology into the curriculum that were not accounted for in the methodology. Other factors not specifically addressed in this study could influence technology integration in a school (e.g., urban or rural school setting, socioeconomic status of the school population).
5. This was an exploratory study, designed to discover relationships among the variables. It did not attempt to establish cause-effect relationships.

### Definition of Terms

*High Tech School:* A school that uses technology in most of its operations, including classroom instruction. In such a school, the pupil-to-multimedia-capable-computer ratio is 7:1, about three quarters of the computers have processors at or above the Intel 386 level, and there is probably Internet access as well as access to a Local Area Network (CEO Forum, 1999b).

*Low Tech School:* A school that uses little or no technology. In such a school, the pupil-to-multimedia-capable-computer ratio is 25:1, there is limited access to computers with processors at or above the Intel 386 level, there is limited Internet access, and there is limited access to a Local Area Network. (CEO Forum, 1999b).

*Mid Tech School:* A school that uses technology moderately. In such a school, the pupil-to-multimedia-capable-computer ratio is 12:1, about one half of the computers have processors at or above the Intel 386 level, there is moderate Internet access, and a high probability of access to a Local Area Network (CEO Forum, 1999b).

*Target Tech School:* A school that has technology fully integrated throughout the curriculum. In such a school, the pupil-to-multimedia-capable-computer ratio is 3:1, most of the computers have processors at or above the Intel 386 level, there is Internet access, and a very high probability of access to a Local Area Network (CEO Forum, 1999b).

## RESEARCH QUESTIONS / DATA ANALYSIS

### Question 1

In the 12 months preceding this study, have the types of technology training received by principals of elementary schools, junior high/middle schools, and high schools been significantly different?

The Frequencies procedure determined how many elementary (Level 1), junior high/middle school (Level 2), and high school (Level 3) principals participated in the research project. The results of the Frequencies procedure are presented in Table 2.

As seen in Table 2, more than one half of the study's participants were elementary school principals. Approximately one fourth were high school principals, and about one fifth of the participants were junior high/middle school principals.

The Frequencies procedure determined the number of principals at each school level receiving each type of technology training. Table 3 presents the results of the Frequencies procedure. The types of technology training were categorized as follows: Type I—basic technology tools and applications (i.e., word processing, spreadsheets, database, presentation software), Type II—basic technology tools and applications with Internet fundamentals (i.e., use of Internet browsers and search techniques), Type III—integrating technology into the curriculum (i.e., specific use of basic tools and content-specific software as tools in the classroom), and Type IV—training customized to the needs of the principals (i.e., any combination of the above provided to a principal upon request).

**Table 2: Participation by School Level**

| School Level | N | % |
|---|---|---|
| Level 1 elementary | 225 | 56.5 |
| Level 2 junior high/middle | 77 | 19.4 |
| Level 3 high school | 96 | 24.1 |
| Totals | 398 | 100.0 |

**Table 3: Frequency of Types of Training Received by Grade Level**

| | Type Training | | | |
|---|---|---|---|---|
| Grade Level | Type I – basic tools / applications | Type II – basics with Internet | Type III – technology integration | Type IV – customized training |
| Elementary school | 19 | 51 | 99 | 56 |
| Jr. high/Middle school | 8 | 21 | 25 | 23 |
| High school | 11 | 17 | 37 | 31 |
| Totals | 38 | 89 | 161 | 110 |

A Chi-Square test determined whether the difference in the number of principals receiving each type of training was significant with respect to school level. The Chi-Square ($\chi^2 = 5.99$; $p > .05$) showed no significant difference in the types of technology training received with respect to school level.

**Question 2**

Are there differences in the levels of technology integration into the schools' curricula indicated by the schools' scores on the School Technology and Readiness (STaR) Assessment instrument with respect to principals' demographic variables?

Demographic data indicate that the majority of principals participating in the study ranged from 41 to 55 years of age. More principals with 7 to 15 years of administrative experience, and more males than females participated. (See Table 4.)

The level of school technology integration was investigated by examining the respondents' total scores, which were derived by summing their scores on the components, (a) Connectivity, (b) Hardware, (c) Content, (d) Professional Development, and (e) Integration and Use, as measured by the STaR Assessment instrument.

Analysis of Variance (ANOVA) determined mean differences across the four categories of administrative experience, three categories of age, and the two sex categories. The Levine test of homogeneity confirmed the assumption that the population variances were equal.

ANOVA showed there was a significant difference between principals 41–55 years of age (mean: 67.920) and those under 41 (mean: 63.900). ANOVA showed no statistical significance for years of administrative experience or sex. ANOVA showed no significant differences when groups interacted two at a time for years of administrative experience, age, and sex. (See Table 5.)

The Scheffe′ post hoc comparison determined whether a statistical significance for Total Score by age existed among the other AGE groups. The Scheffe′ comparison indicated no differences beyond that found by ANOVA.

**Table 4: Relevant Principals' Demographics**

| Variables | n | % |
|---|---|---|
| Age | | |
| Under 41 | 67 | 16.8 |
| 41–55 | 270 | 67.8 |
| Over 55 | 61 | 15.3 |
| Sex | | |
| Male | 232 | 58.3 |
| Female | 166 | 41.7 |
| Years of Administrative Experience | | |
| Under 2 | 36 | 9.0 |
| 2–6 | 78 | 19.6 |
| 7–15 | 156 | 39.2 |
| Over 15 | 128 | 32. |

**Table 5: ANOVA Summary of Total Score by EXP, AGE, and SEX**

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Main Effects | 1909.855 | 6 | 318.309 | 1.870 |
| EXP | 80.432 | 3 | 26.811 | 0.157 |
| AGE | 1476.309 | 2 | 738.155 | 4.336* |
| SEX | 35.834 | 1 | 35.834 | 0.210 |
| 2-Way Interactions | 2708.122 | 11 | 246.193 | 1.446 |
| EXP AGE | 1783.578 | 6 | 297.263 | 1.746 |
| EXP SEX | 506.801 | 3 | 168.934 | 0.992 |
| AGE SEX | 467.500 | 2 | 238.250 | 1.399 |
| Explained | 7010.792 | 223 | 18.672 | 1.872 |
| Residual | 63840.675 | 375 | 170.242 | |
| Total | 70851.467 | 397 | 178.467 | |

*Note:* $^{*}p < .01$

### Question 3

Are there differences in the levels of technology integration into the schools' curricula as indicated by the schools' scores on the School Technology and Readiness Assessment tool with respect to the schools' demographic variables?

The schools' demographics show that the majority of principals participating in the study represented schools with less than 600 students, while only six percent of them headed schools with more than 1,500 students. The demographics also show that more than half of the principals led elementary schools. (See Table 6.)

The level of technology integration into the school was investigated by examining the respondents' total scores, which were derived by summing their scores on the components, (a) Connectivity, (b) Hardware, (c) Content, (d) Professional Development, and (e) Integration and Use, as measured on the STaR Assessment instrument.

ANOVA determined the mean differences across the three categories of school level and three categories of school size. The Levine test of homogeneity confirmed the assumption that the population variances were equal. The ANOVA showed there was no significant difference between any two groups for school level or school size.

**Table 6: Relevant School Demographics**

| Variable | n | % |
|---|---|---|
| School Size (# of Students) | | |
| Under 600 | 258 | 64.8 |
| 600–1500 | 116 | 29.1 |
| Over 1500 | 24 | 6.0 |
| School Level | | |
| Elementary | 225 | 56.5 |
| Junior High/Middle | 77 | 19.3 |
| High | 96 | 24.1 |

### Question 4

Are there differences among schools in their levels of technology integration with respect to the amounts of technology training received by their principals as indicated by the schools' scores on the School Technology and Readiness assessment instrument?

Principals' demographics (see Table 7) show that the majority (79.1%) of the participating principals had received less than 26 hours of technology training. More than half of them had received less than 13 hours of training, while only 7.8% of them had received more than 51 hours of training.

The level of technology integration into the school was investigated by examining the respondents' total scores, which was derived by summing the scores on the components, (a) Connectivity, (b) Hardware, (c) Content, (d) Professional Development, and (e) Integration and Use.

ANOVA determined mean differences across the five categories of amount of technology training received. The Levine test of homogeneity confirmed the assumption that the population variances were equal. The ANOVA showed there was a significant difference between the principals receiving the fewest hours of technology training and those receiving the most hours (see Table 8).

The Scheffe′ post hoc comparison determined whether a statistical significance existed among the other groups. The Scheffe′ comparison indicated that principals with fewer than 13 hours and principals with 13–25 hours were significantly different from each other. Principals with 13–25 hours had a higher mean score (68.923) than those with fewer than 13 hours (63.228).

**Table 7: Principals' Technology Training**

| Variable Technology Training (Clock Hours) | n | % |
|---|---|---|
| Under 13 | 211 | 53.0 |
| 13–25 | 104 | 26.1 |
| 26–38 | 35 | 8.8 |
| 39–51 | 17 | 4.3 |
| Over 51 | 31 | 7.8 |
| Total | 398 | 100.0 |

**Table 8: ANOVA Summary of Total Score by Amount of Training Received**

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Main Effects | 6375.350 | 4 | 1593.837 | 7.404 |
| Training Received | 6375.350 | 4 | 1593.837 | 7.404** |
| Explained | 6375.350 | 4 | 1593.837 | 7.404 |
| Residual | 64476.118 | 393 | 164.061 | |
| Total | 70851.467 | 397 | 178.467 | |

*Note.* **$p < .01$

### Question 5

Are there differences among schools in their levels of technology integration with respect to the types of technology training received by their principals as indicated by the schools' scores on the School Technology and Readiness assessment instrument?

The level of technology integration into the school was investigated by examining the respondents' total scores, which were derived by summing their scores on the components, (a) Connectivity, (b) Hardware, (c) Content, (d) Professional Development, and (e) Integration and Use, as measured on the STaR Assessment instrument.

ANOVA determined mean differences across the four categories of technology training types. The types of training were categorized as follows: (a) basic technology tools and applications, (b) basic technology tools and applications with Internet fundamentals, (c) integrating technology into the curriculum, and (d) training customized to the needs of the principals. The Levine test of homogeneity confirmed the assumption that the population variances were equal.

ANOVA showed that there existed a significant difference between principals receiving basic technology tools and applications training and those receiving training that focused on integrating technology into the curriculum (see Table 9). Principals receiving basic technology tools and applications training had the lowest mean (60.132) and those receiving training that focused on integrating technology into the curriculum had the highest mean (69.547).

The Scheffe′ post hoc comparison determined whether a statistical significance existed among the other groups. The Scheffe′ comparison indicated that a significant difference existed between principals receiving basic technology tools and applications training (mean: 60.132) and those receiving training customized to the needs of the principal (mean: 68.718). The Scheffe′ comparison also indicated that a significant difference existed between principals receiving basic technology tools and applications with Internet fundamentals training (mean: 61.517) and those receiving training customized to the needs of the principal (mean: 68.718). Additionally, the Scheffe′ comparison indicated that a significant difference existed between principals receiving basic technology tools and applications with Internet fundamentals training (mean: 61.517) and those receiving training that focused on integrating technology into the curriculum (mean: 69.547).

The Scheffe′ comparison did not indicate a significant difference when principals who received basic technology tools and applications training (mean: 60.132) were compared to those who received basic technology tools and applications with Internet fundamentals training (mean: 61.517). Also, the Scheffe′ comparison did not indicate a significant difference when principals who received training that focused on integrating technology into the curriculum (mean: 69.547) were compared with those who received training customized to the needs of the principal (mean: 68.718).

The data showed that principals receiving training that focuses on integrating technology into the curriculum lead schools with higher levels of integration

**Table 9: ANOVA Summary of Total Score by Type of Training Received**

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| Main Effects | 5780.736 | 3 | 1926.912 | 11.667 |
| Training Received | 5780.736 | 3 | 1926.912 | 11.667** |
| Explained | 5780.736 | 3 | 1926.912 | 11.667 |
| Residual | 65070.731 | 394 | 165.154 | |
| Total | 70851.467 | 397 | 178.467 | |

*Note.* $^{**}p < .01$

than those receiving any other type of training. Further, the data showed that principals who receive training customized to their needs lead schools with higher levels of integration than those receiving basic technology tools and applications training or those receiving basic technology tools and applications with Internet fundamentals training.

## CONCLUSIONS

The first question examined whether the types of technology training received by principals of elementary schools, junior high/middle schools, and high schools in the 12 months preceding the study were significantly different.

Results indicated that the types of technology training received by principals of different level schools were not significantly different. The trend for principals receiving the four types of training was relatively consistent across school levels.

Importantly, the majority of principals (68% when all levels are combined) reported that they received training of the highest two types. At each school level, more principals reported receiving training that promoted integrating technology into the curriculum than any other type of training. Training customized to the needs of principals was reported as the second most received training type.

This finding is encouraging; however, nearly one third of the principals in this study are still not receiving the type of training that prepares them to lead their schools in the technology integration process. This finding is supported by a study by NETDAY, a California-based nonprofit group that spent five years attempting to wire schools across America for Internet use. The participants in the study were teachers from across the United States. The results of that project revealed that although 87% of participating teachers reported feeling comfortable using technology, and 97% reported having online access in their schools, 73% reported feeling "no pressure to use the technology for classroom instruction" (Weiner, 2001, p. 1). The findings led NETDAY to conclude that, in order to meet their objectives, there was a need to educate school administrators about the importance of integrating the Internet and other modes of technology into classroom activities.

Seventy-eight percent of the teachers who participated in the NETDAY study claimed that the most pronounced barrier to technology integration in their classrooms is lack of time. From that pronouncement, NETDAY determined, "There really needs to be a new dialogue with the leadership…so they can be more understanding of what the time issues mean" (Weiner, 2001, p. 1).

Many of the principals who participated in the study appear to have moved beyond the need for workshops that focus on technology fundamentals. Because those principals have progressed in their understanding of technology, technology trainers should turn their attention to creating training opportunities that provide advanced and ongoing assistance to them, thus providing the strategies and procedures that will help them become better technology leaders in their schools.

As principals become more adept at guiding technology integration, more efficient and effective technology use should become prevalent in schools. The principals' increased knowledge of the benefits and uses of technology should lead to more support of teachers' attempts to infuse technology into the teaching and learning model. The principals' improved technology skills should lead to increased use of technology tools, thereby producing principals who are models of technology use.

The second question examined whether the demographic variables of age, sex, and years of administrative experience of the principal of a school significantly influence the level of technology integration into school.

Results indicated the age of the principal did significantly influence technology integration. The findings showed principals whose ages were 41 through 55 influenced integration very differently from principals who were under 41. Perhaps principals of the ages 41 through 55 are still young enough to be energetic in their leadership, and yet mature enough to have garnered the life experiences and the respect of their staffs necessary to be influential technology leaders.

Although the analysis showed the age of the principal significantly influences technology integration into the curriculum, it did not show that the years the principal has been an administrator or the principal's sex influence integration. It was expected that the years of administrative experience of the principal would be notably influential in the school's integration of technology. One explanation for years of administrative experience not playing more of a role in how technology is integrated into the school might be that the years of administrative experience are intrinsically tied to the principal's overall experiences, with the overall experiences veiling the influence of the years of administrative experience.

The analysis showed no statistical significance for Total Score by two-way interactions of years of administrative experience, age, and sex. This finding indicated that no two of the variables working together greatly influences how technology is used and infused in the school. In summary, the level of technology integration into a school is influenced by the age of the principal, but not of the principal's years of administrative experience or sex.

The third question examined whether the demographic variables, school level, and school size significantly influence the level of technology integration into the school. Results indicated neither school level nor school size significantly influenced the level of technology integration.

The fourth question examined whether the amount of technology training received by the principal in the 12 months preceding the study significantly influenced the level of technology integration into the school. Results indicated that the amount of technology training received in the preceding 12 months did significantly influence the level of technology integration.

The finding that principals with more than 51 hours of technology training lead schools that are noticeably different from other schools confirmed the belief of many that long-term training is worth the effort and expense. Many have questioned the validity of the one-shot, after-school and isolated Saturday morning workshops presented in an effort to improve the technology leadership skills of principals.

The conclusion coincides with the findings of Maxwell (1997). In reporting his case study, he recommended long-term technology training for principals. He believed that, with continuing training, the principal would develop an appreciation for technology and its distribution throughout the school.

The finding that principals with as little as 13 to 25 hours were significantly different from principals with fewer than 13 hours tends to suggest that increasing principal training will produce higher levels of technology integration into schools. Visual inspection of the principals' component scores supported that implication, for schools with principals who had received from 13 to 25 hours of training showed higher levels of technology integration than those with principals who had received less than 13 hours.

As a result of a four-year study of American schools in Hanau, Germany, Davidson, McNamara, and McGillivray (1999) concluded that through technology training and experience, administrators develop a deeper understanding of the potential of instructional technology. Possibly, principals who receive as little as 13 to 25 hours of technology training in a year begin to comprehend technology's worth. Hopefully, as they progress through their training, principals become more empathetic to the anxieties of teachers who are learning to cope with the perplexities that arise each day as they struggle to discover the benefits of technology and to share those benefits with their students.

The fifth question examined whether the type of technology training received by the principal significantly influenced the level of technology integration into the school. Findings showed there exists a significant difference between principals receiving basic technology tools and applications training and those receiving training that focus on integrating technology into the curriculum.

Clearly, this finding indicates that training that teaches the principal the methods and procedures required for integrating technology into the curriculum is preferable to training that concentrates only on teaching her or him to use basic technology tools. Of course, if principals are to model the use of technology for their staffs, they should learn to operate its equipment and software. However, their training should extend beyond learning to make use of technology, for their primary goal should be to guide their teachers as those teachers employ technology in the teaching and learning process.

The finding that there exists no significant difference between principals who receive basic technology tools and applications training and those who receive basic technology tools and applications with Internet fundamentals training is understandable. Although extending basic technology training to include Internet fundamentals might add another dimension to a principal's knowledge of how to use technology, it may not directly influence her or his capacity to guide others in employing technology in the school setting.

One unexpected finding was that there was no significant difference when principals who received training that focused on integrating technology into the curriculum were compared with those who received training customized to the needs of the principal. It was anticipated that principals who received training that focused on integrating technology into the curriculum would lead schools that had higher levels of technology integration. It was expected that the two types of training would produce very different and unequal results when used to prepare principals for guiding their schools.

This study investigated whether the amounts and types of technology training received by K–12 principals influence the levels of technology integration into the schools' curricula. Statistical significance was found for both the amounts and types of technology training principals received, indicating each influences the levels of integration.

The principal is the school's instructional leader and, as such, is responsible for assisting teachers in becoming technologically literate. If these teachers are not now receiving the training they require, the principals should be making plans to provide it, for according to the CEO Forum (1999a), "While teachers should always share responsibility for their own professional development, primarily relying on teacher personal time will never enable a culture of effective technology use" (p. 13).

A study by Crandall and Loucks (1982) formed the theoretical framework for this study. In that study, they contended that one-shot professional development workshops do not address the needs of principals for continuing assistance and coaching. One of the findings in this study supports that theory, for it found the more technology training the principal received, the higher the level of technology integration in her or his school.

In their study, Crandall and Loucks also emphasized that principals vary widely in their skill levels and in their understanding of any topic, therefore their leadership preparation should begin with an assessment of "where each is and how far each individual needs to go in changing roles and behaviors" (p. 6). Moreover, they claimed that the training principals receive should address the roles and skills she or he will require in the implementation of the innovation (in this case, technology). In effect, Crandall and Loucks were recommending personalized and individualized training.

This study's findings support Crandall and Loucks' contentions. The findings showed that schools led by principals who received training that focused on curriculum-specific technology and those who received training that was specific to their individual needs had higher levels of technology integration than other schools.

From these findings, it may be concluded that the more sustained the principal's training experiences and the more those experiences are tied to the school's curriculum and to the principal's needs, the more progress the school is likely to make toward technology integration. The data confirmed that the principal's involvement in infusing technology into the school is indispensable. It appears that the more training they receive, the more integrated into the schools technology becomes.

It is important that superintendents recognize the influence principals have on the use of technology in their schools, and encourage principals to become directly involved with technology initiatives. Superintendents should encourage principals to take risks and to share technological innovations that improve learning outcomes with their peers.

Because the findings showed that the amounts and types of training are significant to technology integration, school districts and universities should increase the amount of technology training specifically designed for school administrators that focuses on infusing technology into the curriculum. A key component of such training should be specific ways in which principals can support teachers in their efforts to integrate technology into the teaching and learning environment. Training efforts should include follow-up components so that principals receive continuing assistance in their school environments.

## RECOMMENDATIONS FOR FUTURE STUDY

Because this study's findings indicated that the amounts and types of technology training received by principals influence integration, researchers should determine what percent of United States principals are receiving training and what types of training they are receiving. Further, a portion of the research might be conducted through interviews in order to obtain more in-depth information and perceptions of school leaders.

Data analysis of the responses led to the belief that had teachers responded to the survey, comparing their perceptions with those of the principals might add a worthy dimension to the study. Therefore, future study of the principal's influence on technology integration should include a teacher's component. Also, a longitudinal, perhaps a case, study could be conducted that focuses on the principal's role in technology integration, with particular attention on how, as well as the extent to which, principals actually support teachers and students in the integration of technology into the classroom.

Although at least 95 percent of schools in the United States have computers and teachers who receive technology training, too many school leaders are still left behind (Holland & Moore-Steward, 2000). The results of this study indicate that the type and amount of technology training principals receive can make a positive difference in schools. Without well-trained, technology-capable principals, the integration of technology into school curricula will remain incomplete.

### Contributors

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