

A Failed Effort to Overcome Tech Barriers in a K-12 Setting: What Went Wrong and Why

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This study investigated the impact of an educational initiative to train teachers to integrate Web-based tools into instruction. Project goals focused on enabling teachers to supplement instruction using Web-based resources, providing parents with access to school and class information, and demonstrating that rural communities can make good use of affordable broadband for educational and civic purposes. Web-sites were developed for participating schools and teachers received training and instructional support. The assumptions were that if teachers, students, and parents had access to Web-based tools, teachers would make more frequent and better use of the Web to communicate with parents and students about classroom activities, parents would take a more active interest in their child's schoolwork, and student performance would improve. Based upon information gathered, this project was not successful due to numerous barriers. Factors contributing to the lack of success are addressed in this manuscript.

Keywords: Technology Barriers, Technology Integration, Professional development

A FAILED EFFORT TO OVERCOME TECH BARRIERS IN A K-12 SETTING: WHAT WENT WRONG AND WHY

In the past twenty years, progress has been made towards integrating Information and Communication Technology (ICT) use in schools (Rudd, 2001), and currently, over 98% of U.S. K-12 classrooms are equipped with Internet access (Cattagni & Farris, 2001; Parsad & Jones, 2005). However, the use of ICT continues to vary from teacher-to-teacher and school-to-school. Lack of skills, sufficient training, and the time and effort required to complete even minimal tasks, such as placing homework assignments online,

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are the reasons teachers cite for not integrating ICT skills into classroom activities (Granger, Morbey, Lotherington, Owston, & Wideman, 2002). Ertmer, Addison, Lane, Ross and Woods (1999) categorize the lack of resources, planning time and support as external or first-order barriers for change. Although these barriers contribute readily to non- or limited-use, they can be overcome through careful professional development training and the acquisition of additional resources. Internal, or second-level, barriers, however, are more difficult to address because they reflect teachers' attitudes about technology as it relates to teaching and learning (Ertmer et al., 1999).

Overcoming internal barriers requires change agents to help teachers rethink their inherent educational philosophies and shift their roles to that of classroom facilitators who help students access, process, and communicate information (Dexter, Anderson, & Becker, 1999). By creating technology-rich learning environments, teachers enable students to use technology as a tool for learning and participate in constructivist-based learning environments that incorporate curriculum differentiation, teacher coaching and feedback, and cooperative learning and collaboration (Newhouse & Rennie, 2001; Smeets & Mooij, 2001). This means that students must have opportunities to become active participants in authentic learning experiences that enable them to link, build upon, or construct knowledge based upon what they already know (Kanuka & Anderson, 1998). Through the social construction of knowledge, students negotiate meaning and develop individualistic knowledge bases, which enable them to continue to connect, assess, and assimilate additional knowledge (Jonassen, 1991). The use of computers and telecommunications facilitates the social construction of knowledge while promoting the development of positive attitudes towards technology and efficacious skills that will enable them to incorporate future technologies into their personal and professional lives (Kanuka & Anderson, 1998). Research acknowledges that this is a departure from the traditional behaviorist or ideological pedagogical preference common in current teaching practices (Nettelbeck, 2002; Reynolds, Treharne, & Tripp, 2003; Smeets & Mooij, 2001). Therefore, well-developed professional development initiatives must be in place so that teachers can adopt new practices to integrate technology into instruction effectively.

This study investigated the impact of a professional development initiative to train K-12 teachers to integrate Web-based tools into instruction. The project was implemented in Nicholville (pseudonym), a small rural town in northwestern Louisiana. Nicholville was selected because, unlike most disadvantaged rural communities, it has affordable broadband access. The project's goals focused on 1) enabling teachers to supplement instruction using Web-based resources; 2) providing parents with access to school and class information; and 3) demonstrating that rural communities can make good use of affordable broadband for educational and civic purposes. Web-sites were developed for the two schools serving this community, and teachers received training and support for using these sites. The study was based upon the assumptions that if teachers, students, and parents all have access to Web-based tools, three things will happen. First, teachers will make more frequent and better use of the Web to communicate with parents and students about classroom activities. Second, parents will take a more active interest in their child's education, and third, student performance will improve.

Despite repeated efforts to train and support teachers, it became evident over the course of the study that none of these things were going to happen, and this caused the investigation to shift to reasons for non-use and barriers to change. The following research questions guided this work:

1. What are barriers for integration of Web-based tools into instruction?
2. How does school leadership influence change?
3. How do teachers' beliefs about teaching and learning influence technology adoption?

METHOD

LOCAL DEMOGRAPHICS

Nicholsville is located in White River Parish (pseudonym), which is in the northwestern corner of the state of Louisiana. White River Parish has a diverse population that faces significant challenges. Nearly half a decade ago, the area was relatively prosperous. When the oil industry moved offshore, however, the region slowly declined. Today, it is one of the most distressed areas in Louisiana. The median household income of \$29,667 is slightly below the state average and well below the national average of \$37,005. More than 20% of the people in White River Parish live below the poverty level as compared to a state average of 18.4% and a national average of 13.3%. Thirty-one percent of children in the parish live in poverty as compared to a state average of 26.3% and a national average of 16.1%. Fifty-four percent of the students qualify for the free/reduced lunch program (Louisiana Department of Education, 2004). Twenty-one percent of White River Parish's residents have not completed high school (U.S. Census Bureau, 2000). The unemployment rate of 7.4% exceeds both state (6.6%) and national (6.0%) averages. Additionally, the teenage birth rate; at 18.8%, it is well above the national average of 12.2% (Louisiana Department of Education, 2005).

PARTICIPATING SCHOOLS

Nicholsville Elementary/Middle Magnet and Nicholsville High School participated in this project. These are the only two public schools in this community. Each year, the Louisiana Department of Education collects and analyzes student achievement data, which are used to determine levels of effectiveness for each school. Every school receives a grade, called a School Performance Score, which is based upon student performance on state-wide standardized tests and the school's targeted expectations for growth. Schools that exceed their expected growth targets receive monetary rewards. Schools that do not reach their growth targets fall into the School Improvement category and receive additional resources to help them improve. Nicholsville Elementary/Middle School (Grades K-8) and Nicholsville High School (Grades 9-12) both achieved scores of Exemplary Growth for the 2003-2004 school year. This means that students in both schools scored well above their schools' targeted growth expectations (Louisiana Department of Education, 2004).

The Nicholsville Initiative was an attempt to help teachers and students from these low SES schools improve their use of Web-based tools to improve teaching and learning. Although many published research reports indicate that use of technology does not have a significant impact on student achievement (Russell, 1999), it maybe possible that much of the research regarding technology and student achievement is insignificant or inconclusive because computer ownership and Internet access are still not equitable. Becker (2000), for example, expressed concern that low-income and minority children's achievement levels lag behind their more affluent peers because they attend schools that are classified as having low SES (Socio-economic status), meaning that 40% or more of the students qualify for Chapter 1. Becker reported that in 1998, low-SES schools were only 50% as likely as high-SES schools to have high-speed Internet access. Since then, the E-Rate has accelerated connectivity in schools dramatically. However, even with these advances, Becker estimated that schools with the most students from low-SES families are one-to-two years behind schools with students from average-SES families and another one to two years behind schools with students from high-SES families (Becker, 2000, p. 47).

Although it appears that technology use may not have a direct impact on student achievement, it seems to be affecting other factors that do. Kuh and Vesper (2001), for example, analyzed data on 125,224 undergraduates and found that students who were familiar with computers considered themselves to be self-directed learners. Flowers, Pascarella, and Pierson (2000) also found positive results between community college students' computer use and reading comprehension. Despite the fact that these studies were conducted outside K-12 settings, the literature then bears out the premise that students in underrepresented populations must be afforded equal opportunities to acquire and develop the same skills more affluent peers are using to be successful.

PROJECT ADMINISTRATION

The Nicholasville Project was funded by the U.S. Department of Education and spanned one year, January–December, 2005. Three professors, two graduate assistants, and a network consultant developed and implemented the project.

Twelve teachers formed a core group of participants. Eight of the teachers were from the K-8 school, and four were high school teachers. Each of the eight K-8 teachers received a digital projector for use in their classrooms. The high school received one projector for faculty use. Each of the 12 teachers also received a stipend for participating in a two-day summer workshop. No other compensation was provided to participating teachers. In essence, the project was simply an added duty.

THE INTERFACE

The interface consisted of one main Web-site for each school with individualized teacher-created classroom Web-pages and blogs branching off the main site. Before the project began, none of the teachers had experience developing a Web-page or had participated in an online course. Although many understood the concept of Web-based learning, they had trouble using the interface. Navigation bars were located at the top, left, and right margins of the Web-site, making it difficult for teachers and students to determine the correct link to retrieve or post information. Additionally, the "Teacher Forums" link at the top of each school's Web-site brought users to a blog rather than to a teacher's Web-page. As a result, teachers and students were unsure of where to post or look for materials. This may have caused some teachers to limit use to functions such as posting announcements and events.

TRAINING AND SUPPORT

The university team members were responsible for teacher training. They conducted three full-day workshops and visited the schools on four other occasions to provide training and support. The first day-long workshop provided the K-8 teachers with individualized instruction on how to use the interface, introduced their students to the project, and trained parents after school. In the month that followed, only one of the 57 elementary/middle school teachers posted anything. To stimulate interest, the university team provided teachers with links to Web-based lessons and sent encouraging e-mail messages. Participation increased marginally. It became apparent that teachers needed additional training.

Nicholasville High School was added to the project in the fall 2005. To accommodate new participants and retrain existing ones, a two-day summer workshop was conducted. Twelve teachers attended. This training focused on navigating the interface, integrating Web-based resources into lesson plans, and establishing opportunities for peer mentoring.

Workshop evaluations indicated that the teachers were very satisfied with the training and were excited about using their Web-pages to enhance instruction. In the weeks that followed, however, none of the teachers posted anything. In October, the university team visited the schools again and learned that the Internet backbone for both schools had not worked for five weeks and as a result, they were not able to use the Internet in their classrooms.

DATA COLLECTION AND ANALYSIS

Data collection consisted of examining the frequency of postings for 57 K-8 and 4 high school teachers. Additionally, twelve of these teachers were interviewed in October, 2005, to determine the impact of their Web-pages on teaching and learning and the barriers for use. Data analysis consisted of frequency counts of teacher postings. These data are reported in percentages or as sum totals.

Qualitative data were collected from teachers during interviews. They were asked to describe:

1. The ways they were currently using technology in their teaching
2. The types of training and coursework they had taken related to technology use in classrooms.
3. The culture of their school regarding the integration of technology into instruction
4. Incentives for integrating technology into their teaching practices
5. The barriers they encountered for using technology in their classrooms
6. How they planned to incorporate the Web site and tools presented during the training sessions into their instructional practices
7. Other resources that would help them incorporate technology into their lesson plans
8. The best ways to get other teachers in their schools interested in using technology
9. Ways that they were collaborating with other teachers to integrate technology into lesson plans
10. The technology proficiency levels of their students

Data collected from teacher interviews were analyzed using constant comparative analysis in order to identify common patterns, themes, and relationships (Glaser & Strauss, 1967). Using constant comparative analysis involved two general processes, unitizing and categorizing. Unitizing the data consisted of chunking the data into small units of information that served as the basis for defining categories. Units were then reviewed, compared, and combined with other units relating to the same content into provisional categories. This process continued until all data collected were compared, and no new or relevant data emerged. Provisional categories were then compared to determine if there was any overlap between categories, and to ensure that all categories were applicable to the study. Through this analysis, theoretically significant categories were defined.

FINDINGS

QUANTITATIVE DATA

Data indicated that at the end of the first semester, 33 % (19/57) K-8 teachers had posted something on their blog or class Web-page. Five teachers had posted on both;

however, 42% (24/57) of the teachers had not posted anything. Fourteen teachers had posted 24 blog entries, but of these, seven had posted once and 13/14 had posted three times or less. Eleven teachers had posted a total of 43 times on their Web-pages, but eight had posted three times or less. Additionally, only four teachers had posted instructional materials. The rest of the postings were announcements.

Frequency counts for the second semester indicated that usage had increased. Twenty-four (42%) teachers had posted something. Of these, 16 had posted only once or twice; however, 12 of the 24 had posted instructional resources. Only six teachers had posted anything in the last 2 months of the semester, and only one of them had posted more than three times.

QUALITATIVE DATA

Twelve teachers were interviewed to learn more about how they were using their Web-pages and blogs and to discover reasons for non-use. These same 12 teachers had attended the summer workshop. They had been selected by their principals based upon their technical levels of expertise and willingness to participate. Of these, five had received some type of computer training. One had taken a college course, one had completed a state-wide department of education professional development program, and three had attended workshops.

Connectivity was the most frequent reason for non-use. Each school had wireless Internet service, but some teachers said that their classroom computers were too old to connect wirelessly, while others said that the Internet service did not work in their classrooms. Additionally, teachers stated that it took several weeks to receive technical support from the school district. Mrs. Brown, for example, was a special education teacher at the high school. She had wireless Internet access in her classroom, but she couldn't get it to work, so she called her school district's tech support for help. They told her to move the computers to the other side of the classroom. She did, but the Internet service still didn't work. At that point, she stopped making any plans to incorporate Web-based resources into her teaching practices. A teacher at the middle school also commented on the district tech support. He said:

To get any technical support, you have to complete a form and send it to the school board office, which is approximately 30 miles away. It often takes several weeks for a response and often the problem is not resolved.

A project facilitator with minimal technical skills also impeded successful implementation at the K-8 school. She was a full-time teacher who had been selected by the principal. She was very nice, but she was not a confident technology user, and this hampered her ability to help others. Her success was also impeded because the university team was too far away to provide her with onsite technical support. Unfortunately, she had great difficulty activating new users, and as a result, many students were not able to post. The high school facilitator, also appointed by the principal, was more computer savvy; however, she did not have the time to activate student users. Consequently, none of the high school students were able to post either. Additionally, the high school facilitator was the only teacher at her school who was posting anything. She estimated that only 15% of faculty colleagues had Internet access at their desks and thought that it was too time consuming for teachers to develop or post from somewhere other than their classrooms. Like their K-8 counterparts, the high school teachers were frustrated by the unavailability of the wireless Internet service in their classrooms and this contributed to their lack of use.

Success was also curtailed because only one of the teachers had participated in online courses. As a result, the others were unfamiliar with the concept and had trouble

visualizing or grasping the overall concept of using something like a course management system for instruction. This slowed their progress because even though they were learning how to create a classroom Web site, they were uncertain about how to use it instructionally. One teacher middle school teacher summed it up by saying that she didn't want to be adventurous and involve her students in a task where she couldn't answer their questions.

DISCUSSION

As mentioned in the introduction, the university team intended to study technology adoption and the formation of online learning communities. However, early on, it became apparent that no adoption was taking place, despite the team's best efforts. This caused the investigation to focus on learning what went wrong and why by examining the barriers for integration of Web-based tools into instruction, how leadership influenced change, and how teachers' beliefs about teaching and learning influence technology adoption.

BARRIERS TO CHANGE

Teachers cannot integrate Internet resources into their teaching practices if reliable Internet access is unavailable to them. The National Center for Education Statistics estimates that nearly 100% of public schools have Internet connections (Parsad & Jones, 2005), and it is likely that the two public schools in Nicholasville are included in this statistic. However, a closer look at these schools indicated that classroom access was nearly nonexistent. Lack of equipment and district technical support also contributed to non-use. These barriers negated most of the training teachers had received during the summer workshop.

Lack of teacher expertise also contributed to non-use. Over time, it became apparent that several teachers lacked the ability to use their school Web-site effectively or to post anything to their individual Web-pages. At least one teacher was not able to copy and paste without assistance. Many of the teachers were unfamiliar with concepts such as blogs and discussion boards. However, after the training sessions, almost all of the teachers were able to post announcements and homework assignments. More advanced uses were not as easy for them. For example, the interface required teachers to be able to use some basic HTML codes to insert pictures, change fonts, or post links. This was beyond the grasp of beginning users. To facilitate use, university team members posted a help section with specific examples.

Distance also curtailed the amount of training and support the university team could reasonably provide. Unfortunately, the two schools chosen for this project were about 300 miles from the closest team members. This meant that all communication between the teachers and schools had to be done by phone or via e-mail because it was simply too far, too expensive, and too time consuming to visit the schools routinely. Team visits had to be scheduled well in advance and always involved an overnight stay. Consequently, team members were not available to assist teachers with curricular integration or to intervene between the schools and the district to resolve technical issues. Consequently, the Web-site never became an integral part of the instructional process. Distance also reduced the team's ability to work collaboratively with the wireless Internet provider in the town to promote connectivity in the community.

SCHOOL LEADERSHIP

Although both principals seemed to attach a high level of importance to the project, they were not using the Web-sites themselves, which presented a mixed message to faculty. For example, the principal at the K-8 school provided teachers with daily reminders to use their Web-pages; however, she did not use it herself and seemed to take no action to expedite requests from teachers for technical support. She also did not appear to be actively seeking solutions to hardware and connectivity issues. The same is true of the high school principal. He appeared to be enthusiastic, but took no action to provide teachers with the technical support or infrastructure they needed. He was also not using the school's Web-site himself. Although it may be unfair to criticize their actions, it seemed that little effort was being exerted by either principal to ensure that the project succeeded. This was also obvious during the final school visit. Although the university team had communicated directly with each principal, none of the teachers or assistant principals at either school had been notified that the team would be onsite to offer instructional and technical support that day.

TEACHER BELIEFS

As previously mentioned, both the elementary/middle and the high school had exceeded their expected state-mandated growth targets due to student performance on standardized tests, and as a result, each had been designated as an Exemplary School. This is remarkable when considering that 31% of the students in this parish live in poverty. This demonstrates that teachers at these two schools are focused on improving achievement and have been successful in doing so. To achieve this type of success, every teacher has to be focused and on task. This means that the teachers at these schools are relying on proven teaching strategies – things that work for them. When a computer does not work or the Internet goes down, they do not have time to worry about it. They have to move on using the resources available to them that day. Based upon numerous conversations, it was apparent that teachers and principals wanted to improve instruction through the use of Internet. However, it was not a high priority because the resources were either unavailable or unreliable. As a result, teaching practices may be influenced more directly by available resources rather than strong convictions about student learning. Even if the teachers and principals thought that the use of Internet resources would improve instruction, they did not appear to have the time or energy to overcome the barriers to make it happen. Therefore, priorities, such as meeting learning objectives, may have a greater impact on teacher use than teacher beliefs.

INADEQUATE PROFESSIONAL DEVELOPMENT

Although resources, administrative leadership, and teacher beliefs contributed, the lack of sound professional development practices probably contributed more to this unsuccessful project. In order to enact change, professional development must be tied to a clear vision of desired outcomes. In this case, the professional development initiative was added to rather than being a part of an overall school improvement plan. As a result, administrators were relegated to following the lead of the PI rather than using the technology initiative to actively support their own visions and objectives. This was compounded by the fact that teachers and administrators were excluded from the planning process. Consequently, they were confused about the project's goals and outcomes and their roles and responsibilities. This in turn led to feelings of ambivalence, which decreased the project's importance, and eroded support for the project. For example, the high school declined the university team's offer to provide an additional mid-year training session because only a few teachers were interested in

attending. Additionally, all teachers received the same amount of generic instructional training, and this limited opportunities for competent teachers to collaborate on activities or assist less-able peers. There were also no built-in times for job-embedded professional development activities outside of the arranged (set) training sessions such as collaborative planning, peer mentoring, or individualized instruction, which are key components of successful professional development initiatives (Sparks & Hirsch, 1997).

Before implementing a technology initiative, professional development planners should review the models that are currently available such as the Technology Integration Model (Hinson, LaPrairie & Cundiff, 2005). This model includes five steps: Planning, Preparation, Instruction, Refinement, and Evaluation. During the Planning and Preparations stages, planners work with administrators, teachers, parents, and community leaders to develop a plan that includes visions, goals and objectives, and create a framework and timeline for implementation. Stakeholder should have opportunities to revise and approve the plan, have choices concerning instruction, and have opportunities to collaborate with others to implement and refine the focus of the initiative. Assessment is an integral part of the process and should be both formative and summative. Formative assessment procedures should be used to redirect instruction or revise the plan as needed and will help the planners and administrators craft well-developed activities and provide meaningful resources to promote maximum success.

CONCLUSION

There are several reasons why this project was not successful. First, one-shot, “Hi, we’re here to help you” initiatives rarely, if ever, have the traction to succeed. In this case, the project was doomed to failure no matter how much blood, sweat and tears the university team put into it because of lack of planning and foresight. Lack of access was probably the second biggest reason the project failed. It was a fallacy to assume that all classrooms have Internet access. Issues related to access also may have caused some teachers to suspend their beliefs about teaching and learning when connectivity is difficult. In today’s world of accountability, these teachers were focused on improving student achievement, with or without technology. Based upon the comments of teachers and principals, there appeared to be a collective attitude that technology was a luxury, not a necessity. Nevertheless, all students now live in a society where information literacy is valued. Therefore, it is important for school leadership to be diligent in their efforts to provide faculty with the resources, training, and support needed to provide students with high quality educational experiences in order to prepare them to eventually compete with technically-proficient peers. Complacency will cause students to have fewer options open to them and may doom them to continue to be a part of the grim demographic statistics that describe communities such as Nicholasville for many years to come.

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