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ABSTRACT

This research examined the pedagogical beliefs and classroom practices of 17 exemplary technology-using K-12 teachers. Specifically, the following questions guided data collection and analysis: (1) What are the pedagogical beliefs of exemplary technology-using teachers? (2) How do these beliefs facilitate and support meaningful uses of technology? and (3) What are teachers' perceptions regarding the incentives that foster meaningful use? Open-ended questionnaire, interview, and observation data were collected and analyzed to identify the beliefs and practices that were common, as well as distinct, across teachers. Findings suggest that teachers' exemplary technology practices were guided by strong pedagogical visions which were rooted in their beliefs about student-centered classrooms. Teachers' primary reasons for using technology related not to extrinsic rewards, but to the many ways in which students benefited. (MES)

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Technology-Using Teachers: How Powerful Visions and Student-Centered Beliefs Fuel Exemplary Practice

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Abstract: This research examined the pedagogical beliefs and classroom practices of seventeen exemplary technology-using teachers. Open-ended questionnaire, interview, and observation data were collected and analyzed to identify the beliefs and practices that were common, as well as distinct, across teachers. Findings suggest that teachers' exemplary technology practices were guided by strong pedagogical visions which were rooted in their beliefs about student-centered classrooms. Teachers' primary reasons for using technology related, not to extrinsic rewards, but to the many ways in which students benefited.

Introduction

Previous research has examined the relationships among teachers' levels of technology use and a number of key factors including years of experience (Hadley & Sheingold 1993), degree of self-confidence (Marcinkiewicz 1994), and access to resources (Gilmore 1995). Although these factors are considered crucial in shaping teachers' use, Hadley and Sheingold noted that classroom integration may be more highly influenced by the particular context of the school, community, policies, purposes, and individuals involved. Thus, the same "key" factor (e.g., knowledgeable peers) may look and act differently in different situations; serving, perhaps, as an incentive in one context yet as a barrier in another. More specifically, although some teachers have limited access and support, they seek to incorporate technology in ways that put learners and ideas at the core of the educational process and that achieve *consequential* student outcomes (i.e., those that extend to real world applications). In other contexts, teachers with unlimited access and high levels of support may achieve negligible, or unintended, outcomes by using technology in carefully prescribed ways that focus primarily on students' acquisition of low-level skills (Harrington 1993).

Hadley and Sheingold (1993) suggested that technology's impact is a function of teachers' use, as well as their interpretations of that use. These interpretations depend on the value teachers assign to technology, which is embedded in the beliefs they hold about teaching and learning, in general, and about the use of technology, specifically. Based on the assumption that teachers behave in concert with their beliefs (Erickson 1986), it is important to identify the interpretations, meanings, and beliefs that foster exemplary technology practice (i.e., the use of technology to achieve consequential student outcomes, as described above) as well as additional incentives that motivate teachers to persist in their efforts.

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Pedagogical beliefs provide a meaningful context for understanding what teachers are trying to accomplish in classrooms, as well as the methods and tools they choose for doing so. By identifying beliefs common to exemplary technology-using teachers, educators will be in a better position to situate technology training within a supportive pedagogical framework, thus increasing the chances that teachers will learn to use technology to implement new practice and achieve new goals.

This Study

Purpose

This research was designed to explicate the pedagogical beliefs of technology-using teachers in an effort to understand what leads to and supports integrated technology use. Specifically, the following questions guided data collection and analysis:

- What are the pedagogical beliefs of exemplary technology-using teachers?
- How do these beliefs facilitate and support meaningful uses of technology?
- What are teachers' perceptions regarding the incentives that foster meaningful use?

Methods

We used a qualitative case-study design to examine and describe the pedagogical beliefs of exemplary technology-using teachers. Case study methodology allowed us to examine the phenomena of technology integration in-depth and to describe it through our participants' eyes. Through a series of written responses, telephone and e-mail conversations, and extended face-to-face interviews and videotaped classroom observations, we examined how teachers' beliefs aligned with and supported their classroom technology use.

We initiated the participant selection process by soliciting self- and peer-nominations of exemplary technology-using teachers from k-12 school colleagues located within an hour's driving distance of the university. Twenty-two teachers, representing 17 different classrooms (8 teachers constituted 3 teacher-teams), completed an application form in which they described their beliefs and practices regarding classroom technology use. Seventeen of these 22 teachers were available for in-depth interviews and classroom observations (including all three teams). Teachers who were interviewed represented a range of subject areas, classroom contexts, and levels of access to technology and were not considered to be significantly different from those who were not interviewed.

Our interview sample included teachers from two high schools (grades 9-12), one 6th-12th cross-age private school, five middle schools (grades 6-8), one prek-8, and six elementary schools (grades 1-5). Five of the 17 teachers taught at private schools. The high school teachers (a 3-teacher team and a single teacher) taught science, four middle school teachers (a 3-teacher team and a single teacher) taught music, and 3 teachers (one elementary, one middle school, one prek-8) taught computer skills in a lab setting. The remaining teachers taught in self-contained elementary or cross-age (6th-12th grade) classrooms. The majority of each school's population was white; ethnic minority students accounted for 4% to 45% of each school's enrollment (Tab.1).

Teachers' applications comprised our initial data set. Specifically, 22 teachers (8 male, 14 female) completed the application form in which they described their instructional and professional uses of technology, their visions for an integrated classroom, and examples of successful classroom uses of technology. In respect to this last item, teachers were asked specifically "to include information about the *roles* you, your students, and the technology played, how students were *grouped*, the *goal* of the activity, its relevance to the *curriculum*, and the manner in which you *assessed* outcomes." By considering successful use from the teachers' point of view, we gained valuable insights into teachers' definitions of technology integration, as well as the kind of visions toward which they were oriented. Furthermore, the specific information that teachers included in their successful examples helped us identify similarities and differences among the relevant dimensions of teachers' pedagogical beliefs and classroom practices.

Based on teacher and researcher availability, 17 teachers were interviewed and observed in their classrooms during the 1998 Fall semester. Eight teachers were interviewed two times; nine teachers were interviewed one time. Four teachers were observed one time; all other teachers were observed two or more

times. Observations were conducted over a one or two hour time period; interviews lasted approximately an hour. Field notes were taken during each observation; interviews were audiotaped and transcribed. Interviews enabled us to examine, in more detail, teachers' beliefs about technology use and to identify the incentives that motivated them to integrate technology; observations enabled us to witness the manner, as well as the extent, to which teachers' beliefs were translated into practice.

Open-ended questionnaire, interview, and observation data were analyzed using both within- and cross-case analyses (Patton 1990). We began by searching for recurring words and themes that captured each teacher's beliefs about classroom practices as well as their technology use relevant to those practices. We also identified incentives that teachers perceived had impacted their use. Secondary data obtained through telephone and e-mail conversations, and teacher and student artifacts (lesson plans, technology projects) were used to support or negate tentative themes that emerged in early analysis stages. Finally, case profiles were created for each teacher and then compared across teachers to discern both common and unique patterns of beliefs and incentives related to exemplary technology use.

Name	Years Tchg	School Size	School Location	Ethnic Makeup	Public/ Private	Grade Level	Content Taught	Special Features
Kate	21	360	urban fringe of large city	18%	private	3k-5	Computers	
Teresa	3	400	urban fringe of large city	DK	private	prek-8	Computers	school for gifted; predominately white
Melissa	5	917	urban fringe of mid-size city	8.4 %	public	1	All subjects	
Joan Jessie	6 12	600	urban fringe of large city	20%	3.6%	1-2	Science themes	looping; job sharing; sci & tech magnet school
Lindsey	5	505	small town	3.8%	public	4th	All subjs	
Vivian	17	527	urban fringe of mid-size city	3.8%	public	4th	All subjs	
Bev	23	800	urban fringe of large city	45%	public	6-8	Music, Communication Skills	
Mary Joe BethAnn	21 29 14	863	mid-size central city	13.6%	public	6-8	Music	team planning
Emilie	5	204	urban fringe of large city	15%	private	6-8	Computers	
Jamie	8	6	mid-size city	0%	private	6-12	All	crossed-age students
Don	10	395	large city	24.6%	private	9-12	Science; Computers	
Sam Annie Connie,	30 6 10	2000	mid-size central city	10%	public	9-12	Biology	team taught; block 8 schedule; 45 students/hour

Table 1: Demographics of Interview Sample of Technology-Using Teachers (names are pseudonyms)

Findings

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Teachers' technology integration stories are described using three overlapping themes: guiding visions, teaching pedagogy, and intrinsic incentives. Within each theme we highlight both the similarities and differences among teachers and their uses of technology.

Guiding Vision

Teachers' uses of technology were guided by what they believed was most important for their students to know and do, rather than by what could be done, given current technological capability. For example, one high school teacher stated, "To me the computer is not the coolest part of this. It is may be the weakest part. Learning happens when people are doing. The computer allows us simply to do more of that." Teachers were quick to recognize that technology enabled them to achieve educational visions that focused on learning, not technology. A few teachers took this a step further to emphasize, not specific content goals, but students' attainment of independent learning skills. As a fourth-grade teacher stated, "It's important not just to teach about carnivorous plants and that kind of thing, but to teach the skills of how you go about finding information on the Internet." A music teacher noted, "We feel more successful (when we use technology) motivating kids to like our subject area, but even more important, motivating them to like to learn."

While some teachers believed that technology had *changed* their educational visions, others simply saw technology as an enabler--a tool that allowed them to teach the way they have always wanted to teach. As one biology teacher noted, "I have always been devoted to the notion that you have to be active to learn. This computer technology has allowed me to pursue that. It hasn't really changed my philosophy; it has *enabled* my philosophy, allowed me to continue my philosophy that I have had for a long, long time."

Perhaps because these teachers had such strong visions of classroom technology use, they did not appear to be easily frustrated by common implementation barriers. In fact, many of these teachers had achieved high levels of use despite the lack of equipment, training, or time. Teachers tended to approach barriers with no-nonsense attitudes. It was quite common to hear a teacher state that a particular barrier was "no big deal—I'll just write a grant." Or "It's not a problem—I'll find resources in the community." All of the teachers we interviewed faced barriers, yet none of them permitted the barriers to halt their efforts. Their unwillingness to give up in the face of difficulty allowed them to overcome barriers that typically keep others from proceeding. It is important to note, however, that all of the teachers interviewed in this study felt strongly supported by their school administrations. By providing ongoing technical support, as well as multiple opportunities for continued professional development, the administrations demonstrated a strong commitment to technology integration, in general, and to these teachers, in particular. However, it is unclear from the results of this study which came first; were teachers' visions facilitated by this strong support or was support provided as a result of teachers having strong visions for use? Additional study is needed to determine the relationship among these factors.

Teaching Pedagogy

Teachers expressed similar beliefs about classroom practice, particularly as they related to four main categories: teacher, student, and technology roles; classroom organization and activities; curricular and social characteristics; and assessment practices. Specifically, teachers described learning environments that placed students in self-directive roles, themselves in facilitative roles, and technology in supportive, tool-oriented roles. In addition, classrooms tended to be flexibly organized and managed, with students moving easily among activities and groups. A great deal of students' work occurred in cooperative groups and revolved around the completion of project-based assignments.

Thematic instruction and interdisciplinary approaches were commonly noted among the teachers interviewed. For example, a music teacher noted how students' projects required knowledge of social studies and English, a math teacher described his use of process writing, and a middle school computer teacher noted how her students completed a project involving foreign languages, math, science, technology, language arts, and geography.

Almost all teachers interviewed described their classrooms as being student-centered; that is, they provided opportunities for students to set their own goals, make choices about learning methods and activities, and self-evaluate progress. Assessment practices were quite varied and included the use of

rubrics, self-reflective journals, oral quizzes, group debriefings, product try-outs, peer evaluations, oral presentations, and web-based publishing. Although a few teachers still mentioned assigning grades, it appeared as though grades were based on multiple alternative assessment measures.

Intrinsic Incentives

There were many reasons why teachers persisted in their efforts to use technology. Not surprisingly, the incentives that inspired them were rarely related to external rewards. Rather, our participants indicated that their efforts were powered by their perceptions that technology leads to increased student motivation and achievement outcomes. As one teacher noted, "I use it because it allows the students to be active learners."

Although some teachers mentioned that they, themselves, enjoyed using technology, the majority of teachers were quick to point out that the primary reason for using technology related to the many ways in which students benefited. Student benefits were thought to go beyond preparing students to use technology for future jobs. Teachers noted how technology enabled all students, including students with attention deficit disorders, learning disabilities, and low self-esteem, to meet academic goals. In addition, students from culturally diverse backgrounds were thought to benefit from using technology. Teachers noted that students were more likely to *own* their learning when they created multimedia presentations or other technology-based products. As one music teacher noted, " When students create their own songs, it's their work. And they are so intent on it. They truly own their music when they are on computers."

When used well, teachers perceived that technology helped students make connections within and across subject areas, thus making content more meaningful and more authentic. As one teacher noted, "They use it as a tool for inference and other higher thinking skills, and have fun, too." Teachers also believed that the use of technology made classroom learning more dynamic and relevant, motivating students to actively engage in the learning process. "Students are engaged and excited about what they are doing."

Perhaps the incentives that inspired these teachers, and the successes that they have achieved, can be leveraged to help other teachers initiate the technology integration process. As we search for ways to motivate more teachers to begin the process, we might consider finding ways to connect them (via e-mail, classroom observations, or virtual field trips) with those who have already seen success in terms of increased student engagement and high levels of independent learning. According to Glenn and Knapp (1996), these types of successes can serve as powerful change agents: "What ignites the final fires of enthusiasm and commitment to change is when teachers see their colleagues integrating technology tools successfully, when they see students enthusiastically using them, and when they see the sophisticated products that these students create" (p. 221).

Summary

Although our participants described a variety of approaches to achieving technology integration, they shared a common vision of their students as self-regulated learners, capable of setting goals, making choices, monitoring progress, and evaluating learning outcomes. As noted by one high school biology teacher, "The least important of our goals is that they learn biology. We are much more concerned that they become independent learners and critical thinkers." Furthermore, this goal, although attainable *without* technology, was perceived as being more readily achieved when technology *was* used as one of many available learning tools.

Educational Implications

Achieving meaningful technology use is a slow process that is influenced by many factors. When educators and researchers look for ways to help teachers use technology effectively, it may be important to look at what they have (in terms of beliefs and practices) in addition to what they do not have (in terms of equipment). Understanding teachers' visions for technology use and their beliefs about teaching and

learning may be necessary if we are going to support their efforts to initiate and sustain the kind of systemic changes required for innovation to become practice.

The purpose of this study was to explicate the pedagogical beliefs that support integrated technology use as the first step in developing an effective approach to technology education for both pre- and in-service teachers. As with any professional development endeavor, it is critical that we know where we want to go first and then figure out how information technologies can help us get there. The results of this study suggest that it is important to address pedagogical issues during training efforts. Furthermore, it appears important to spend time fostering visions of technology use that focus on providing, increasing, improving and/or assessing student learning, as opposed to visions that focus on increasing technological capability (e.g., obtaining laptops for every student). It is hoped that by sharing these few teachers' stories, others who are just beginning their own technology integration journeys may benefit. By examining both the pedagogical beliefs and classroom practices of exemplary technology-using peers, we expect that teachers will gain a better understanding of *how* technology can be used (the practical considerations), as well as *why* it should be used (the supporting pedagogy). The visions and beliefs that have empowered our participants, as well as the strategies they have devised to overcome common obstacles, provide models for others who wish to change current classroom practice. It is our hope that the teacher case profiles generated from this study can serve as powerful reflection tools for others—visions on which to reflect and from which to grow new and even more powerful visions.

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