TEACHERS’ STRUGGLES TO USE TECHNOLOGY IN CAREER MAGNET SCHOOLS

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ABSTRACT
Do teachers expect the learning environment to change in response to new technology? Or do they expect the technology to adapt to their routine classroom practices? Or is it a combination of both? Underlying these questions are teachers’ views of what they teach and how it should be taught. This paper discusses our work with a group of teachers at a Mid-western, suburban vocational school to implement a computer-based approach in teaching integrated curricular units. We examined the ways in which technology was used to help enhance instruction in the core areas of mathematics and science within career-centered classrooms. We found that teachers were reluctant to change their curricula and instead expected technology to adapt to their current teaching methods. These teaching methods reflected a static view of curriculum and the learning environment. Data were collected from interviews, email, and classroom observations of three teachers. We discuss the complex interactions among teacher attitudes, core content, technology, and career concerns that curriculum developers may face while engaging in technology-based reform efforts.

KEYWORDS
Technology integration, career oriented schools, teacher support, science and mathematics education

INTRODUCTION

Technology plays a dominant role at the workplace, our homes, and schools. In rich industrialized nations like the United States, computers and the Internet are abundant in schools and classrooms. According to the “Teachers’ Tools for the 21st Century” survey, in 1999 almost all public school teachers (99 percent) reported having computers available somewhere in their schools and 84 percent of them reported having computers available in their classrooms (National Center for Educational Statistics, 2000). Furthermore, there is a rapid increase in the proportion of schools that are connected to the Internet. In 1994, 35 percent of US schools were online, compared to 95 percent in 1999 (National Center for Educational Statistics, 2000).

Given these rapid changes, teacher training and participation in curriculum reform efforts and technology integration are of great importance, if innovations are going to succeed. More than two decades ago, House (1979) argued that research on education and reform indicated that change could only happen at a large scale when is supported by the socio-historical and political milieu of a certain point in time. In addition, for educational innovations to succeed, they require close collaboration of the teachers involved. History of education reform has shown that innovations have failed dramatically when teachers input was not incorporated and when teachers were not actively involved in the innovation (Means, 1994). Therefore, for successful integration of computers in schools, it is essential that the organized body of teachers participates in the decision making process, as well as in the design, implementation, and evaluation of programs relating to this innovation.

On the other hand, increasing technological requirements for entry-level jobs, the growing numbers of high school students and greater recognition of the value of higher education are driving the demand for career-oriented education. The Bureau of Labor Statistics reported that 45% of all jobs in the U.S. required skilled laborers with this percentage growing to over 60% in the next five years (Flaxman, Guerrero, & Gretchen, 1999). As workplace technological requirements continue to rise, students need to be able to use technology to complete projects in a career field. Career magnet high schools represent an important alternative to comprehensive high schools. By combining career preparation with traditional college preparatory courses, students interested in career opportunities do not have to choose between college and an entry-level job after high school graduation. Curriculum reform and staff development in this context presents unique challenges compared with other comprehensive high schools.

Some of the barriers to technology integration include the lack of teacher release time, lack of support, lack of expertise, and lack of technology (National Center for Educational Statistics, 2000; Vrasidas & McIsaac, 2001). Efforts for technology integration in comprehensive schools create a variety of responses to teachers that range from enthusiasm, skepticism to fear and uncertainty (Cuban, 1993; Zembylas & Reese, 1999). But there are questions that need to be answered in career-oriented schools: What responses do teachers in career-oriented schools have when computers are introduced in their career programs? What are some challenges in dealing with the introduction of technology in this context?

We are aware that the unique characteristics of career-oriented schools pose further challenges to staff development. The primary challenge is that career-oriented schools require that students satisfy an array of both academic and vocational requirements to graduate. Thus, teachers need to be qualified both academically and vocationally, if they are going to make meaningful integration of academic and vocational coursework. For example, the idea of integrated curriculum and integrated work experience was a new idea for school reform at the time we conducted the study. Such reforms initially existed only as partially articulated program efforts at this school. As Flaxman et al., (1999) point out this might be due to the perceived status differences in the professional preparation and experiences of academic and vocational teachers.

Traditionally, vocational teachers have a lower status in the comprehensive high school, which is often perceived as an academic school in the school system. At the career magnet school in which we conducted the study, however, vocational teachers had a particular status as instruments of carrying out the school's career focus. The academic teachers in the region around the career magnet school—which covered 21 comprehensive high schools—were under pressure to prepare students for statewide tests in the traditional academic subjects (e.g., mathematics and science). Even in schools with strong career focus, like the one we conducted the study, could not ignore these demands. Thus, integrating academic and vocational education was considered unthinkable. On the other hand, teachers at career-oriented schools felt the pressure of preparing their students to fulfill the requirements of different vocational associations (e.g., automobile mechanics). All these pressures created increasing demands and struggles for teachers at career-magnet schools.

This paper is a report on a study of teachers' struggles with technology at a career-oriented magnet high school in suburban Chicago. The main purpose of the study was to examine the responses of teachers at this school regarding the introduction of computers into their classrooms. In addition, we looked at the ways these technologies did and did not influence teacher attitudes toward mathematics and science curricula. Finally, through this study, we examined the complexities underlying classroom situations and the use of technology.

THEORETICAL FRAMEWORK

Dealing with the problems and possibilities of network-based technology is one of the important challenges for education in the coming years. There has been a great deal of discussion about preparing students for work in the next century. Government reports such as The Secretary's Commission on Achieving Necessary Skills (SCANS) demand that students must not only have basic skills, but they must also have competency in handling information, working with technology and strong interpersonal skills (U.S. Department of Labor & The Secretary's Commission on Achieving Necessary Skills, 1992). As it is emphasized, students should be prepared for problems that have more that one solution and for environments that require problem solving, reasoning and decision-making.

Reforms calls such as the above, combined with ideas advocated by other government agencies and organizations creating national standards (e.g., National Council of Teachers of Mathematics, 2000; President's Committee of Advisors on Science and Technology, 1997) led us to create technology-intensive instructional modules woven throughout realistic problems. For example, one module involved keeping track of food purchases within a delicatessen operated at the school. Another one suggested the integration of various mathematical and scientific concepts in analyzing the emission control data produced in an automotive repair course. For the former, we introduced a database to monitor the purchases and inventory, and tried to weave instruction in mathematics into this real-world context. For the latter, we introduced a study of ecological concepts in real-world data.

While critics are very concerned that corporate interests can pit teacher and students against administrators (Noble, 1998), or end up promoting products rather than education (Olson, 1989), we hoped to avoid both these pitfalls by working closely with the teachers and the principal. In addition, we spent many weeks (which became months) revising the curricular units and adapting the databases and Web pages that were produced.

A long history of technology use in education shows that the first inclination is to use new technology in the same traditional ways as the old technology (Cuban, 1986; Means, 1994). Continuing old practices with new technology will neither change nor improve education. Old curricula and pedagogical approaches should be reformed, and if necessary replaced, to take advantage of the affordances of the new media. Teacher time, workload, technology skills, and support are some of the problems facing technology integration efforts. The education system's (including the teachers') resistance to change is difficult to overcome. Cuban's (1986, 1993) research has shown that computers are used less often in the classroom that in other organizations. The dominant traditional culture of schools has inhibited technological innovations from playing a central role in educational reform. Cuban (1993) argued that the two most important reasons that technology has not dominated schools are:

> First, certain cultural beliefs about what teaching is, how learning occurs, what knowledge is proper in schools, and the teacher-student (not student-machine) relationship dominate popular views of proper schooling. Second, the age-graded school, an organizational invention of the late nineteenth century, has profoundly shaped what teachers do and do not do in the classrooms, including persistent adaptation to fit the contours of these age-graded settings.

BACKGROUND AND METHODOLOGY

Our primary collaboration with teachers at this career magnet school was to develop modules that utilized computers and integrated academic and vocational goals. The modules that we developed and then examined for the purposes of our study contained Web pages and two databases. The first database kept track of sales and inventory data for a culinary arts program. The other database kept track of emission control data produced in an automotive repair course. For samples visit the following sites:
http://www.mste.uiuc.edu/tcd/mini/airresi.html http://www.mste.uiuc.edu/davea/aviation/frame.html
http://www.mste.uiuc.edu/tcd/ecology/frame.html

The teachers involved with the projects had expressed a need for having this kind of data at their disposal. Their goals, as instructors participating in the project, were to improve their teaching and to give their students greater exposure to the use of computers. The principal and we, as facilitators, were also concerned with integrating the core subjects into the modules. Thus mathematics and science threads were woven into the tasks and assessments that were designed. The implementation of the modules was slower than predicted. However, by the end of a full year, the preliminary aspects of the modules were completed. Throughout the process and at the end, we were in contact with the teachers to evaluate the modules, revise the software, and discuss some changes in direction. We were gathering data throughout the process.

Methods

For our study we used primarily qualitative methods in an effort to get at some of the knotted issues involved in using network-based technologies for teaching and learning. Our hope was that qualitative methods would help us get at "those devilish but enlightening details lying behind the hype" about using technology (Windschitl, 1998, p. 32). We wanted to see if teachers were using the technology merely to extend what they were already doing. Teachers (like most people) tend to look at any new technology in terms of the frame of reference with which they are most familiar (Cuban, 1986; Owston, 1997). With this project, we were attempting to create a new frame of reference by giving the teachers new tools.

Data collection

Data were collected from interviews, email messages, and classroom observations of three teachers. Two teachers were in the culinary arts and the third was in automotive technology. The culinary arts teachers were interviewed for 15 one-hour sessions; the automotive instructor was interviewed for 10 one-hour sessions. Teachers were also observed in a variety of contexts throughout three academic semesters. Data were also collected through email messages, workshop meetings, personal journal entries, and related documents (e.g., handouts, lesson plans, written curriculum guidelines).

DATA ANALYSIS

The complexity of the issues indicated the use of an interpretive case study approach (Stake, 1995; Yin, 1994). The hour-long interviews with teachers took place in the school setting and they included talking to them about their expectations, their preferences, their tension and frustration, and their reflections on the advantages and disadvantages of bringing technological innovations to their curriculum. Multiple data sources provided "thick description" (Geertz, 1973). Transcripts of the taped interviews and the field notes were analyzed using the constant comparative method (Strauss, 1987). In analyzing the data we constructed themes and categories which exemplified the teachers' actions and shared meanings in the school culture of the technological innovations. In our effort to generate rich descriptions and to establish "triangulation" (Lincoln & Guba, 1985) we checked our accounts with the principal of the school.

Analyzing the data allowed numerous categories to emerge that provided the foundation for identifying themes (Erickson, 1986; Miles & Huberman, 1994). Each theme emerged from putting several relevant categories together. For example, we picked out references of how teachers felt about the introduction of technology in their school, and the implications for their students, their pedagogy, and so forth. Excerpts that involved positive and negative emotion words like fear, frustration, and excitement were categorized. We then placed these categories into separate themes. Many individual data extracts were relevant to several themes and we assigned these simultaneously to different categories. For example, we placed the following categories under the theme "Teachers' attitudes about the introduction of computers in their classrooms": "frustration," "excitement" and "enthusiasm". We progressively re-analyzed the data, refining the categories and themes that originally appeared, looking for similarities and contradictions until there was enough evidence to warrant the assertions we generated and the themes were "saturated". These were the themes we wanted to discuss and which were reflecting some aspects of teachers' responses at this career magnet school.

RESULTS AND CONCLUSIONS

There were important similarities in the career magnet teachers' attitudes toward the introduction of new technology with the attitudes of teachers in comprehensive schools, as already identified in other studies (Zembylas & Reese, 1999). However, there were some significant differences that were unique to the career magnet context and had to do, in our view, with the demands that this school had a dual mission: that of college *and* career preparation, to be achieved via explicit connections between occupational and academic coursework within school and well-structured links between coursework and work-based learning. At the time of our study, this goal seemed to have created additional pressure to the teachers.

We found that there was resistance to change even though the teachers initially voiced enthusiasm for the use of technology in their courses. The resistance emerged in three circumstances. First, when teachers found that computers could not quickly and easily accomplish all that they wanted in their curriculum, they were reluctant to use them. Second, when they did not understand all the aspects of the software they hesitated to give any control to students. Finally, they found connections to other disciplines to be irrelevant to their career-oriented instruction.

Teachers wanted to fulfill the curricular needs immediately. They were disappointed to discover that computers and software required more time and energy to learn than they were able to give. From our perspective, we needed time to become familiar with the classrooms and the needs of the teachers before we could help them. Time and patience were essential elements in introducing major technological changes into the classroom. We found that the current curricular expectations acted as a barrier to technological innovation.

At the beginning of the project, teachers expected the technology to adapt to their current methods and environment, but after using the technology for some time, two of the teachers began to change their views, looking for more ways to use technology in their instruction. Thus we found that this static view of curriculum was the starting place for integration of technology. Throughout, all three teachers looked at instruction in mathematics and science as either ancillary or pre-requisite to their main task, but not a major component of their instruction.

In some respects, our account constitutes a highly contextual tale. Teachers vary in their teaching knowledge, experience and values. They differ in the positions they occupy as the reform begins and in what they lose or gain at the end of the reform effort. They embrace the proposed reforms for different reasons and encounter different kinds of support from the institution or their peers. Most vividly, this case establishes that active engagement in school-wide reform may constitute an important emotional investment.

Our study identified that the participant teachers were located in long-standing traditions and contexts of career-oriented teaching. A significant contributor to the struggles these teachers faced is the convergence of multiple pressures—pressure to create a meaningful vocational and academic integration; pressure to use new technologies; pressure to cope with the escalation of demands. In effect, each of these pressures irretrievably weakened the initial enthusiasm shown. Taken together, these teachers' struggles reveal the affective side of reform efforts and point to the possible intersection of attitudinal impacts and the success or failure of such reforms.

IMPLICATIONS OF THE STUDY

Ambitious reforms have the capacity to engage teachers deeply while also challenging the "fundamental grammar of schooling" (Tyack & Tobin, 1994). The ambitious secondary school reforms of the past decade respond to a number of concerns, many of them voiced by teachers as well as outside observers. In career magnet schools some urge closer ties between academic study and work education and between school and community. Such reform initiatives implicate long-established features of career magnet schools. Especially at issue are teachers' conceptions of their subject fields, their perspectives on the purposes of career oriented schools, their expressed curricular priorities and preferred instructional approaches, the norms and values surrounding relationships at school and their view about new reform efforts. As our study has shown, the significance of each of these for teachers' work has bearing on teachers' conception of reform initiatives that involve new technologies. Each effort for reform challenges the fundamental beliefs about teaching and learning and alters the deep-seated faces of identity and professional community (Little, 1996).

These multiple strands of reform gave rise to the case we have examined here. From the teachers' account, large scale school restructuring, such as the introduction of computer in their classrooms, is difficult and full of struggles. Yet it is not the failure of promising ideas that give rise to struggles that we witnessed among the teachers in this study. *Rather, it is the relentless reshaping of work-place conditions and demands that created much of the negative reactions to change efforts.* Little (1996) is right to point out that whatever the broad principles to excite interest and motivate action, teachers nonetheless experience reform at a very personal level—in the small niches of particular partnerships, through responsibility and demand for this or that curriculum. This case here point to certain contextual conditions that intensify teachers' emotional experience and that might plausibly account for effects on the attitudes toward new reforms (e.g., regarding technology).

Our study has implications for teachers and researchers studying the effects of technologies on learning. In our case, effectiveness was limited by a number of factors: time-consuming teacher training and retraining, reluctance to use software that they did not completely control and loss of enthusiasm for integration. These factors may be complicated by constant change in hardware and software needs, rapid growth in educational demands from the workplace, and pressures from standardized curriculum needs and from the industry. Exploring these complications would be a basis for further research.

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