Teachers Integrating Technology: Case Studies

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Abstract

To understand better the process by which P-12 teachers come to integrate technology into their instructional practices, the researcher undertook a yearlong investigation into technology use at two different school sites in northern Louisiana. Teachers' stages of concern about technology, levels of technology use, perceptions about coursework impact on technology use and integration, and practices and perceptions about teaching and learning with technology were analyzed. Although all teachers perceived the coursework to be effective in facilitating their utilization and integration of technology, they perceived no single best way to integrate technology. Each teacher identified, designed and developed, and implemented his or her own meaningful application throughout the duration of the coursework accomplished his or her own effective technology integration. Researchers, administrators, change agents, and evaluators might consider these findings when facilitating and sustaining changes in instructional practices supported by technology.

The Impact of Technology on Teachers

With national emphasis and financial support by government and educational institutions on technology as a tool to facilitate greater achievement of students and the need to know how technology impacts teaching and learning, there is a need to consider how teachers view the utilization and integration of technology. Cawelti (1993) acknowledged that the impact of technology on society has dramatically altered the classroom, necessitating different skills and qualifications for teachers. While statistics have shown that schools in the United States have access to technology, specifically computers, teachers were not adequately trained to use technology or to incorporate technology into classroom practices (Jerald & Orlofsky, 1999; Kent & McNergney, 1999).

Results of a study conducted by O'Donnell (1996) on the integration of computers in the classroom indicated that the majority of teachers failed to utilize computers in direct classroom instruction. O'Donnell reported that teachers did not understand how to use computers in the teaching process, how to utilize software, or how to redesign their instruction to incorporate computers in the classroom. Suggestions from the study included the need to know teachers' perceptions of their computer skills and the extent of their desire to receive further training. O'Donnell stressed that professional development programs must address the specific needs of teachers and should be ongoing over an extended period of time.

The Office of Technology Assessment (1995) reported that technology training has been fragmented and unrelated to content, and teachers have lacked ongoing support. In addition, the opportunity for teachers' learning did not appear to mirror what everyone expects for students, i.e. engaging students in experiencing, creating, and solving real problems, using their own experiences, and working with others (Lieberman, 1995).

Obstacles that Hinder Teacher Utilization of Technology

Researchers (Bradshaw, 1997b; Meltzer & Sherman, 1997) acknowledged that the lack of time for training, for trying out technology in the classroom, and for talking to other teachers about technology was a major barrier. Bradshaw (1997b) and O'Donnell (1996) have reported fear, insufficient access, and lack of support. Cuban (1995b) offered the following as explanations to why teachers use technologies infrequently and selectively:

1. Limited access to equipment that quickly becomes obsolete.
2. Limited time to use technology due to class schedules.
3. Each teacher's beliefs about instruction and learning, knowledge about new technologies, and prior attitudes toward technology determine whether and how students will get to use computers.

Cuban offered these explanations to acknowledge that those who believe technology will make a difference will have to be very patient.

Charp (1996) agreed that technology integration was a slow and gradual process due to a number of factors, including faculty indifference, lack of training, lack of administrative support, lack of proper infrastructure to encourage use of technology, lack of a strategic plan to follow, and lack of funds. Teachers needed computers and peripherals, software knowledge, software availability that met learning objectives, confidence and skill in handling computers and software, and time to learn and use computers and software for teaching practices. Marsh (1999) asserted that teachers must move beyond excuses such as "I haven't been trained," "I don't have the time," and "I'm no good with computers" because much of the learning about technology has to be self-taught. Teachers learned through experimenting, reading, attending computer education meetings, and interacting with other teachers involved with computers. Learning took time and needed to be ongoing, but teachers must "just do it" (Mergendoller, 1997; Marsh, 1999).

Professional Development

One purpose of professional development is to provide teachers with the knowledge and skills that enable them to implement new curricula. Programs often focus on training teachers to use resources and activities associated with new curricula but do little to include teacher contributions to the content and format of these programs. Professional development is clearly essential (Meltzer & Sherman, 1997; Mergendoller, 1997), "but it does not exist in a vacuum" (Bradshaw, 1997b, p. 86). Bradshaw contended that necessary steps included visualizing, planning, and financing. In addition, Loucks-

Horsley (1997) suggested that professional development be based on what is known about adult learning and the process of innovation, teachers must be involved in planning and implementing professional development activities. Darling-Hammond and McLaughlin (1995) found that teachers were motivated for professional development by career advancement opportunities, pay increases, and personal satisfaction. Knowledge, skills, attitudes, and behaviors of teachers were also essential in planning effective professional development.

Professional development was a process, like change, which impacted teachers' practices used in the classroom (Hall & Hord, 1987). Recognizing the link between professional development and successful educational change, Lieberman, Darling-Hammond, and McLaughlin were among the leading school reformers who called for a new approach to professional development (Sparks & Hirsch, 1997). Lieberman (1995) recognized that while everyone appeared to want a wide array of learning opportunities for students which would engage them in experiencing, creating, and solving real problems, these same opportunities were somehow absent when teachers reversed roles and became learners. She noted the following similarities between the ways students learn and teachers learn:

> People learn best through active involvement and through thinking about and becoming articulate about what they have learned. Processes, practices, and policies built on this view of learning are at the heart of a more expanded view of teacher development that encourages teachers to involve themselves as learners in much the same way they wish their students would (p. 592).

Success in any improvement effort hinges on the smallest unit of the organization and in education that was the classroom teacher (McLaughlin, 1992). Teachers were the individuals chiefly responsible for implementing change. Therefore, professional development, regardless of form, must be relevant to teachers and must directly address their specific needs and concerns (Hall & Loucks, 1977; Sparks & Loucks-Horsley, 1990). In professional development from a constructivist perspective, "teachers and administrators will collaborate with peers, researchers, and their own students to make sense of the teaching/learning process in their own contexts" (Sparks, 1994, p. 27).

Utilization and Integration of Technology by Teachers

To understand better the process by which P-12 teachers come to integrate technology into their instructional practices, the researcher undertook a yearlong investigation into technology use at two different school sites in northern Louisiana.

Three questions guided the research:

1. How do teachers' stages of concerns about technology change after completing two technology courses: (1) Introduction to Technology for Teachers, and (2) Software Applications, Teaching Methods and Software Development for Teachers?
2. How do teachers' levels of technology use change after completing the technology courses?
3. How do teachers integrate technology after completing the technology courses?

The research employed two conceptual frameworks. The first conceptual framework, the constructivist approach to learning, characterized the setting for the coursework in which teachers learned basic computer operations/concepts and applied them for their own professional growth, productivity, and instructional practices. Constructivism represents a collection of theories, including group investigation (Dewey, 1944), social interaction (Vygotsky, 1962), discovery learning (Bruner, 1961), direct experience (Piaget, 1954), and situated learning (Brown, Collins and Duguid, 1989). The Concerns-Based Adoption Model (Hall, Wallace, & Dossett, 1973) which diagnoses changes that occur during implementation of an innovation provided the second framework. The ideas for the model and instruments developed to analyze change emerged from research and practice initiated in the early 1970s. Observations of innovation implementation led to hypothesized developmental stages and levels that teachers moved through as they became increasingly involved and skilled in using the innovation.

Constructs of Qualitative Research

Examining teachers' changes in attitudes, skills, and behaviors as well as their perceptions of a constructivist approach to professional development required methodology that allowed for individual thought and expression to be recorded and analyzed. Qualitative methods were of particular value to the study. According to Stake (1995), qualitative methods permit observation of the process of how people come to understand what they experience. Naturalistic inquiries, enlisted in this case study, are considered by Lincoln and Guba (1985) to be the best choice for looking into the constructed realities of individuals.

To understand better the process by which teachers come to integrate technology into their instructional practices, three important aspects of Piaget's (1954) theory of learning, the notions of disequilibrium, accommodation, and assimilation, need to be introduced. Piaget believed that when an individual encounters information that is either new or contrary to prior knowledge, a person experiences a discord that needs to be resolved. One way of accomplishing this resolution is to incorporate that information as part of that person's view of the world. The individual makes adjustments in the way he or she views the information and its relationship to what he or she already knows by means of accommodation. When successful, the information becomes internalized or assimilated. Therefore, it is Piaget's philosophy that assisted the researcher in understanding the problem.

Moreover, four constructs of qualitative research, proposed by Lincoln and Guba (1985), were used to judge the soundness, usefulness, and bias of the data collected during the study. Credibility demonstrates that the inquiry is conducted in a manner that ensures the subject is accurately identified and described. In this construct, the subject is said to be valid when it includes an in-depth description of the setting, group of individuals, and theoretical framework of the study. Transferability refers to the usefulness of the study. The external validity of the study can be achieved when the researcher ties data collection and analysis to the conceptual framework of the study. The triangulation (Denzin, 1989) of data or the use of multiple sources of data to support each point within the study serves to strengthen the study's usefulness for other settings. Dependability accounts for the changing conditions of what is being studied and what is being learned from the study. As the researcher attempts to understand the phenomena of the study, he or she acknowledges that the inquiry takes place in a evolving social system. Finally, confirmability means that the data should confirm the general findings of the study and lead to implications, not the researcher's evaluation.

Data Collection and Analysis

During the 1998-1999 academic year, Basinger (2000) studied 12 classroom teachers as they participated in field-based technology coursework. Objectives in each course were aligned with Standards for Basic Endorsement in Educational Computing and Technology Literacy (International Society for Technology in Education, 2000). Standards identified what teachers should know about basic computer/technology operations and concepts, how they should apply technology for their own professional growth and productivity, and how they should use technology to support instruction. However, participants had different levels of technology skills and coursework expectations (i.e., from how to use the computer to how to utilize the computer as a teaching/learning tool in the classroom).

In September 1999, a presurvey instrument was used to collect teacher's self-reported computer-using proficiency of all teachers. The researcher also gathered each teacher's coursework expectations.

Table 1 Teacher's Presurvey Computer Proficiency and Course Expectations

Teacher	9/99 Presurvey Computer Using Proficiency	9/99 Presurvey Coursework Expectation
Kim	3-Confidently	How to integrate technology better.
Christy	2-Comfortably	To gain computer skills to help my students and myself.
Sandra	1-Minimally	How to use computer for work and home.
Kathy	4-Proficiently	Not reported.
Sandra Jo	1-Minimally	How to use all Office applications, Internet, etc., to support instruction.
Claudia	1-Minimally	To learn all the new technology that has come out for computer in teaching, since it has been several years since I took a course.
Deric	2-Comfortably	Not reported.
Rita	1-Minimally	To learn how to use the computer to help me and to be able to teach a computer class.
Irene	2-Comfortably	How to utilize the computer as a teaching/learning tool in my classroom.
Monica	3-Confidently	Not reported.
Amanda	1-Minimally	Make maximum use of my computer as far as my classroom is concerned.
Myrna	2-Comfortably	Not reported.

The Stages of Concern Questionnaire (SoCQ) was used to collect data associated with attitudes and skills of technology utilization and integration (Hall et al., 1979). The SoCQ was devised to measure the C-BAM seven stages of concern: (a) 0-Awareness, (b) 1-Informational, (c) 2-Personal, (d) 3-Management, (e) 4-Consequence, (f) 5-Collaboration, and (g) 6-Refocusing. Thirty-five items gauging the seven stages were rated on an 8-point Likert-type scale to measure teachers' attitudes about and skills associated the technology.

The hypothesized development of stages of concern (Hall et al., 1973) for individuals as they initially implement an innovation usually identifies more than one intense concern but still follows one of the patterns of a normal development of stages of concern. According to the model, nonusers of an innovation have intense Stages 0, 1, and 2 concerns, with low intensity Stages 4, 5, and 6 concerns. As use of an innovation begins, inexperienced users normally have more intense Stages 3, 4, 5 and 6 concerns; and Stages 0, 1, 2 normally decrease in intensity. These are the developmental stages of concerns that case study teachers would be expected to exhibit during the first year of implementation, according to the theory.

Table 2 Teacher's Stages of Concern

Inexperienced	Inexperienced to Renewing	Experienced
Kim, Sandra, Sandra Jo, Claudia, Deric, Rita, Irene, Amanda, Myrna	Monica	Christy, Kathy

The Levels of Use (LoU) Interview of an innovation, a focused interview, was used to collect data associated with technology utilization and integration (Loucks et al, 1975). Generic in nature, the LoU provided such detail that questions could be asked about various independent yet related behaviors which contributed to establishing an individual's overall level of use (see Level of Use, Appendix G). Eight levels of use of an innovation are (a) 0-Non-Use, (b) I-Orientation, (c) II-Preparation, (d) III-Mechanical, (e) IVA-Routine, (f) IVB-Refinement, (g) V-Integration, and (h) VI-Renewal.

Table 3 Teacher's Level of Use

Teacher	2/00	5/00
Kim	III-Mechanical	III-Mechanical
Christy	II-Preparation	IVB-Refinement
Sandra	I-Orientation	I-Orientation
Kathy	IVA-Routine	IVB-Refinement
Sandra Jo	I-Orientation	III-Mechanical
Claudia	II-Preparation	III-Mechanical
Deric	0-non-use	I-Orientation
Rita	I-Orientation	I-Orientation
Irene	I-Orientation	II-Preparation
Monica	III-Mechanical	IVB-Refinement
Amanda	II-Preparation	III-Mechanical
Myrna	I-Orientation	II-Preparation

An electronic bulletin board was designed and developed by a local Internet provider for the researcher to facilitate discussions of technology utilization and integration. Eight questions pertaining to course objectives were developed and posted by the researcher during *AMDT*. Teachers' responses were used to develop and describe individual teacher perceptions and uses of technology in teacher profiles. Two examples are illustrated below:

> At the beginning of the course I knew enough to use the computer as a typewriter, make cards using a PrintShop disk, and a little of the computer language. I did not know how to save to a floppy or even what "save" and "save as" meant. We have been told we have to use computer technology in the class, and I had no clue what to do or what I could do. I am excited to be able to make charts, use a spreadsheet a little, and use PowerPoint. I have learned a tremendous amount about the many toolbars and their functions. I am eager to use computer technology in the classroom, such as graphs and PowerPoint presentations (Sandra Jo, bulletin board, November 8, 1999).

> I reluctantly signed up for the computer courses because I knew nothing. I knew I had to learn because the new teaching standards were demanding students become computer literate, and I had to be comfortable with computers before I could help others. Plus, I wanted to learn just for myself. I am elated over the knowledge I have acquired. Not only am I using my newly acquired skills in the classroom, but the skills are helping me with many other activities in which I am involved. Thank you for your encouragement and constantly telling us we can do the work. Your flexibility helps relieve a lot of stress (Sandra Jo, bulletin board, May 6, 2000).

Three other types of data were also used to develop and describe individual teacher profiles. Observation logs identified instructional practices and describe how teachers were utilizing and integrating technology within their own classrooms, computer usage logs documented teacher's daily use of technology, and descriptors of a constructivist approach to professional development compared teacher's responses from electronic bulletin board discussions, interviews, and coursework to investigate whether teachers perceived the course to be constructivist in design and delivery and whether or not they were changing to a constructivist approach in their own instructional practices. In addition, through extensive reading, reflecting, and triangulating of data, the researcher identified two themes. The first theme, the effect of a constructivist approach to coursework, was found to have a facilitating effect on teachers' resolving concerns and changing their levels of technology use. The second theme to emerge was the issue of how to use technology effectively. Regardless of teachers' prior technology use, once the teachers' identified meaningful applications for their students, they perceived the use of technology to be effective.

Discussion of Findings

Qualitative methods used in this research provided for a more concrete, contextual, and constructed knowledge of each teacher's case (Stake, 1995). Their changes in stages of concerns and levels of use, experiences in coursework, and practices in the classroom provided a vivid picture and better understanding that, in turn, provided the necessary data to answer the following research questions.

1. How do teachers' stages of concerns about technology change after completing two technology courses: (1) Introduction to Technology for Teachers, and (2) Software Applications, Teaching Methods and Software Development for Teachers?

   All teachers had high self concerns. However, changes in concerns were shifting from self to task and impact concerns. Seven teachers were resistant to the innovation.

2. How do teachers' levels of technology use change after completing the technology courses?

   Teachers' levels of technology use changed from acquiring new skills and information to utilizing and integrating technology effectively.

3. How do teachers integrate technology after completing the technology courses?

Teachers' perceived that they were effectively integrating technology. Kim and Claudia developed and designed a PowerPoint presentation on insects and a HyperStudio stack on dinosaurs. Christy and Kathy developed and designed a PowerPoint presentation on Louisiana and a Storybook Weaver electronic book and HyperStudio stack on farm animals. Sandra developed and designed a PowerPoint presentation on A-B-Cs and created a Mother's Day card using Word. Sandra Jo developed and designed a lesson on measurement using Access and Excel. Deric developed and designed a PowerPoint presentation on World War II. Rita developed and designed a PowerPoint presentation poetry lesson. Irene developed and designed a PowerPoint presentation on conjunctions. Monica presented a PowerPoint presentation on grammar with hyperlinks to the Internet. Amanda developed and designed a PowerPoint presentation on the solar system. Finally, Myrna developed and designed a PowerPoint presentation on poetry.

Conclusions

Stages of Concern and Levels of Use data may describe attitudes and behaviors associated with technology but do not explain causality or describe how teachers' feel about technology usage. Therefore, additional data were needed to understand the how and why of teacher technology use. Recorded interviews provided descriptions of teachers' perceptions on the initial use of technology during the first year of implementation. Recorded observations documented actual practices of technology use in the classroom during the first year of implementation. An electronic bulletin board provided rich, descriptive dialog. All provided a better understanding of the processes involved for teachers in the integration of technology and allowed the researcher to develop vivid cases of each teachers technology use. Data described in teacher profiles were analyzed for themes. Two themes emerged, the effect of coursework and how to use technology effectively.

1. Introduction of site-based, teacher recruited coursework designed with a constructivist approach can change teacher attitudes, skills, and levels of technology usage.
2. Interventions suggested in the Concerns-Based Adoption Model can change teacher attitudes, skills, and levels of technology use.
3. A period of discord or discomfort is a normal part of the learning process.
4. A constructivist approach to implementing technology was easier for teachers already practicing with a learner-centered approach.
5. Effective use of technology can be achieved with a teacher identifies meaningful applications for his or her students.

6. Implementation of technology usage follows concerns-based patterns on innovations found by other researchers.
7. Teacher attitudes, skills, and behaviors must be acknowledged and infused into a professional development program to facilitate and sustain innovation implementation.
8. Personal meaning and understanding about change enabled the teachers to implement new ideas with confidence and led to autonomy.
9. Each type of data supported and validated the other.

Recommendations

On the basis of the findings of this research, the following recommendations are offered.

1. Technology integration should include field-based coursework using a constructivist approach to facilitate engaging, hands-on, activity-based, problem-centered curricula that are flexible and based on the needs of each teacher.
2. Technology instruction should ascertain the needs of each teacher and provide meaningful applications and appropriate support and assistance.
3. Technology instruction should include a cohort of colleagues in order to facilitate a common vision and network of support.
4. Teachers should be aware of the process of learning and of change associated with an innovation.
5. Access to equipment and resources, both during and after school, should be available for teachers to alleviate frustration and expedite the integration of technology.
6. Administrators should support teachers who seek professional development in technology integration and provide resources to facilitate and sustain the use of technology.

References

Basinger, D.S. (2000). *Utilization and integration of technology by teachers: A case study.* Doctoral dissertation, Louisiana Tech University, Ruston, LA.

Bradshaw, L. K., & Buckner, K. G. (1994). Changing times, changing schools, changing leadership. *NASSP-Bulletin, 78*, 78-83.

Bradshaw, L. K. (1997). Alternative routes to teaching: Providing needed support. *The Delta Kappa Gamma Bulletin, 63*(3), 27-31.

Bradshaw, L. K. (1997). Technology-supported change: A staff development opportunity. *NAASP-Bulletin, 81*, 86-92.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Bruner, J. S. (1961). The act of discovery. *Harvard Education Review, 31*(1), 21-32.

Cawelti, G. (1993). *Introduction: Change in American education. Challenges and achievements of American education. 1993 Yearbook of the Association for Supervision and Curriculum Development.* Alexandria, VA: American Society for Curriculum Development.

Cawelti, G. (1993). *Conclusion: The search for a system. Challenges and achievements of American education. 1993 Yearbook of the Association for Supervision and Curriculum Development*. Alexandria, VA: American Society for Curriculum Development.

Cawelti, G. (1993). *Designing curriculum appropriate to the 21st century. Paper presented at the annual meeting of the Association for Advancement of International Education.* (ERIC Document Reproduction Service No. ED 357 491)

Charp, S. (1996). Curriculum integration. *Technological Horizons in Education Journal, 23*(10), 4.

Cuban, L. (1993). Computers meet classroom: Classroom wins. *Teachers College Record, 95*, 185-210.

Cuban, L. (1995). DéjB vu all over again? Why the computer may in fact go the way of the stereopticon. *Electronic Learning, 15*(2), 34-37, 61.

Cuban, L. (1995). Reality bytes. *Electronic Learning, 14*(8), 18.

Darling-Hammond, L., & McLaughlin, M. W. (1995). Policies that support professional development in an era of reform. *Phi Delta Kappan, 76*, 597-604.

Denzin, N. K. (1989). *Interpretive interactionalism*. Newbury Park, CA: Sage.

Dewey, J. (1944). Democracy and education. New York: Macmillan, Inc.

Hall, G. E., & Hord, S. M. (1987). *Change in schools facilitating the process*. Albany, NY: State University of New York Press.

Hall, G. E., & Loucks, S. F. (1977). A developmental model for determining whether the treatment is actually implemented. *American Educational Research Journal, 14*, 263-276.

Hall, G. E., Wallace, R. C., Jr., & Dossett, W. A. (1973). *A developmental conceptualization of the adoption process within educational institutions*. Austin, TX: The University of Texas Research and Development Center for Teacher Education.

International Society for Technology in Education. *National standards for technology in teacher preparation.* [On-line]. Available: http://www.iste.org. Last accessed: September, 2000.

Jerald, C., & Orlofsky, G. (1999). Raising the bar on school technology. *Education Week, Technology Counts, 19*, 58-62.

Kent, T. W., & McNergney, R. F. (1999). *Will technology really change education?: From blackboard to web.* Thousand Oaks, CA: Corwin Press.

Leiberman, A. (1995). Practices that support teacher development. *Phi Delta Kappan, 76*, 591-596.

Lincoln Y., & Guba, E. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.

Loucks-Horsley, S. (1997). Professional development for science education: A critical and immediate challenge. In R. W. Bybee (Ed.), *National standards and the science curriculum: Challenges, opportunities, and recommendations* (pp. 83-95). Dubuque, IA: Kendall/Hunt Publishing Company.

Marsh, M. (1999). Time for the teachers in your school to "just do it." *Technology & Learning, 19*(5), 60.

McLaughlin, M. W. (1992). How district communities do and do not foster teacher pride. *Educational Leadership, 50*(1), 33-35.

Meltzer, J., & Sherman, T. M. (1997). Ten commandments for successful technology implementation and staff development. *NASSP-Bulletin, 81*, 23-31.

Mergendoller, J. R. (1997). Sifting the hype: What research says about technology and learning. *Principal, 76*(3), 12-14.

O'Donnell, E. (1996). *Integrating computers into the classroom: The missing key*. Lanham, MD: Scarecrow Press.

Office of Technology Assessment. (1995). *Teachers and technology: Making the connection* (OTA-HER-616). Washington, D.C.: U.S. Government Printing Office.

Piaget, J. (1972). *To understand is to invent*. New York: The Viking Press.

Sparks, D. (1994). A paradigm shift in staff development. *Journal of Staff Development, 15*(4), 26-29.

Sparks, D., & Hirsch, S. (1997). *A new vision for staff development*. Oxford, OH: National Staff Development Council.

Sparks, D., & Loucks-Horsley, S. (1990). *Five models of staff development*. Oxford, OH: National Staff Development Council.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: Harvard University Press.