

Is Technology Integration Finding Its Way Into the Classroom?

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Abstract

In response to the need to prepare teachers to effectively integrate technology into elementary and secondary classrooms, a program funded by a South Dakota initiative provided an intensive professional development model for K-12 teachers to learn to integrate instructional technology. This study investigated how well teachers integrated technology during the four years following the professional development model and what hindered or supported technology integration in the classroom. The data analyses from the survey completed by 174 teachers revealed that teachers used, facilitated, and integrated technology, but technology integration still needs to continue as a professional development focus in the classroom. The survey questions show teachers had the highest mean as technology operators and technology facilitators with the mean for teachers as technology integrationists being the lowest. The two greatest barriers to technology integration, according to the survey, both relate to finding time to develop, implement, and communicate with students and time commitment to learn and implement technology. The respondents agreed most strongly that what helped technology integration included support by school administration and up-to-date computers with hardware and software. The current literature indicates that teachers use and facilitate learning with technology, but teachers need to continue learning and finding strategies for integration of technology in the classroom.

1. Introduction

Professional development is critical to ensure that teachers keep up with the changes in technology and with the creation of new technology tools. Since students have access to communication and information technologies both in school and at home, schools need to ensure that teachers integrate technology effectively to support student learning.

Warlick (2004) said teachers have not been able to make dramatic changes in teaching to prepare students for the future with activities using technology. Technology integration is not a “one size fits all” where teachers do the same thing for their students or where teachers possess the same specific skills to be competent technology users (Wepner, Tao, & Ziomek, 2006). Teachers know *how* and *why* to use technology in the learning process, but effective technology integration to enhance and support teaching and learning in the classroom

eludes many teachers (Plair, 2008). Professional development focus has been on the teachers’ operation and use of productivity tools before technology integration to enhance student learning. Intensity and time commitment to professional development activities requires teachers to become competent at integrating technology to enhance teaching and learning (Overbaugh & Lu, 2008).

South Dakota implemented a technology integration model for teachers called the Technology for Teaching and Learning Academies in 1997 that lasted through 2003. Several important objectives of the South Dakota model were that (a) teachers develop technology-supported activities to promote engaged, worthwhile learning, (b) teachers use integration practices related to instructional technology, and (c) teachers model life-long learning using technology (Schopp & Rothernel, 2001). The professional development model was to establish a growing cadre of highly trained educators who change teaching and learning through the integration of technology into the curriculum. The Basic TTL Academy was designed as a four-week academy that provided teachers with skills to effectively use technology as a teaching and learning tool in the classroom. The Distance Teaching and Learning (DTL) Academy was created as a three-week academy that allowed K-12 educators to research, implement, and evaluate distance learning theory; practice interactive video; and apply instructional design and multimedia production using distance strategies (Gosmire & Vondruska, 2001). The purpose of the Advanced TTL Academy was to provide a two-week academy for educators to build on their skills and abilities presented at the Basic TTL and to extend skills in advanced software applications, Web design, and video production. The TTL Academies were intensive professional development for teachers who attended class during the day and collaborated with colleagues in the evening for weeks at a time. The TTL Academies enhanced individual education, helped the state become one large interactive classroom, and equalized technology learning across the state (Schopp & Rothernel, 2001).

2. Literature on Technology Integration

The increase of technology hardware and software in schools and classrooms makes it important for teachers to be prepared to integrate technology into instruction (Lawless & Pellegrino, 2007). The definition of technology integration by the International Society for Technology in Education

(ISTE) is the ability of students to be able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally (Overbaugh & Lu, 2008). Word processing and basic computer skills are the most frequent uses of computers in instruction (Lawless & Pellegrino, 2007). Integrating technology in classrooms is not about operating machines but helping teachers integrate technology as a tool for learning. Efforts have been successful in learning how to use technology, but there has been less success in identifying what computer skills should be taught and how technology should be used for teaching and learning (Dooling, 2000). Even though teachers have a steady wave of workshops and seminars, integrating technology into the classroom is not happening (Plair, 2008). Technology integration requires individual change as well as system change (Shuldman, 2004). Teachers, regardless of whether they are veterans or novices, have limited understanding and experience about how technology should be integrated to facilitate teaching and learning (Chen, 2008). Veteran teachers (fifteen or more years in the classroom) struggle with new innovative devices, and they are often resistant to technology because they do not see how it fits with their content area (Plair, 2008).

Chen (2008) identified several issues that explained the inconsistency between teachers' reported beliefs and technology-integration practices: (a) influence of external factors including not enough access to computers and software, insufficient time to plan instruction, and inadequate support, (b) lack of teachers' understanding how to engage students in active problem-solving, and (c) teachers' pedagogical beliefs. Technology integration increases immediately following professional development training, but there is no indication that pedagogical change persists (Lawless & Pellegrino, 2007). Barriers and support structures for using and facilitating technology have been identified in literature. This study looks at technology integration to determine if it is happening after an intensive professional development model and what is hindering or helping to effectively integrate technology for pedagogical change.

2.1 Literature on Barriers to Technology Integration

Teachers find that barriers continue to prevail and the continued evolution of new technology becomes overwhelming (Plair, 2008). Barriers to integrating technology are not only the cost and distribution of hardware and software, but also the increased demand on teachers' time for course preparations (Snyder, 2001). Bauer and Kenton (2005) found that teachers who are highly educated and skilled with technology and are adept at overcoming obstacles still do not integrate technology. The authors listed key issues that are barriers to technology integration: students not having enough time at computers,

teachers needing extra planning time to integrate technology into lessons, out-dated hardware, lack of appropriate software, skill levels of students, equipment difficulties, scheduling for teachers to use computer labs, software compatibility and availability, Internet connectivity, and large class size.

Besides time, skills, and equipment, another significant factor affecting technology integration may be teachers' self-efficacy – the teachers' belief in their capacity to work effectively with technology. Lack of confidence by teachers plays a part in teachers' dispositions toward computer use in the classroom and may be an indicator of the different levels of technology integration in the classroom (Wang, Ertmer, & Newby, 2004).

2.2. Literature on Support for Technology Integration

ChanLin (2005) determined that structures important to support technology integration by teachers fall into five clusters: social impact, curriculum concerns, interest, experience, and personal need. ChanLin's studies showed the following are important to support technology integration: support from peers, attitudes of authorities, student achievement and attitudes, reactions from parents, technology trends, social value of using technology, curriculum objectives, skills and need for literacy enhancement, assessment of student performance, adoption of new teaching strategies, experience with technology, interest in using and teaching technology, and student achievement from using technology. Teachers are willing to increase technology integration provided equipment, support personnel, and training are available (Hall & Elliott, 2003).

Wireless classrooms are becoming classrooms of the future with one-to-one mobile computers making new teaching capabilities possible since all students have portable computers in a wireless networked classroom. The mobile computing environment should be seen as a paradigm shift where teachers adjust instructional delivery and design and move from a teacher-focused environment to a student-focused technology environment (Griffioen, Seales & Lumpp, 2002). Other incentives of mobile computing in the classroom are access any time and any place, students increased control over their learning experiences, and increasing student interactions in the classroom (Jones, Jo, Moon, Russell, & Cranitch, 2004).

The use of mobile computers and wireless technology in education is expected to give students increased learning experiences, greater convenience, more flexibility, and better collaboration. The real-time, interactive component of wireless mobile classrooms and the use of interactive, immediate hands-on activities are critical issues to support technology integration (Griffioen, Seales, & Lumpp, 2002).

Teachers, who have convenient access to technology, are adequately prepared to use technology, have freedom in curriculum design, and know the importance of technology support integrating technology as an instructional tool (Ertmer, 2005). Increased access to technology along with learning ways to use technology which includes professional development opportunities can help teachers increase technology integration in the classroom.

2.3 Literature on Professional Development

Professional development activities are useful to help veteran teachers rethink the role of technology and how new technology tools are critical to student learning (Plair, 2008). Overbaugh and Lu (2008) found that professional development courses effected change in how teachers taught – if teachers had sufficient time to implement new knowledge, skills, and instructional strategies, students were learning more actively and thoroughly. Their study also showed that as teachers become more competent in using productivity software, mapping tools, online databases, and Web resources, confidence increases in using technology productivity tools and resources.

Literature shows that high-quality professional development activities are longer in duration, provide access to new technologies for teaching and learning, actively engage teachers in relevant context activities, promote peer collaboration, and have a clear vision for student achievement (Lawless & Pellegrino, 2007). Longer, more intense professional development activities may help teachers integrate technology when the focus is on content, standards, and technology along with measures that determine the impact on teachers' knowledge and student outcomes.

Teachers indicated they need knowledge brokers or experts to help them sort through all the information about new technology and then explain or demonstrate how to use it to support student learning (Plair, 2008). Chen (2008) felt that to integrate technology teachers must believe that (a) technology will help achieve higher level goals, (b) technology in the classroom will not disturb higher level goals, and (c) teacher will have the ability and resources to use technology. Teachers' change and enhancement are central to professional development activities. Increasing teachers' knowledge levels and elevating their attitudes and confidence are tied to teachers' understanding of content knowledge and how to integrate technology to facilitate learning and achievement among students. Teachers who implement new pedagogical practices with technology that are acquired through professional development can change student performance (Lawless & Pellegrino, 2007). Professional development programs need to go beyond teacher training to identify beliefs about effective teaching, strategies for improved teaching and learning, and curriculum design for pedagogical purposes (Chen, 2008).

Teachers who devote more time to professional development activities acquire skills for integrating technology and plan and organize classroom instruction around technology (Wepner, Tao, & Ziomek, 2006). Educational practices and strategies in professional development programs that address beliefs, skills, and knowledge improve teachers' awareness and insights about the changes that are ahead in the classroom (Levin & Wadmany, 2008).

3.0 Methodology of the Study

The purpose of this study was to determine if teachers are integrating technology after completing an intensive professional development model initiated by the state to help teachers learn, use, facilitate, and integrate technology. The study is to determine teacher perceptions regarding the barriers and support structures influencing technology integration after the teachers have had time to work with technology in the classroom following the professional development academies. The issues in this study were addressed by answering the following research questions:

1. How well are teachers integrating technology into the classroom after a professional development program designed specifically for learning, using, facilitating, and integrating technology into the classroom?
2. What do teachers perceive as the barriers for integrating instructional technology after completion of the professional development model?
3. What do teachers perceive as the support structures for integrating instructional technology after completion of the professional development model?

The study can help teachers determine if technology integration still needs to be a focus in the classroom. The study will identify teachers' perceived barriers to integrating technology and support structures for integrating technology for teaching and learning. Administrators can use the results of this study to document support for continued professional development to learn new technology tools and to integrate technology to enhance student learning.

3.1 Population and Instrument

The general population for this study consisted of K-12 teachers who attended the Teaching and Learning Academies in South Dakota. The TTL Academies helped teachers learn and gain proficiency in the educational use of technologies such as the Microsoft Office products (Word, Excel, PowerPoint, and FrontPage), e-mail, listservs, Web browsers to locate and share information, and computer peripherals such as digital cameras, video cameras, scanners, and printers. Teachers enhanced their technology skills to accomplish meaningful integration of technology into teaching and learning based on best practices. The emphasis of the TTL Academies was the creation of high quality, interactive curricular content by teachers to use with

teaching and learning technologies. The TTL Academies also extended skills in Web design applications, video editing and streaming, digital photography, personal digital assistants, and global positioning. In South Dakota 300 teachers completed the TTL Academies at Dakota State University in Madison, SD, and were mailed the survey with two reminders sent by e-mail.

3.2 Survey

The instrument was a paper survey with teacher completing demographic information on gender, age, teaching experience, grade level taught, content area, and educational level. The survey was returned by 172 teachers out of 300 teachers who received the survey, which represents a 57% response rate for this study.

For Research Question 1 on how teachers integrate technology, 35 survey items determined how teachers integrate technology. Mills and Tincher (2003) developed the Technology Integration Standards Configuration Matrix (TISCM) as a model for determining technology integration by teachers. Mills and Tincher's (2003) survey was organized and developed by identifying instructional strategies that demonstrate appropriate use of technology for enhancing student learning in the classroom. The instructional strategies were set up along a continuum from using technology as a tool for productivity to using technology for enhancing student learning to using technology as a tool for professional productivity. The process of developing the instrument attempted to show a true and accurate gradient of technology integration with reasonable validity and reliability. The results of the data analysis of the study supported the construct validity of the TISCM and showed that the TISCM was an effective tool to determine technology integration by teachers (Mills & Tincher, 2003). Mills created another version of the Technology Integration Configuration Matrix (TICM) which is more user-friendly and emphasizes what teachers do and what students do in a technology-rich classroom (Mills, 2004). The Technology Integration Configuration Matrix (TICM) was used in this study to determine technology integration by teachers.

For Research Question 2 on what hinders technology integration, 22 questions on barriers impacting integration of technology were listed, and teachers were asked to respond. Barriers to technology integration were determined from the literature review on barriers to technology integration.

For Research Question 3 on what supports technology integration, 14 questions on various structures supporting integration of technology in the classroom were listed, and teachers were asked to respond. Support structures for technology integration were determined from the literature review on ways to support technology integration.

3.3 Demographic Data

The primary demographic data analyzed include gender, age, years in teaching, grade level taught, content area, and educational level.

Gender. The largest percentage of the respondents was females with 144 (83.7%) completing the survey compared to 28 (16.3%) males completing the survey.

Age. The largest number of teachers responding were in the 50 or above age bracket at 88 teachers (51.2%) with 84 (48.8%) under the age of 50 responding.

Years in Teaching. For teaching experience, the largest number of teachers 83 (48.2%) had 11 to 25 years of teaching experience with 18 (10.5%) under 10 years and 71 teachers (41.3%) above 26 years.

Grade Level Taught. The survey results showed that 56 (32.6%) of the respondents taught Grades K-5, 22 (12.8%) taught Grades 6-8, 57 (33.1%) taught Grades 9-12, and 37 (21.5%) taught multiple grades.

Content Area. For the content area with only the middle school and high school teachers responding: 21 taught business/computer (16.8%), 20 taught English (16.0%), 21 taught math or science (16.8%), six taught fine arts (4.8%), five taught social science (4.0%), 27 taught other areas (21.6%), and 25 taught multiple disciplines (20.0%).

Educational Level. Of the respondents completing the survey, the largest number 107 teachers (62.2%) had a bachelor's degree with 59 (34.3%) a master's degree, and six (3.5%) with a specialist or doctorate degree.

4.0 Findings of the Study

4.1 Technology Use and Integration

For the research question on teachers' integration of technology for teaching and learning in the classroom, survey questions 1-18 addressed technology integration in the classroom. Phase 1 (survey questions 1-6) identified teachers as operators who use technology for professional productivity. Phase 2 (survey questions 7-12) identified teachers as facilitators who facilitate and deliver instruction using technology, and Phase 3 (survey questions 13-18) identified teachers as integrators who integrate technology into student learning.

The composite means for the three phrases of technology integration are shown in Table 1. Teachers' responses on the questions about technology integration ranged from (1) *never*, (2) *seldom*, (3) *sometimes*, (4) *often*, and (5) *always*. The mean was highest for Phase 1 where teachers are technology operators ($M = 4.01$). The mean for Phase 2

Table 1
Composite Means for Three Phases of Technology Integration

Technology Integration Phrase	Mean	Standard Deviation
Phase 1 – Operate and use technology	4.01	0.73
Phase 2 – Facilitate and deliver technology	3.83	0.77
Phase 3 – Integrate technology	3.07	0.86

where teachers are technology facilitators was $M = 3.83$, and for Phase 3 teachers with teachers integrating technology $M = 3.07$ (Mostad, 2008).

4.2 Barriers to Technology Integration

For the second research question on teachers' perceptions of the barriers to integrating technology, survey questions addressed technology barriers that impact integration of instructional technology. For the survey questions teachers rated the barriers as *no impact* (1), *little impact* (2), *neutral* (3), *some impact* (4), or *high impact* (5). Table 2 shows the mean responses and standard deviations to the barriers that impact integrating technology into teaching and learning. The two greatest barriers both relate to finding time to develop, implement, and communicate with students ($M = 4.01$) and time commitment to learn and implement technology ($M = 3.84$). The next greatest barrier relates to funding to keep up with technological changes ($M = 3.49$) and funds to implement instructional technology ($M = 3.40$). Other barriers include lack of student time with computers ($M = 3.24$), lack of technology resources ($M = 3.14$), and equipment difficulties ($M = 3.14$). The lowest means for barriers to integrating technology are job security issues ($M = 1.66$), little or no knowledge about technology ($M = 1.82$), Internet connectivity ($M = 2.13$), lack of recognition ($M = 2.23$), and commitment to technology ($M = 2.40$).

4.3 Support Structures for Technology Integration

The third research question addressed teachers' perceptions of the structures that support integrating instructional technology. Survey questions addressed technology structures that support integration of technology in the classroom. For the survey questions teachers rated the structures as (1) *very unsatisfied*, (2) *unsatisfied*, (3) *neutral*, (4) *somewhat satisfied*, or (5) *very satisfied*. Means of teachers' perceptions of the structures that support integrating instructional technology are shown in Table 3. The respondents agreed most strongly that support structures for technology integration were use of technology by school administration ($M = 4.10$) and up-to-date office and classroom computers with hardware and software ($M =$

4.06). Respondents followed in agreement with support by technical coordinators ($M = 4.01$), student support for technology ($M = 4.01$), and network support ($M = 3.97$) as the structures that helped teachers integrate technology into the classroom. Those structures providing the least support were rewards for implementing new technology ($M = 2.62$) and funds to implement new technology from the state ($M = 2.76$).

5.0 Conclusions

South Dakota implemented an intensive professional development model to help teachers learn, use, facilitate, and integrate technology to impact student learning. The study showed that teachers operate and use technology as well as facilitate and deliver technology in the class, but teachers still need to continue professional development to integrate technology. Even though the South Dakota model provided intensive professional development on technology during the summer, teachers indicated barriers to integrating technology included insufficient time to develop and implement, insufficient time to learn, no funds to keep up with technology changes, insufficient funds to implement instructional technology, and insufficient time for students to be at computers. Lack of time was indicated is the main barrier to integrating technology in the classroom. Teachers indicated structures that support integrating technology included support by school administration, up-to-date classroom computers with current hardware and software, support by technical coordinators and department heads, support by students, and network/DDN support.

Teachers have valid concerns about integrating technology into the classroom and the main concern is time to learn the new technology and then time to develop and implement the technology. Given these findings, administrators must continue to work to provide teachers with time for in-service activities, professional development workshops, and university course offerings where teachers can come together to collaborate on activities to integrate technology into teaching and learning. The support teachers need to integrate technology is from school administration, technical

Table 2
Means of Teachers' Perceptions of Barriers Hindering Technology Integration

Survey Question	Mean	Standard Deviation
No time to develop, implement, communicate	4.01	1.09
Time commitment to learn and implement technology	3.84	1.30
Funding for technological changes	3.49	1.27
Funds to implement instructional technology	3.40	1.29
Not enough student computer time	3.24	1.35
Lack of technology resources	3.14	1.27
Equipment difficulties	3.14	1.32
Teacher reward structure	3.03	1.32
Software compatibility and availability	2.97	1.30
Inadequate support	2.96	1.25
Professional development	2.96	1.35
Scheduling when computer labs are available	2.89	1.47
Lack of student competency and skills	2.83	1.20
Large class size	2.82	1.44
Unrealistic expectations by administrators	2.61	1.26
Projection systems (wired or wireless)	2.59	1.38
Ability to teach and use technical content at a distance	2.47	1.17
Commitment to technology	2.40	1.28
Lack of recognition	2.23	1.17
Internet connectivity	2.13	1.26
Little or no knowledge about technology	1.82	1.08
Job security issues	1.66	0.90

coordinators, department leaders, students, and from network/DDN administrators. Support and encouragement from colleagues and integrationists is necessary. Teachers need dependable, up-to-date classroom computers that are installed with current operating systems and software applications.

Adding laptops for each student to the classroom strengthens faculty interactions with students and is a paradigm shift for teachers to move from a teacher-focused environment to a student-focused environment emphasizing technology integration. Professional development activities must continue to support integrating technology into

teaching and learning especially with the movement to mobile devices where students and teachers have daily access to technology. Professional development for teachers must continue on a regular basis because new technology tools are continuing to be developed specifically for teachers to use in the classroom. Technology integration should be a priority for professional development activities in schools because teachers need that constant reinforcement if change is to continue in the classroom.

Table 3
Means of Teachers' Perceptions of Structures Supporting Technology Integration

Survey Question	Mean	Standard Deviation
Support for using technology by school administration	4.10	1.03
Office/classroom computers and hardware/software	4.06	0.92
Support for using technology by technical coordinator or technology department leaders	4.01	1.12
Student support for technology	4.01	0.84
Network and DDN support	3.97	0.93
Support and encouragement by colleagues	3.72	0.86
Library or multimedia support for technology	3.66	0.98
Support from the State K-12 Data Center	3.66	0.85
Support through professional development training	3.55	1.07
Community and parent support for new technology	3.45	0.84
Funds to implement new technology from school district	3.18	1.12
Support from higher education administration and faculty	3.18	0.90
Funds to implement new technology from the state	2.76	1.10
Rewards for implementing new technology	2.62	0.97

6.0 Recommendations

6.1 Recommendations for Practice

Universities, administration, and technology leaders must continue to support technology integration for teaching and learning in the classroom. Even though teachers use and facilitate in the classroom with technology, technology integration still must be a priority. Support can take the form of new equipment, support to learn new software and hardware, professional development activities such as courses and training to learn how to integrate technology, or statewide conferences specially on technology integration. Creative ways to give teachers more time or compensation for integrating technology into teaching and learning is needed. Teachers need time to learn about new software and hardware, to design new teaching activities with the technology, to implement the new technology in the classroom, and to determine how to best utilize the technology to increase student learning.

Teachers also need time to collaborate and share activities with teachers in their content areas. Exchanging teaching strategies using technology recognizes the efforts and innovative practices teachers are currently using in the classroom. Teachers seem to be motivated when their students acknowledge that teaching methods with

technology help with learning in the classroom. Student testimonials on the benefits from having and using technology in the classroom recognize the efforts of teachers. Encouraging collaboration to share teaching strategies using discussion boards, listservs, and e-mail groups can be set up to help reduce costs of travel. Teachers can share “best practices” of using and integrating technology through digital means. Teachers who are technology leaders should be interviewed to determine what strategies or practices they are using in the classroom.

Administrators and school leaders must recognize that it takes time to integrate technology. Teachers are busy teaching in the classroom and need more time for learning, planning, and preparing for technology integration. Administrators should identify ways to help teachers find more time during the day or give extra rewards for using the teachers’ weekends and summers for professional development focusing on technology integration. Administrators should look for ways to assist teachers in helping each other learn new technologies. As new technology such as mobile laptops and tablets replaces computer labs, professional development programs are important to help classroom teachers keep current with the technology. Support for teaching and learning involves increasing time for teachers to learn, use and integrate new

technology through professional development activities as well as time to work with colleagues and experts on classroom activities integrating technology.

6.2 Recommendations for Further Study

This study has provided baseline data on three phrases South Dakota teachers go through for technology integration: operate and use technology, facilitate and deliver technology, and then finally integrate technology to impact student learning. South Dakota is moving to a wireless, mobile initiative where its high schools are going to a 1-to-1 wireless mobile classroom with students having their own laptop or tablet in the class. Professional development for the 1-to-1 wireless, mobile initiative was delivered to the actual school site during the summers to show teachers how to use the mobile devices, learn new software, and integrate technology. This study should be repeated to determine if continued professional development on technology especially with the movement to one-to-one computing increased the mean for Phrase 3 in this study on integrating technology. This study was restricted to the South Dakota geographic location and population. Other studies could be done on a larger scope to compare how well teachers are integrating technology across the nation. A broader study would be interesting to determine if technology integration is higher in others regions or states. If the means are higher, a study could be done to determine what is being done in the state or region to integrate technology in ways that change or impact student learning. The barriers that hinder technology integration and the structures that support should be studied to determine ways to address the needs of teachers.

Teachers face many challenges in the classroom with a technology environment that continues to change. Teachers need to connect with students who use video games, the Internet, cellphones, and iPods regularly. The new interactive technologies and Web 2.0 applications are technologies that teachers have to learn and then integrate effectively in the classroom. Students are competing in a workplace where technology is the norm. Professional development for teachers must address new technology tools and ways to integrate these tools into classroom activities so students are using 21st Century technology skills in the workplace.

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