NETS•A Scholarship: A Review of Published Literature

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Abstract

To date, no systematic analysis of the current body of literature has aimed to understand the extent to which school technology leadership is being investigated. This review of the literature presents a content analysis of articles published from 1997 through 2010 housed in the Education Resource Information Center (ERIC) database on the topic of school technology leadership. We structured and conceptually framed our analysis around the National Educational Technology Standards for Administrators (NETS•A). Based on our content analysis, 37 articles had any focus on technology leadership as defined by the NETS•A. Although we found all indicators of the standards were covered to some degree, there was a glaring lack of in-depth research around this topic. In fact, nearly 68% of the articles were simply descriptive in nature. We determined that Standard 4: Systemic Improvement and Standard 5: Digital Citizenship were least studied in the current body of literature. We conclude that more scholarly efforts need to focus on topics germane to the technology standards for school leaders. (Keywords: National Educational Technology Standards for Administrators, NETS•A, school technology leadership)

More than a decade has passed since the initial passage of the National Educational Technology Standards for Administrators (NETS•A) in 2001. Since that time, a number of research studies, theoretical pieces, and other writings have been published that deepen our understanding of the technology leadership elements captured in these standards. This article reviews the published scholarly literature that focuses on some element of the current 2009 NETS•A. Our intent is for this literature review to serve as a benchmark for future studies, with a main goal of identifying where more scholarly activity is needed. The next decade of school technology leadership will be informed by how this field is researched in both K–12 schools and educational leadership preparation programs. Thus it is imperative to understand what we know and what had been researched as a way to identify where gaps currently exist in the knowledge base.

Professional Standards for Administrators

School success is often intricately linked with educators mastering a given set of professional standards. Professional standards allow for more effective evaluation of teachers and administrators and provide a framework to compare oneself to other colleagues for further self-evaluation (Wildy, Pepper, & Guanzhong, 2010). The goal of having professional standards in education is to improve professional practice. This is evidenced when states align teacher certification, promotion, and tenure requirements with a corresponding set of professional standards (Center on Education Policy, 2011; Student Learning/Student Achievement Task Force, 2011).

Hancock and Fulwiler (2007) discussed the history of technology standards in the field of educational leadership. They describe how, in 1998, 10 educational associations whose aim was to develop standards for school administrators formed the National Policy Board for Educational Administration (NPBEA). In 1994, the founding associations of NPBEA created the Interstate School Leaders Licensure Consortium (ISLLC) and released the ISLLC Standards for School Administrators in 1996. Within one year of its release, 41 states adopted the ISLLC Standards (Hancock & Fulwiler, 2007). Around the same time, the Educational Leadership Constituent Council (ELCC) released a set of guidelines for administrators called the ELCC Guidelines, which were more applicable to universities because of their focus on professional preparation. The onus placed on school leaders to both know the ISLLC Standards and follow the ELCC Guidelines in their preparation programs led to the creation of the ELCC Standards.

As technologies became increasingly omnipresent in educational systems, the need arose for administrators to understand their impact and respond to these technological changes. Although the ISLCC Standards and the ELCC Standards remain central to educational leaders and educational leadership preparation, it became clear that there was a need to not simply infuse technology into these existing standards, but to create new standards that focused exclusively on the technology needs of school administrators.

Technology Standards

In 2001, the International Society for Technology in Education (ISTE) called together stakeholders, including the National Association of Secondary School Principals (NASSP), National Association of Elementary School Principals (NAESP), American Association of School Administrators (AASA), National School Board Association (NSBA), North Central Regional Educational Laboratory, state departments of education, and university faculty, among other interested parties (Schrum, Galizio, & Ledesma, 2011). Led by ISTE, this team decided there was a need to promote "the idea that knowledge, practice, and specific skills were needed for administrators to be ready to support the appropriate use of technology in a school" (Schrum, et al., 2011, p. 242). This team created and released the National Education Technology Standards for

Administrators (NETS•A) in 2001. ISTE updated the NETS•A in 2009 to take into account the widespread function of technology within the workplace and the necessity for administrators to create learning environments more aligned with technological and career shifts (Schrum, et al., 2011). The NETS•A exist within a broader framework of standards that include technology standards for teachers (NETS•T) and students (NETS•S), along with the recently added standards for coaches (NETS•C) and Computer Science Educators (NETS•CSE) (see http://www.iste.org/standards.aspx for a full description of the NETS family).

The 2009 NETS•A (see Appendix A, pp. 148–150) are comprised of five standards, each representing skills deemed necessary for administrators to lead schools in an increasingly technology-infused society (ISTE, 2009). These standards are:

1. Technology leaders provide a technology-focused vision for all stakeholders in the education system.
2. Technology leaders create and sustain a digital age learning culture.
3. Technology leaders promote an environment of professional practice through the implementation of technology and digital resources.
4. Technology leaders manage their organizations with the effective use of technology.
5. Technology leaders model and understand social, ethical, and legal issues related to digital technologies.

For each of the five standards, ISTE develops performance indicators that give more specific descriptions of the overall standard, thus providing administrators with a guide to achieving the standard.

Like most professional standards, the NETS•A are brief statements of topical coverage and expertise that school leaders should have with regard to school technology leadership. There is little detail, however, in the standards that a leader can use to actually improve leading, teaching, and learning. The work of providing more detailed, contextualized information and evidence is left to scholars through their published research. Thus, this review seeks to capture the emerging literature base on technology leadership in schools, provide data on the types of studies conducted, and align the applicable literature with corresponding NETS•A. Finally, through this review, we sought to identify holes in the current scholarly literature and offer recommendations for providing a more robust literature base to improve future NETS•A-focused research.

Methods and Limitations

We used the Education Resources Information Center (ERIC) database to locate all published work that focused on any element of the NETS•A between the years 1997 and 2010. We chose to start our research in 1997 because the mid-1990s marks a point in time when computers and the Internet began to firmly take hold in K–12 schools. We recognize that 1997–2001

were pre-NETS•A; however, we did our analysis using the NETS•A as a conceptual frame. In other words, we did not seek research specific to the NETS•A, but rather sought research about topics covered by the NETS•A. Thus, we included these formative years because research from that time helped inform the field.

As of early 2011, searching ERIC for the phrase *school technology leadership* returned 59 results for the years in questions. Given that we know the field is much larger than 59 publications, we searched ERIC using various combinations of keywords extracted from each of the five NETS•A (see keyword searches in Appendix B, pp. 150–152). We included only literature specifically focused on issues of K–12 school leadership in this research. We found many broader articles about technology with regard to classrooms and student learning that implicate the NETS•A standards by proxy, but this study sought only literature that focused specifically on leadership.

After conducting the database searches, we read each abstract to determine whether or not we could potentially categorize the article by some element of any of the five standards. We searched until reaching the point of saturation (i.e., locating the same articles using different combinations of keywords). As described in more detail below, we collected all potential articles and then individually analyzed them, seeking any focus pertinent to any of the NETS•A. Only 37 articles in ERIC had topics focused on some aspect of the NETS•A. We conducted a secondary analysis of these 37 articles to determine applicable standards and performance indicators.

We conducted our analyses using three researchers with five rounds of coding, until we reached full agreement across all standards and performance indicators for each article. To increase inter-rater reliability, the first researcher looked across all 37 articles and coded each by applicable standards and performance indicators. In the second round, a second and third researcher analyzed the coding and achieved an 88.16% agreement rate. In the third round, the first researcher attempted to reach agreement with researchers 2 and 3. The first researcher agreed on all codes but found a focus on additional performance indicators within six articles. In this round, we achieved a 94.98% agreement rate. In round four, researchers 2 and 3 agreed on 36 out of the 37 articles, reaching a 99.54% agreement rate. In the fifth and final round, the first researcher agreed on the final code, reaching 100% agreement.

We used ERIC because it is one of the largest, most comprehensive national educational databases. However, this choice imposes some limitations. Because ERIC does not include all educational leadership publications within its database, we did not include every publication in the field of educational leadership in this study.

Additionally, as required by the Education Sciences Reform Act of 2002, the federal government made significant changes to the ERIC database. Starting in late 2003, the ERIC contract with various clearinghouses expired, and in March 2004 the Department of Education awarded the new contract

Table 1. Totals and Percentages of Articles Represented across the NETS•A

Articles	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5
Total (Peer Reviewed)	20(4)	20(7)	20(7)	15(3)	12(4)
Percentage	23.0%	23.0%	23.0 %	17.2%	13.8%

to Computer Sciences Corporation. As part of this change, ERIC no longer included many journals that were previously indexed and did include other journals that may have not been indexed previously. Thus, some journals are indexed from 2004 forward, whereas others are indexed only up until 2004 (ERIC, 2008). For the current study, this means that only certain years of some journals were accurately captured.

Ever-increasing journal coverage further adds to this limitation. For example, before the new contract, ERIC pulled from 16 subject-specific clearinghouses, capturing possibly thousands of journals. In 2008, just a few years after the release of the new ERIC, the database was indexing only 600 journals. By the fall of 2012, ERIC housed 1,166 journals. ERIC does not always index back issues of these new titles prior to their inclusion. Thus, this current study may or may not capture some back issues. ERIC has publicly noted gaps (e.g., a gap of approximately 300 journals from 2002 through 2003) and has made efforts to address these gaps (ERIC, 2007). Corby (2007) noted how these changes indicate a fundamental restructuring of this knowledge base that has implications for both content and accessibility. Hence, the issues regarding ERIC's transition may have significantly limited the search results of the current study.

Results

We conducted a content analysis framed around the NETS•A on the 37 applicable publications found in ERIC. It should be noted that a single article can cover multiple standards and performance indicators. Table 1 details the total articles by standard from 1997 to 2010.

Table 2 (p. 136) details the results of the analysis of each article by where it was published and by standard. Five of the articles came from a source other than a journal (i.e., Other, Nonjournal), *District Administration* contained four articles focused on some element of the NETS•A, and *Learning & Leading with Technology* contained three such articles. All remaining journals housed just one or two articles containing NETS•A elements.

We also wanted to understand how prevalent NETS•A-focused articles are in journals most common to educational leadership researchers. Thus, Table 2 also denotes the journals that Richardson and McLeod (2009) determined to be the most often cited in the field of educational leadership. Out of the 24 journals listed in Table 2, only three journals appeared in Richardson and McLeod's (2009) most-often-cited list in this field of educational leadership.

Table 2. Journals Publishing NETS•A-Focused Articles

Journal	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5
AASA Journal of Scholarship and Practice	1	1	1	1	0
British Journal of Educational Technology	1	0	0	0	0
Computers & Education	0	1	1	0	0
District Administration	1	2	3	2	2
Education	0	1	0	0	1
*Educational Administration Quarterly**	1	1	1	1	1
Educational Considerations	0	1	1	0	0
International Journal of Education Policy & Leadership	1	0	0	1	0
International Journal of Leadership in Education	0	0	1	1	0
Journal of Computer Assisted Learning	0	1	0	0	0
Journal of Educational Technology Systems	0	1	0	0	1
Learning & Leading with Technology	2	1	3	1	1
Management in Education	1	1	1	1	1
*Phi Delta Kappa**	1	1	1	0	0
Principal Leadership	0	0	0	1	0
*School Administrator**	1	0	1	0	0
School Leadership & Management	0	1	1	0	0
Technology & Learning	0	0	0	0	1
Technology, Pedagogy and Education	0	2	2	0	0
TechTrends	1	0	0	0	1
T.H.E. Journal	2	0	0	1	0
The Technology Teacher	1	0	0	0	0
The Turkish Online Journal of Educational Technology	1	1	0	0	0
Thrust for Educational Leadership	1	0	0	0	0
Other, Nonjournal	4	4	3	5	3
Total	**20**	**20**	**20**	**15**	**12**

**Listed in Richardson & McLeod (2009) as top-cited journals in the field of educational leadership*

Table 3 (p. 138) details the type of research methodology used in each article by standard. Twenty-five of the 37 articles (67.6%) in the study were published as reports, meaning that the publications were written as descriptions of projects rather than as descriptions of empirical studies. Whereas qualitative research made up only three of the articles (8.1%), quantitative research accounted for 9 of the 37 articles (24.3%). Only Standard 2: Digital Age Learning Culture and Standard 3: Excellence in Professional Practice contained qualitative research articles, whereas the other standards were more evenly distributed among quantitative and report-based articles.

Standard 1: Visionary Leadership

We found six quantitative studies with some focus on Standard 1: Visionary Leadership of the NETS•A. For organizational purposes, we discuss three of the studies under this standard and discuss the remaining three under the final subheading of All Standards, where we describe the articles that covered all five standards. Lecklider, Clausen, and Britten (2009) observed and surveyed 57 school administrators to understand the priority principals place on technology within their day-to-day tasks. A discussion of being a visionary leader prevailed throughout the article. Ritzhaupt, Hohlfeld, Barron, and Kemker (2008) surveyed 2,482 K–12 teachers across the state of Florida for the 2003–2004 and 2005–2006 school years to better understand funding and planning issues relevant to technology integration. The results showed a significant increase over the years of the involvement of all stakeholders in the planning and visioning process. Afshari, Bakar, Luan, Samah, and Fooi (2008) collected data from 30 secondary principals in Tehran, Iran, and found that the principals used technology 2 or 3 days a week to complete their administrative tasks. The researchers suggested that, as Iranian principals become more proficient with technology and its uses in education, their technology leadership skills will improve, allowing them to infuse a stronger vision for the use of technology in their schools.

The remaining articles that contained information on the first standard were classified as descriptive studies or reports. Butler (2010a) published a description of an administrator who successfully implemented his technology vision over the 4 years of his superintendency in a Wisconsin, USA, school district. McCombs (2010) outlined how, when the textile mills around Kannapolis City Schools in North Carolina, USA, were abruptly shut down, billionaire David Murdock bought the space and turned it into the North Carolina Research Campus. Many families lost their jobs, and many new families moved into the area, but at the K–12 level, there was a new focus on preparing students for 21st century, technology-driven jobs. McCombs outlined the strategic plan and vision that Kannapolis City Schools put into place. Ferrandino (2001) discussed the ever-growing responsibilities of an elementary teacher at the turn of the century. Ferrandino warned that 21st century challenges demand that principals must be prepared to revise their vision to include stakeholders and involve the community when implementing and funding technology initiatives. Wolf (2007) led readers through a personal journey of how an administrator was concentrating on tradition and rules and was unable to understand the digital age reforms the teachers were attempting to implement. Wolf said that creating, sharing, and believing in a vision is a vital aspect of an administrator's job description. Scoolis (1998) wrote about ways to become a visionary leader in the school. This focuses on asking questions about how technology implementations have led to positive changes in the learning environment.

Table 3. Research Methodology for Each Article by NETS•A

Article		Standard 1	Standard 2	Standard 3	Standard 4	Standard 5
Anderson & Dexter (2000)	Quantitative	1	1	1	1	1
Anderson & Dexter (2005)		1	1	1	1	1
Afshari, Bakar, Luan, Samah, & Fooi (2008)		1	0	0	0	0
Afshari, Bakar, Luan, Samah, & Fooi (2009)		0	1	1	0	0
Afshari, Bakar, Luan, Afshari, Fooi, & Samah (2010)		0	1	0	0	0
Lecklider, Britten, & Clausen (2009)		1	1	1	1	0
Parks, Sun, & Collins (2002)		1	1	1	1	1
Ritzhaupt, Hohlfeld, Barron, & Kemker (2008)		1	0	0	1	0
Stuart, Mills, & Remus (2009)		0	1	1	0	0
Granger, Morbey, Lotherington, Owston, & Wideman (2002)	Qualitative	0	1	0	0	0
Haughey (2006)		0	1	1	0	0
Deryakulu & Olkun (2009)		0	1	1	0	0
Abrego & Pankake (2010)	Report / Descriptive Study	0	1	1	0	0
Butler (2010)		1	1	1	1	0
Butler (2010)		0	0	0	0	1
Coffman (2009)		0	0	1	0	0
Darrow (2010)		1	0	1	0	0
Davidson & Olson (2003)		0	0	1	1	0
Davies (2010)		1	1	1	1	1
Dessoff (2010)		0	1	1	0	0
Dessoff (2010)		0	0	1	1	1
Dyal, Carpenter, & Wright (2009)		0	1	0	0	1
Erekson (2005)		1	0	0	0	0
Ferrandino (2001)		1	1	1	0	0
Fletcher (2009)		1	0	0	0	0
Garland (2009)		0	1	0	0	1
Kowch (2009)		1	0	0	0	1
Lankutis (2004)		0	0	0	0	1
Larson, Miller, & Ribble (2010)		1	1	1	1	1
Lesisko & Place (2005)		0	0	0	1	0
Maddox (2009)		0	0	0	1	0
McCombs (2010)		1	0	1	0	0
Mee (2007)		1	0	0	0	0
Riedle, Smith, Ware, Wark, & Yount (1998)		1	1	0	1	0
Scoolis (1998)		1	0	0	0	0
Slowinski (2000)		1	1	1	1	1
Wolf (2007)		1	0	0	1	0
Total		**20**	**20**	**20**	**15**	**12**

Mee (2007) focused on the United Kingdom's centralized funding of technology initiatives and the difficulty with using local funding to support government-started programs. Mee suggested five funding models that policy- and decision-makers can use to support technology initiatives. Darrow (2010) outlined how a California high school began to offer some courses online to cut costs and thus allowed more students to enroll in different classes. To begin these online classes, the high school administrators had to work with different stakeholders to develop a plan and advocate at the local level to have funding for this new technology program.

Fletcher (2009) wrote exclusively about institutes in Illinois and Maine that provide a space for collaboration for principals to discuss technology implementations in their schools. Along with providing resources and information for these principals, both of the institutes helped the administrators develop and update their technology visions. Kowch (2009) wrote about helping future administrators in charter schools envision a cybercharter school built around distributed leadership and discussed the importance of a vision plan for such a school. Erekson (2005) offered various vignettes of educational leaders to help others learn how previous and current administrators have led technology change within their school districts. Erekson also stressed the importance of collaborating with stakeholders and having a passion for the school vision that includes a focus on technology. Riedl, Smith, Ware, Wark, and Yount (1998) described all aspects of the first standard by discussing the importance of developing a technology vision, along with deployment, support, and communication of that vision.

Standard 2: Digital Age Learning Culture

Along with discussing visionary leadership, Lecklider et al. (2009) showed how administrators are attempting to create a culture at their school that promotes instructional innovation and learning-centered environments. Stuart, Mills, and Remus (2009) surveyed New Zealand school leaders and found that they had reasonably high levels of technology competency. By effectively modeling the use of technology, these school leaders were able to ensure effective practice of technology use in their schools for learning purposes. Afshari, Bakar, Luan, Samah, and Fooi (2009) used questionnaire data from 30 secondary school principals in Iran and found that these schools leaders had moderate levels of technology competency. The majority of the article offered suggestions for future schools in Iran, including the necessity to equip classrooms with more technology and learning resources. Afshari, Bakar, Luan, Afshari, Fooi, and Samah (2010) took the final data from the questionnaire discussed above and, based on a final data set of 320 Iranian secondary school principals, examined the extent to which the principals used computers. Findings showed four factors played a role in principals' computer usage: computer access, perceptions of the characteristics of using technology, computer competence, and behaviors ascribed to leaders.

Three of the articles coded for Standard 2: Digital Age Learning Culture were based on qualitative research. Granger, Morbey, Lotherington, Owston, and Wideman (2002) analyzed four case studies of Canadian schools to see what factors are successful in technology integration. Results of the study showed how administrators focus on instructional innovation and are participating in collaboration for digital age learning. Haughey (2006) interviewed 30 Canadian principals to see how they model and promote the use of technology within the learning environment. Analyses of the interviews showed that the use of technology is helping schools switch from hierarchical leadership to more distributed leadership. Deryakulu and Olkun (2009) interviewed 74 Turkish computer teachers to examine their experiences with school administration. The researchers found that the computer teachers thought the administrators lacked basic knowledge and skills with technology and were not helping to promote the frequent use in schools.

In Butler's (2010a) case study, the superintendent redefined the digital age culture in his school district. Through modeling his own use of technology in the learning environment, writing several grants to equip his schools with devices, and ensuring effective practice in the use of these devices, the superintendent ensured that his schools are well prepared for the 21st century. Ferrandino (2001) encouraged elementary principals to not only promote the use of technology for learning, but to work harder to provide a technology-infused learning environment. Riedl et al. (1998) pointed out the necessity of providing an environment equipped with the appropriate learning technology and effective practice, whereas Garland (2009) added that school leaders should advocate for equity and access for new technologies.

Dyal, Carpenter, and Wright (2009) discussed how administrators should provide learner-centered environments and ensure instructional innovation related to the use of assistive technology for students with disabilities. Dessoff (2010b) discussed the importance of reaching digital natives within the school by providing a learning-center environment infused with technology and resources to help students more. Abrego and Pankake (2010) added that administrators should be preparing their teachers and students for the 21st century by providing resources and support to best fit the diverse needs of all learners.

Standard 3: Excellence in Professional Practice

Lecklider et al. (2009) emphasized that administrators place a higher priority on professional development versus other aspects of the technology integration process. Along with identifying the effective use and promotion of technology in New Zealand school leaders, Stuart et al. (2009) found that school leaders preferred professional development that was hands-on and collaborative. Afshari et al. (2009) discussed how professional development programs should engage stakeholders in the study and use of technology for learning.

Two qualitative studies mentioned apspects of the third NETS•A standard. Haughey (2006) found that through modeling technology use, Canadian principals are creating a learning environment of collaboration and better communication between all stakeholders. Deryakulu and Olkun (2009) interviewed Turkish computer teachers and found that school administrators were not collaborating with computer teachers to implement the best technology practices.

Butler (2010a) described how one superintendent found funding to provide appropriate one-on-one help with classroom technology integration from fellow teachers. The superintendent also used outside consultants to work with teachers on new instructional techniques. In McCombs' (2010) overview of how Kannapolis City Schools transformed their school culture to include 21st century learning and tools, the researcher noted how the first part of the strategic plan was to provide professional development for teachers and administrators. Ferrandino (2001) also discussed the importance of the administrator providing professional development based on technology integration, even at the elementary school level. By staying on top of an emerging practice of providing high school students with online course opportunities, Darrow (2010) discussed how the administration was able to offer extensive professional development to teachers willing to teach an online course.

Along with providing a learning-centered environment for digital natives, Dessoff (2010b) suggested that teachers need to be provided with resources and access to learn more about technology and ways to use technology in the classroom. Abrego and Pankake (2010) advised school leaders in virtual schools to not focus on a single solution, but rather continue to read the research so that the field of education can continue to move forward. Dessoff (2010a) reviewed how different school districts have been able to use flexible technology to make schools future ready.

Davidson and Olson (2003) discussed the sociological aspects of a case study of the Hessen Model School Partnership, which was a school district they studied between 1995 and 2001 to understand the impact technology had on the learning environment. The authors focused on how the use of technology transformed the administrator's role and created a collaborative culture where administration and teachers were able to provide better support and more effective communication mechanisms.

Standard 4: Systemic Improvement

Another focus in Lecklider et al.(2009) is how an administrator should continually strive to improve learning goals by leading purposeful change in the use of technology. Along with the increase in stakeholders being involved in the planning process, Ritzhaupt et al. (2008) suggested that educational administrators should not only look at purposeful change to achieve learning goals, but also look to sustain and create new funding for technology resources, even if the change entails creating partnerships outside of the educational system.

Butler (2010a) provided an example of how a Wisconsin superintendent was able to lead purposeful change to increase learning goals as well as maintain an infrastructure for technology in his school district. Wolf (2007) said that the principal must understand how every technology effort benefits student learning and teacher growth. Riedl et al. (1998) discussed the importance of vision and environment but also added how goals and objectives of the technology implementation should be aligned with assessment measures to appropriately follow the progress of learning and teaching, implicating the evaluation element of Standard 4: Systemic Improvement. Dessoff (2010a) wrote about how different technologies, such as interactive whiteboards and cloud-based computing, continue to be cost effective while improving the learning and teaching process.

Davidson and Olson (2003) described how the Hessen Model School Partnership project was able to successfully implement a large technology system that led to purposeful change for the students. Coffman (2009) examined how instructional technology resource teachers are a useful part of school systems. Coffman focused on a law in Virginia that requires every school to have one of these teachers for every 1,000 students. Coffman argued that instructional technology resource teachers can provide in-house professional development to support administrators, faculty, and staff in the effective use of technology. Maddox (2009) supported a blended learning environment. Maddox noted that retaining competent teachers to help implement a blended learning environment, which includes elements of online learning and traditional classroom learning, can have positive effects on student outcomes. Lesisko and Place (2005) wrote about the importance of hiring the most qualified school technology coordinator. If they hire a highly competent individual, schools can use this person to help develop a technology vision, provide support to stakeholders, and develop technology budget plans, among other duties.

Standard 5: Digital Citizenship

In discussing the benefits of distributed and subjective leadership techniques for cybercharter schools, Kowch's (2009) article also focused on providing equitable access to digital learning tools and resources. Dyal et al.(2009) mentioned that equitable access is an important part of a school administrator's duties. The researchers also suggested that the facilitation of policies and a shared school culture for students with disabilities should include 21st century learning. Lankutis (2004) further noted that "the Individuals with Disabilities Education Act requires every school to provide its special needs students with whatever technologies are necessary for a 'free and appropriate education' " (p. 30). Lankutis mentioned that administrators should find more ways to include all stakeholders in decisions involving individual education plans (IEPs) and which technologies should be used to address the needs of each student.

In Garland's (2009) discussion on emerging technology trends, the principal was advised to keep in mind student diversity, to have safe Internet policies in place, and to guarantee "environmentally sound procedures" (p. 39). Dessoff (2010a) pointed out that using new technologies and constantly evaluating their cost effectiveness have led to educational opportunities for students. Butler (2010b) wrote about school districts around the United States that have used social media networks as a way to communicate with the greater community. The authors remained conscious of individuals who could not afford the expense of technology that supports social media. Butler wrote that many school districts were continuing their traditional means of communication, along with the incorporation of social media outlets.

All Standards

Six articles focused explicitly on the NETS•A and thus contained elements of all five standards. That is, six articles were about the NETS•A. Anderson and Dexter (2000) used a 1998 nationwide survey of more than 800 schools to examine technology leadership characteristics, as defined by the NETS•A, and effects of technology outcomes. Anderson and Dexter (2005) used the same dataset from their 2000 study and found technology leadership played an essential role in technology outcomes more than any other indicator analyzed in the research. Parks, Sun, and Collins (2002) conducted a pre- and postsurvey on 341 principals and superintendents from the U.S. state of Alabama who attended the Alabama Renaissance Technology Academy for School Leaders. This survey, consisting of factors aligned with the NETS•A, measured school leaders' perspectives on providing technology leadership within their school districts. Results showed that the 10-month training program in educational technology improved these administrators' performance to provide technological leadership within their school districts.

The remaining three articles that focused explicitly on the NETS•A were reports or conceptual pieces rather than empirical research studies. Larson, Miller, and Ribble (2010) provided an overview of the NETS•A and discussed ideas about how different stakeholders in education can integrate technology into all aspects of learning and teaching. Slowinski (2000) reported on past research and current resources for school administrators to address legal issues, funding, and professional development issues. The publication provided a vision plan that addresses the same standards for which NETS•A was developed. Finally, Davies (2010) conducted a literature review using Google Scholar between the years of 1998–2008. The researchers discussed the search results in terms of definitions of technology leadership, the leader's role in educational change, and why schools were adopting digital technology.

Discussion

After a thorough review of all included literature, it is clear that more scholarly effort needs to focus on the technology standards for educational leaders, specifically the NETS•A. While the literature generally covered all aspects of each standard, researchers need to further the field by going in depth for each performance indicator. Some articles mentioned performance indicators but gave them only a simple overview. From the quantitative findings in this study, it is clear that Standard 4: Systemic Improvement and Standard 5: Digital Citizenship lack extensive research compared to the first three standards. Although it is important to undertake research studies on any aspects of the NETS•A, it is concerning that relatively less attention has been paid to digital equity and technology evaluation aspects of leadership. Given the potential social and economic impact of these expensive and horizon-broadening tools, we must focus more on providing a solid literature base on these issues. For instance, an increase in scholarly literature in these areas could foster not only the effective and efficient growth of technology in schools, but also more responsible use of these tools as we seek to improve student learning outcomes for all students.

Because of these holes in the literature, future scholarly research opportunities are plentiful. Further studies need to include a focus on many, if not all, of the performance indicators. In particular, scholars can seek to provide more qualitative examples of successful administrator implementations and could seek to quantify and analyze more generalizable data across districts. Furthermore, given the limited availability of literature on school technology leadership in those journals most often referenced by educational leadership scholars, the field should work more with journals to provide special issues on school technology leadership. Although there currently is no single journal focused on issues of technology leadership, special issues such as the March 2011issue of *Journal of School Leadership* evidence how technology leadership can be brought to the forefront in the educational leadership literature.

One positive finding of this review is the highly international nature of the scholarship on school technology leadership. Most of this non-U.S. research was published in journals indexed by ERIC but typically based in non-English speaking countries, such as Turkey. This is a positive sign but begs the question of what other international scholarly research has been conducted that ERIC has not indexed. Additionally, what globally relevant lessons can we draw from this work? Thus, scholars must not only continue to research technology leadership in their own countries, but increasingly they need to communicate with international scholars through conferences, journals, social media, or other means to broaden the application of their work.

There is still much work to be done as the NETS•A enter their second decade of existence. The literature produced to date does show that the field of educational leadership, globally, has at least begun to respond to the technology leadership challenges articulated in the NETS•A that schools are facing. With the many remaining holes in the literature as well as the lack of in-depth research on many vital areas, the scholarly field has not yet provided the necessary resources for educational leaders working to implement technology-facilitated changes in learning and teaching. These leaders are facing many difficult and daily challenges, from purchasing to professional development. Further, students and communities need leadership from principals and other administrators in how to be smart digital citizens and consumers of these new resources. Thus, the challenge facing school leaders is substantial, with only a less-than-extensive literature base to turn to for assistance. Technology-driven change will only continue to accelerate. The scholarly community must do its part to provide more and better investigations and literature on technology leadership in the future. If the scholarly community can provide a more substantial school technology leadership literature base, and leaders in turn improve their leadership in schools on technology issues, students and communities will have more robust learning opportunities in the future.

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References

*Abrego, J., & Pankake, A. (2010). PK–12 virtual schools: The challenges and roles of school leaders. *Educational Considerations, 37*(2), 7–13.

*Afshari, M., Bakar, K., Luan, W., Afshari, M., Fooi, F., & Samah, B. (2010). Computer use by secondary school principals. *The Turkish Online Journal of Educational Technology, 9*(3), 8–25.

*Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2008). School leadership and information communication technology. *The Turkish Online Journal of Educational Technology, 7*(4), 1–10.

*Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., & Fooi, F. S. (2009). Technology and school leadership. *Technology, Pedagogy and Education, 18*(2), 235–248. doi: 10.1080/14759390902992527

*Anderson, R., & Dexter, S. (2000). *School technology leadership: Incidence and impact.* Retrieved from http://escholarship.org/uc/item/76s142fc

*Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*(1), 49–82. doi: 10.1177/0013161x04269517

Branigan, C. (2003, July 16). Thousands object to ED's proposed ERIC changes. *Eschool News.*

*Butler, K. (2010a). A small district's big innovator. *District Administration, 46*(9), 78–80.

*Butler, K. (2010b). Tweeting your own horn. *District Administration, 2*(2), 41–44.

Center on Education Policy. (2011). *States' progress and challenges in implementing common core state standards.* Washington, DC: Center on Education Policy.

*Coffman, T. (2009). Getting to the heart of technology integration: Virginia's instructional technology resource teacher program. *Learning & Leading with Technology, 36*(7), 20–23.

*Darrow, R. (2010). The bottom line: Funding online courses. *School Administrator, 67*(4), 26–30.

*Davidson, J., & Olson, M. (2003). School leadership in networked schools: Deciphering the impact of large technical systems on education. *International Journal of Leadership in Education, 6*(3), 261–281. doi: 10.1080/1360312032000138692

*Davies, P. M. (2010). On school educational technology leadership. *Management in Education, 24*(2), 55–61. doi: 10.1177/0892020610363089

*Deryakulu, D., & Olkun, S. (2009). Technology leadership and supervision: An analysis based on Turkish computer teachers' professional memories. *Technology, Pedagogy and Education, 18*(1), 45–58. doi: 10.1080/14759390802704055

*Dessoff, A. (2010a). Making your schools future proof. *District Administration, 46*, 64–67.

*Dessoff, A. (2010b). Reaching digital natives on their terms. *District Administration, 46*, 36–38.

*Dyal, A., Carpenter, L. B., & James, W. (2009). Assistive technology: What every school leader should know. *Education, 129*(3), 556–560.

Education Resource Information Center (ERIC). (2007, May 31). *ERIC addresses 2002–2003 gap in indexed records.* Retrieved from http://eric.ed.gov/ERICWebPortal/resources/html/news/eric_news_45.html

Education Resource Information Center (ERIC). (2008, August 3). *New journals boost ERIC collection coverage.* Retrieved from http://eric.ed.gov/ERICWebPortal/resources/html/news/eric_news_58.html

*Erekson, T. L. (2005). Examples of leadership: What we can learn from technology education leaders. *The Technology Teacher,* 27–30.

*Ferrandino, V. L. (2001). Challenges for 21st century elementary school principals. *Phi Delta Kappa, 82*(6), 440–442.

*Fletcher, G. H. (2009). A matter of principals. *T.H.E. Journal, 36*(5), 22–28.

*Garland, V. E. (2009). Emerging technology trends and ethical practices for the school principal. *Journal of Educational Technology Systems, 38*(1), 39–50.

*Granger, C. A., Morbey, M. L., Lotherington, H., Owston, R. D., & Wideman, H. H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning, 18,* 480–488.

Hancock, R. J., & Fulwiler, J. (2007). Technology for 21st century educational leaders: A new standard for success. In S. Donahoo & R. C. Hunter (Eds.), *Teaching leaders to lead teachers* (Advances in Educational Administration) (Vol. 10, pp. 41–56). Emerald Group Publishing Limited.

*Haughey, M. (2006). The impact of computers on the work of the principal: Changing discourses on talk, leadership and professionalism. *School Leadership & Management, 26*(1), 23–36.

International Society for Technology in Education (ISTE). (2009). *NETS for administrators 2009.* Retrieved from http://www.iste.org/docs/pdfs/nets-a-standards.pdf?sfvrsn=2

*Kowch, E. (2009). New capabilities for cybercharter school leadership: An emerging imperative for integrating educational technology and educational leadership knowledge. *TechTrends, 53*(4), 41–48. doi: 10.1007/s11528-009-0305-7

*Lankutis, T. (2004). Special needs technologies: An administrator's guide. *Technology & Learning, 25*(2), 30–35.

*Larson, L., Miller, T., & Ribble, M. (2010). 5 considerations for digital age leaders: What principals and district administrators need to know about tech integration today. *Learning & Leading with Technology, 37*(4), 12–15.

*Lecklider, D., Clausen, J. M., & Britten, J. S. (2009). Principals priority for technology as an indicator of observed use in schools. *Journal of Scholarship and Practice, 5*(4).

*Lesisko, L. J., & Place, R. A. (2005). *Hiring the best qualified technology coordinator: A Pennsylvania perspective.* Paper presented at the PASA-PSBA School Leadership Conference, Hershey, PA.

*Maddox, M. (2009). Blended learning: The Internet and the classroom. *Principal Leadership, 10*(4), 72–74.

*McCombs, B. (2010). Culture of collaboration. *Learning & Leading with Technology, 38*(3), 10–13.

*Mee, A. (2007). E-learning funding for schools: A policy paradox? *British Journal of Educational Technology, 38*(1), 63–71. doi: 10.1111/j.1467-8535.2006.00596.x

*Parks, S., Sun, F., & Collins, B. C. (2002). *Alabama Renaissance Technology Academy (ARTA) for school leaders survey report (pre & post data).* Paper presented at the Mid-South Educational Research Association, Chattanooga, TN.

Richardson, J. W., & McLeod, S. (2009). Where should educational leadership authors publish to get noticed by the top journals in the discipline? *Educational Administration Quarterly, 45*(4), 631–639.

*Riedl, R., Smith, T., Ware, A., Wark, A., & Yount, P. (1998). *Leadership for a technology-rich educational environment.* Paper presented at the Society for Information Technology & Teacher Education International Conference, Washington, DC.

*Ritzhaupt, A. D., Hohlfeld, T. N., Barron, A. E., & Kemker, K. (2008). Trends in technology planning and funding in Florida K–12 public schools. *International Journal of Education Policy & Leadership, 3*(8), 1–17.

Schrum, L., Galizio, L., & Ledesma, P. (2011). Educational leadership and technology integration: An investigation into preparation, experiences, and roles. *Journal of School Leadership, 21*(2), 241–261.

*Scoolis, J. (1998). What is vision and how do you get one? *Thrust for Educational Leadership, 28*(2), 20–21, 36.

*Slowinski, J. (2000). *Becoming a technologically savvy administrator.* (EDO-EA-00-1). Retrieved from http://www.eric.ed.gov

*Stuart, L. H., Mills, A. M., & Remus, U. (2009). School leaders, ICT competence and championing innovations. *Computers & Education, 53*(3), 733–741.

Student Learning/Student Achievement Task Force. (2011). *Student learning, student achievement: How do teachers measure up?* Arlington, VA: National Board for Professional Teaching Standards.

Wildy, H., Pepper, C., & Guanzhong, L. (2010). Applying standards for leaders to the selection of secondary school principals. *Journal of Educational Administration, 49*(3), 276–291.

*Wolf, M. A. (2007). Systemic school reform: A guiding hand. *T.H.E. Journal, 34*(7), 12–25.

** Articles included in the literature review.*

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Appendix A

NETS for Administrators (ISTE, 2009)

1. **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. Educational Administrators:
   a. Inspire and facilitate among all stakeholders a shared vision of purposeful change that maximizes use of digital-age resources to meet and exceed learning goals, support effective instructional practice, and maximize performance of district and school leaders
   b. Engage in an ongoing process to develop, implement, and communicate technology-infused strategic plans aligned with a shared vision
   c. Advocate on local, state, and national levels for policies, programs, and funding to support implementation of a technology-infused vision and strategic plan

2. **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 student. Educational administrators:
   a. Ensure instructional innovation focused on continuous improvement of digital age learning
   b. Model and promote the frequent and effective use of technology for learning
   c. Provide learner-centered environments equipped with technology and learning resources to meet the individual, diverse needs of all learners
   d. Ensure effective practice in the study of technology and its infusion across the curriculum
   e. Promote and participate in local, national, and global learning communities that stimulate innovation, creativity, and digital-age collaboration

3. **Excellence in Professional Practice.** Educational Administrators promote an environment of professional learning and innovation that empower educators to enhance student learning through the infusion of contemporary technologies and digital resources. Educational administrators:

a. Allocate time, resources, and access to ensure ongoing professional growth in technology fluency and integration

b. Facilitate and participate in learning communities that stimulate, nurture, and support administrators, faculty, and staff in the study and use of technology

c. Promote and model effective communication and collaboration among stakeholders using digital-age tools

d. Stay abreast of educational research and emerging trends regarding effective use of technology and encourage evaluation of new technologies

4. **Systemic Improvement.** Educational Administrators provide digital-age leadership and management to continuously improve the organization through the effective use of information and technology resources. Educational administrators:

a. Lead purposeful change to maximize the achievement of learning goals through the appropriate use of technology and media-rich resources

b. Collaborate to establish metrics, collect and analyze data, interpret results, and share findings to improve staff performance and student learning

c. Recruit and retain highly competent personnel who use technology creatively and proficiently to advance academic and operational goals

d. Establish and leverage strategic partnerships to support systemic improvement

e. Establish and maintain a robust infrastructure for technology including integrated, interoperable technology systems to support management, operations, teaching, and learning

5. **Digital Citizenship.** Educational administrators model and facilitate understanding of social, ethical, and legal issues and responsibilities related to an evolving digital culture. Educational administrators:

a. Ensure equitable access to appropriate digital tools and resources to meet the needs of all learners

b. Promote, model, and establish policies for safe, legal, and ethical use of digital information and technology

c. Promote and model responsible social interactions related to the use of technology and information

d. Model and facilitate the development of a shared cultural understanding and involvement in global communication and collaboration tools

Appendix B

Keywords Used to Search

Standard 1: Visionary Leadership

	Search Terms			
Search 1	educat*	vision*	lead*	
Search 2	NETS	vision*	lead*	
Search 3	digital	vision*	educat*	administrat*
Search 4	educat*	tech*	lead*	vision*
Search 5	educat*	tech*	vision*	administrat*
Search 6	educat*	administrat*	tech*	plan*
Search 7	educat*	administrat*	tech*	fund*
Search 8	educat*	administrat*	tech*	financ*
Search 9	educat*	administrat*	tech*	polic*
Search 10	educat*	administrat*	tech*	program*
Search 11	educat*	lead*	tech*	plan*
Search 12	educat*	lead*	tech*	financ*
Search 13	educat*	lead*	tech*	polic*
Search 14	educat*	lead*	tech*	program*
Search 15	educat*	lead*	tech*	vision*

Standard 2: Digital Age Learning Culture

	Search Terms			
Search 1	NETS	standard 2	educat*	
Search 2	tech*	school*	administrat*	
Search 3	tech*	educat*	administrat*	
Search 4	tech*	educat*	principal*	
Search 5	school tech*	administrat*	principal*	
Search 6	educat*	tech*	promot*	
Search 7	educat*	tech*	administrat*	
Search 8	educat*	tech*	administrat*	promot*

Standard 3: Excellence in Professional Practice

	Search Terms			
Search 1	educat*	administrat*	profession*	tech*
Search 2	educat*	fluency	integrat*	tech*
Search 3	educat*	communicat*	collaborat*	tech*
Search 4	educat*	tech*	administrat*	
Search 5	educat*	facilitat*	profession*	devel*
Search 6	educat*	research*	tech*	eval*
Search 7	access*	grow*	educat*	tech*

Standard 4: Systemic Improvement

	Search Terms				
Search 1	system* improve*	digital	leader*	administrat*	educat*
Search 2	change	tech*	leader*	educat*	
Search 3	change	tech*	administrat*	educat*	
Search 4	data	result*	tech*	administrat*	
Search 5	personnel	tech*	recruit*	educat*	
Search 6	educat*	partner*	improv*	tech*	
Search 7	dddm	educat*			
Search 8	didm	educat*			
Search 9	coordin*	lead*	hir*	educat*	
Search 10	assess*	system*	lead*	tech*	
Search 11	coordin*	lead*	recruit*	educat*	
Search 12	coordin*	lead*	retain*	educat*	
Search 13	tech*	educat*			
Search 14	admin*	school*	hir*		

Standard 5: Digital Citizenship

	Search Terms				
Search 1	tech*	social	ethic*	legal	administrat*
Search 2	tech*	access	equity	administrat*	
Search 3	educat*	lead*	tech*	develop*	disabl*
Search 4	educat*	lead*	teach*	special need*	
Search 5	involv*	global*	collab*	educat*	
Search 6	involv*	global*	collab*	administrat*	
Search 7	lead*	tech*	special need*	5b	
Search 8	tech*	lead*	educat*	global*	
Search 9	international	tech*	lead*		