Connecting Technology with Student Achievement: The Use of Technology by Blue Ribbon School Principals

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ABSTRACT

The purpose of this study was to investigate perceptions and technology usage of K-12 school principals of Blue Ribbon Schools to identify technological characteristics of successful school leaders. Items on the questionnaire were aligned with the International Society of Technology Education National Educational Technology Standards and Performance Indicators for School Administrators. The researchers sent questionnaires to 500 principals throughout the United States with a return rate of nearly 37%.

Pearson and Spearman correlations were conducted to determine the level of agreement with NETS-A Standards of Blue Ribbon School Principals and if there was a relationship between use of technology and NETS-A Standards. Independent-sample t-tests were also conducted to determine if the levels of agreement with NETS-A Standards differed by gender.

Results of this study indicated that there is evidence to support high levels of agreement of Blue Ribbon School Principals with the NETS-A Standards with females reporting higher levels of agreement then males, and the need for professional development to support technology integration.

Keywords: Principals, Technology Integration, Student Achievement, Leadership, Technology Standards for Administrators

INTRODUCTION

The United States Department of Education Blue Ribbon School Program was created in 1982 by then Secretary of Education, Terrel H. Bell. It was created to honor America's most successful schools. Since then awards have been given to elementary, middle, and high schools that are either academically superior or have demonstrated dramatic academic student achievement gains for disadvantaged students. Since it's inception, 5,150 different schools have been recognized. This represents approximately 4.3% of the nation's 133,000 public, private, charter and parochial schools [1].

Principals of Blue Ribbon Schools were selected for this study because of their extra-ordinary leadership skills as evidenced by the recognition of their schools by the United States Department of Education. Results from this study are intended to provide school leaders with a better understanding of the role of technology within their school settings and how to effectively integrate technology standards across their school curriculum. Results will also be used to help inform curricular decisions related to principal preparation programs to better prepare future administrators. Furthermore, it is the intention of the researchers to determine if Blue Ribbon School principals agree with current technology standards to inform best practices related to improved student achievement.

THEORETICAL FRAMEWORK AND PERTINENT LITERATURE

Data gathered for this study have been sorted by standards identified by the International Society of Technology Education (ISTE). These standards are widely recognized by school leaders as an effective road map concerning the integration of technology in such a way as to maximize student achievement. They represent the theoretical framework for this study.

National Educational Technology Standards

The National Educational Technology Standards and Performance Indicators for School Administrators (NETS-A) were originally developed in 2002 by ISTE and subsequently updated in 2009. In addition to administrator standards, ISTE developed teacher and student standards with corresponding rubrics to facilitate the acquisition of technological competencies.

NETS-A Standards include [2]: Visionary Leadership—Educational Administrators inspire and lead development and implementation of a shared vision for comprehensive integration of technology to promote excellence and support transformation throughout the organization; Digital-Age Learning Culture—Educational Administrators create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students; Excellence in Professional Practice—Educational Administrators promote an environment of professional learning and innovation that empowers educators to enhance student learning through the infusion of contemporary technologies and digital resources; Systemic Improvement—Educational Administrators provide digital-age leadership and management to continuously improve the organization through the effective use of information and technological resources; and Digital Citizenship—Educational Administrators model and facilitate understanding of social, ethical, and legal issues and responsibilities related to an evolving digital culture.

Technology and Student Achievement

Refereed articles cited in this literature review substantiate the connection between proper usage of technology and improved student achievement [3]. When utilized properly, quality integration of technology in daily instruction has been documented to have a positive effect on student achievement. Research suggests that the quantity of technology alone is not critical to student learning [4].

Upon implementation of a computer-assisted learning program, Banerjee, Cole, Duflo, and Linden [5] found an increase in mathematic test scores by 0.47 standard deviation. Penuel et. al. [6] conducted a meta-analysis of 19 studies and found increased student achievement in mathematics, reading and writing when utilizing laptop, home desktop, discrete educational software and voicemail programs into instruction.

The United States Department of Education Institute of Education Sciences (IES) has published several studies through their What Works Clearinghouse (WWC) pertaining to the use of technology and improved student achievement in mathematics. In 2006, IES found that *Everyday Mathematics*, published by Wright Group/McGraw-Hill, had positive effects on students' mathematics achievement. This program addressed real-life problem solving, student communication of mathematics thinking, and appropriate use of technology [7]. In 2009 IES published The *Cognitive Tutor® Algebra I* curriculum study. This curriculum represented an approach combining algebra textbooks with interactive software. The software was developed around an artificial intelligence model that identified student strengths and weaknesses relative to mastery of mathematical concepts. The study included 255 9th grade students and was found to have positive effects on student achievement [8]. What's more in 2009, IES published a meta-analysis report called the *I CAN Learn® Pre-Algebra and Algebra* program. This program was an interactive self-paced, mastery-based software system. Contained within the meta-analysis were 5 different studies including 16,519 8th grade students. Based on data from these studies it was concluded that the software system had a positive effect on mathematics achievement [9].

There have been several published studies pertaining to the use of technology and improved student achievement in reading. In 2007 Knezek and Christensen gathered data from schools in Texas to determine the effect of technology-intensive classroom learning activities. Results of their study indicated technology helped to foster improved reading accuracy in 1st and 2nd graders [10]. Tracy and Young [11] evaluated the effectiveness of the Waterford Early Reading Program software on early literacy development and found that students who utilized this software performed significantly better. In a study by Yip and Kwan [12], undergraduate students increased their vocabulary skills after utilizing online vocabulary games from selected websites. Fasting and Lyster [13] investigated the effect of a computer-based intervention on the enhancement of skills in below average readers and spellers. They found that student improvement in word reading, reading comprehension and spelling occurred.

Studies also indicate positive gains in science achievement when using technology-based instructional strategies properly. Working with middle school students, Dunleavy and Heinecke [14] found that those with one-to-one laptop use with 24-hour access, had improved student achievement in science as measured by standardized tests. Loaded on the laptops was Microsoft Office software, Internet Explorer, and Glencoe/McGraw-Hill textbook resources. Schroeder et al. [15] conducted a meta-analysis of research found in 61 studies from 1980-2004 on science pedagogical strategies. The data in these studies indicated that the instructional use of technology has a significant impact on student achievement. In 7 experiments conducted by Van Lehn et al. [16], it was determined that computer-mediated tutorials could be more beneficial than traditional one-on-one tutorials when the preparation matched content.

Research also indicated that effective computer technology usage can help improve student collaboration and develop learning communities by facilitating the planning, monitoring and evaluating of learning. Computer technology may as well help students understand remember, and learn complex concepts [17]. In addition, web-based virtual environments allow teachers to better address varied student learning styles through the integration of information and communication technology into instruction. Results of a study by Sun, Lin and Yu also indicated technology integration lead to improved academic achievement [18].

Technology and The Role of Administrators

Schools are changing at a speed never witnessed before and technology is at the very center of these changes. School administrators, as technology leaders, must not be consumed with the management of technology at the expense of working through teachers' fears and emotions. Since school leaders play a significant role in the successful implementation and integration of technology, they must play a more proactive role in implementing technology, connecting technology with the improvement of student achievement [19].

As evidenced by the work of Roschelle et al. [20], the commonality to successfully linking technology to improving student achievement is the effective integration of technology into real-life daily instructional practices. All too often administrators provide technological resources to teachers, such as hardware and software, but stop short of attaining the other conditions necessary for connecting technology with improved student achievement.

To serve as an administrative guide, ISTE [2] has identified 7 factors for successful implementation of technology for learning. They include: 1) Providing effective professional development for teachers in the integration of technology into instruction, 2) Aligning local and/or state curriculum standards with appropriate use of technology, 3) Incorporating technology into the daily learning schedule, 4) Providing individualized feedback to students and teachers regarding programs and applications and having the ability for teachers to tailor lessons to individual student needs, 5) Incorporating technology usage into a collaborative teaching environment, 6) Focusing instructional technology utilization into project-based learning and real-world simulations, and 7) Providing leadership, modeling, and support [2].

In a report by NCREL & Metiri Group [21], several reasons were identified for administrators to know and utilize instructional technology. They include the need to prepare students to function in an information-based, Internet-using society, the need to make students competent in using tools found in almost all work areas, and the need to make education more effective and efficient.

METHODOLOGY

Description of Procedures

This purpose of the study was to explore the perceptions and use of technology by principals at Blue Ribbon Schools throughout the United States. A pilot study was conducted prior to the study to determine the reliability and validity of the survey instrument. After making appropriate revisions as identified by pilot study respondents, the researchers deployed a questionnaire based on the 2009 NETS-A Standards and Performance Indicators. These questionnaires were delivered by postal mail.

Participants

Researchers used a criterion-based sample to select principals of nationally recognized Blue Ribbon Schools from 2007 - 2008. Behaviors of Blue Ribbon School principals are important because of the status afforded to them by this recognition. The application process and corresponding requirements and award represent the apex of curricular rigor and academic achievement. Blue Ribbon Schools, together with their teachers and administrators, are seen as models for all members of K-12 educational communities to emulate. Five hundred questionnaires were mailed with 183 returned for a rate of 37%. Participants' age fell within the range of 27 to 60. A list of all Blue Ribbon Principals may be found at http://www2.ed.gov/programs/nclbbrs/.

Research Questions

There were three research questions guiding this study. They were: 1) What was the level of agreement with NETS-A Standards of Blue Ribbon School Principals? 2) Was there a relationship between use of technology and NETS-A Standards? 3) Did the levels of agreement with NETS-A Standards differ by gender?

Instrument

The demographic section of the questionnaire included questions regarding to participant's age, education level, school region, use of mobile devices, email, Internet, and web 2.0 tools, whether or not the participant had received technology training and if so, where the training was received. In addition, 22 closed form questions were included on the instrument. These questions were based on the 2009 ISTE NETS-A Standards and Performance Indicators for Administrators. Items on the questionnaire were related to one of the five emphasis areas. Questions were on a six point Likert Scale and ranged from strongly disagree (1) to strongly agree (6).

The researchers utilized items from the questionnaire to create five variables, one to represent each Standard including Visionary Leadership; Digital-Age Learning Culture; Excellence in Professional Practice; and Systemic Improvement; and Digital Citizenship.

Evidence of Reliability: Cronbach's alpha was computed and reported for the instrument at an alpha level of .936 showing strong consistency and stability in the scores of the questionnaire, as such, the reliability of the instrument is high. Table 1 shows the variable alpha level for each of the five Standards. Alpha levels ranged from .792-.881, showing adequate to good reliability for each measure.

Table 1. Alpha levels of NETS-A Standards

Standard	Alpha Coefficient
Visionary Leadership	.792
Digital-Age Learning Culture	.874
Excellence in Professional Practice	.856
Systemic Improvement	.881
Digital Citizenship	.829

Evidence of Validity: The instrument was designed and developed by researchers who possessed content expertise in the field of K-12 educational leadership. The five main components of the instrument were selected because of their link with NETS-A Standards and Performance Indicators. The components were reviewed to ensure comprehensiveness. Revisions recommended by the focus group, consisting of K-12 administrators, were completed prior to the administration of the questionnaire. Moreover, a Blue Ribbon School principal, who was not selected as part of the sample group, was asked to conduct a final evaluation of the instrument to determine level of difficulty, applicability and practicality of questions, and provide feedback on the wording of questions before mailing.

Analysis Procedures

Data was entered into the SPSS statistical analysis program. Pearson and Spearman correlations were conducted to determine 1) if a relationship existed between the five Standards; 2) if a relationship existed between the level of agreement of the five Standards and the use of mobile devices, email, Internet, and web 2.0 tools; and 3) if a relationship existed between the level of agreement with the five Standards and technology use in general. Independent-sample t-tests were also conducted to determine if there were significant differences between the levels of agreement with the five NETS-A components and gender.

Findings

Descriptive Statistics: Of the 183 participants, over half were female (60.2%) with 39.8% male participants. A large majority of participants held a Master's degree (79.7%) with 13.7% reporting a doctoral degree, 4.9% reporting a Specialist, and 1.6% reporting a Bachelor degree. The study also had a diverse geographic representation with 20.7% of participants reporting from the North, 39.6% reporting from the South, 16.6% reporting from the East, and 23.1% reporting from the West. Sixty-one percent of participants were over the age of 50 with 28.6% reporting in the age of 40-49, 9.9% reporting in the age of 30-39, and less than one percent (.5) reporting in the age of 20-29. Participants were also asked to report his/her level of use of mobile devices, email, Internet, and web 2.0 tools.

Participants reported using email the most frequently with 100% using it on a daily basis, followed by 96.7% of participants using Internet on a daily basis. Mobile device use was split into two main categories with 74% using mobile devices daily and 22.1% never using mobile devices. Most participants rarely used web 2.0 tools such as Wikis, Podcasts, and Online Video Presentations with 20.8% reporting no use and 43.8% reporting once a month use.

Table 2 provides descriptive information on each NETS-A Standard. Each of the five Standards was connected to 3-6 questions from the 22 on the questionnaire. The Likert Scale ranged from 1 being "strongly disagree" to 6 being "strongly agree," however, the minimum and maximums calculated were based on the means of the questions that comprised the respective variable. Visionary leadership reported the highest mean (M = 5.22, SD = .83) and digital citizenship reported the lowest mean (M = 4.19, SD = 1.01).

Table 2. Descriptive Statistics for NETS-A Standards (N=183)

Standard	Min	Max	Mean	Std. Deviation
Visionary (Vis.)	1.00	6.00	5.22	.83
Digital (Dig.)	1.40	6.00	5.02	.79
Excellence (Exc.)	1.67	6.00	5.07	.73
Systemic (Sys.)	1.17	6.00	5.01	.79
Citizenship (Cit.)	1.33	6.00	4.19	1.01

Correlational Analysis: Pearson product-moment correlation coefficients were computed in response to the first research question to determine if relationships existed between the five Standards. As seen in Table 3, positive relationships were found statistically significant between the five Standards with the highest correlation between Digital-Age Learning Culture (Dig.) and Excellence in Professional Practice (Exc.) [r (183) = .865, p< 0.01]. The lowest correlations for each variable were reported with digital citizenship (Cit.).

Table 3. Pearson Correlation Output for NETS-A Standards (N=183)

Standard	Dig.	Exc.	Sys.	Cit.
Vis.	.842**	.853**	.780**	.618**
Dig.		.865**	.824**	.751**
Exc.			.814**	.709**
Sys.				.625**
Cit.				

**. Correlation is significant at the .01 level (2-tailed).

The second correlation tests were conducted to determine if relationships existed between the level of agreement of the five Standards with the specific use of mobile devices, email, Internet, and web 2.0 tools. For each category of technology use participants were asked to self-identify their level of use with the respective technology. The Ordinal Scale ranged from 1 being "daily use"; 2 being "once a week"; 3 being "once a month"; and four being "never." For Visionary Leadership, the Spearman rank correlation coefficients indicated significant positive relationships between mobile devices (r (183) = .233, p< 0.01), Internet (r (183) = .163, p< 0.05), and web 2.0 tools (r (183) = .247, p< 0.01); for Digital-Age Learning Culture, the Spearman rank correlation coefficients indicated significant relationships between mobile devices (r (183) = .183, p< 0.05), Internet (r (183) = .181, p< 0.05), and web 2.0 tools (r (183) = .226, p< 0.01); for Excellence in Professional Practice, the Spearman rank correlation coefficients indicated significant relationships between mobile devices (r (183) = .215, p< 0.01), Internet (r (183) = .205, p< 0.05), and web 2.0 tools (r (183) = .298, p< 0.01); for Systemic Improvement, the Spearman rank correlation coefficients indicated significant relationships between mobile devices (r (183) = .160 p< 0.05), Internet (r (183) = .170, p< 0.05), and web 2.0 tools (r (183) = .194, p< 0.01); and for Digital Citizenship, the Spearman rank correlation coefficients indicated significant relationships between mobile device (r (183) = .200, p< 0.05), and web 2.0 tools (r (183) = .275, p< 0.01). Email was not correlated because all participants reported daily use of email. Additionally, the only correlation not found was between Digital Citizenship and use of the Internet.

The final correlation tests were conducted to determine if relationships existed between the level of agreement with the Standards and technology use in general. For this correlation the variable named TechUse was created to sum use of all four technologies, mobile devices, email, Internet and web 2.0 tools into one variable. A Pearson product-moment correlation coefficient found a positive significant relationship between technology use and Visionary Leadership [r (183) = .270 p< 0.01], Digital-Age Learning Culture [r (183) = .234 p< 0.01], Excellence in Professional Practice [r (183) = .278 p< 0.01], Systemic Improvement [r (183) = .190 p< 0.01], and Digital Citizenship [r (183) = .264 p< 0.01].

Independent Samples T-Test: The final statistical test, an independent samples t-test, was conducted to determine whether or not differences existed in the level of agreement of the NETS-A Standards by gender. Females reported level of agreement was significantly different from males level of agreement in visionary leadership, t (179)=-1.99, p = .048; digital-age learning culture, t (179)=-2.72, p = .007; Excellence in Professional Practice, t (179)=-2.26, p = .025; Systemic Improvement, t (179)=-2.93, p = .004; and in Digital Citizenship, t (179)=-1.77, p = .079. Table 4 provides means and standard deviations by gender for each Standard. Females reported higher levels of agreement than males for all five Standards.

Table 4. Means and Standard Deviations for NETS-A Standards by Gender

Standard	Gender	N	Mean	Std. Deviation
Vis.	Male	72	5.06	.84
	Female	109	5.31	.81
Dig.	Male	72	4.82	.85
	Female	109	5.14	.72
Exc.	Male	72	4.92	.76
	Female	109	5.16	.69
Sys.	Male	72	4.79	.81
	Female	109	5.14	.75
Cit.	Male	72	4.01	.96
	Female	109	4.28	1.02

DISCUSSION

Data and analysis resulting from this study have provided useful insights to help answer the research questions posed by the authors of this work. The answer to the first question, what was the level of agreement with NETS-A

Standards of Blue Ribbon School Principals, has been ascertained within the descriptive statistics generated by the study. This data set indicated that there was a high level of agreement with the Standards as mean scores were between 4.1 and 5.2. The answer to the second question, was there a relationship between use of technology and NETS-A Standards, has been also been ascertained within the correlational statistics. This data set indicated that all NETS-A Standards' relationships were significant and correlated with each other. Finally, the answer to the third question, did the levels of agreement with NETS-A Standards differ by gender, has been ascertained with T-test data. This data set indicated that females reported higher levels of agreement than males for all five Standards.

Recommendations for Policy and Practice

Due to validity concerns, two of the performance indicators were not included in the correlational analysis. They were, adequate funding to support technology integration in their schools (M = 3.81, SD = 1.43), and technology promoting responsible social interactions (M = 3.67, SD = 1.24). Accordingly, it is recommended by the authors of this work that school leaders seek ways to establish sufficient, permanent funding for technology initiatives, as long as these initiatives are connected to real-world applications and are planned in concert with faculty. Also, it is recommended by the authors of this work that school leaders seek ways to promote meaningful social interaction via web 2.0 through active involvement. Sixty-four percent of participants did not belong to a social network. Since web 2.0 is the medium of choice by the digital generation [22], leaders must figure out ways to become compassionate and collaborative partners with students to be able to model appropriate interactions and practices between peers.

College administrators may consider the results of this study to help inform policy decisions regarding administrator preparation programs. Information found in this work can be used to help determine course content pertaining to technology preparation and may also be used to help structure degree programs with technology integrated throughout. Topics such as funding for technology initiatives, knowledge/involvement with social networks, technology equity along with legal and ethical issues may receive additional emphasis since evidence cited in this study suggest deficit areas in need of improvement.

Recommendations for Future Research

Future research is suggested to help determine if regional differences exist among levels of agreement with NETS-A standards. Future research is also recommended to help devise professional development pertaining to technology. Data found in the descriptive statistics indicated a need for professional development as 72% of participants indicated they were self-taught. Added research may be conducted regarding gender differences and differing levels of NETS-A Standards' agreement found at non-Blue Ribbon Schools.

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