Adoption and Use of Technology-Supported Learner-Centered Pedagogies: Barriers to Teachers’ Implementation

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Abstract: Implementation of learner-centered pedagogies in K-12 classrooms poses a number of difficulties for teachers that are not readily addressed through traditional professional development efforts. In this session, we outline the activities and strategies we have used over the last three years to support teachers’ implementation of problem-based learning in their classrooms. Based on teacher interviews and PBL implementation data, we describe strategies that have worked, as well as those that haven’t, and outline steps taken to confront the various barriers teachers encounter as they attempt to incorporate learner-centered pedagogies within traditional classroom practice.

Introduction

According to recent reports from Market Data Retrieval (2002), computers have achieved a ‘substantial’ presence in schools today. In the year 2000, the student-computer ratio dropped to an all-time low of 4.9 to 1, with 60% of available computers now Internet-connected. Yet, despite this increased access, teachers continue to grapple with both practical and philosophical problems posed by the adoption and implementation processes (Dexter, Anderson, & Becker, 1999). Even among exemplary users, barriers exist (Becker, 1994). Furthermore, obstacles may include both first-order (e.g., technical and organizational support) and second-order barriers (e.g., underlying pedagogical beliefs; Ertmer, 1999). Although teachers may not face all of these barriers as they implement new technological tools and strategies in their classrooms, they are likely to face many of them. As Dexter et al. noted: “For teachers to implement any new instructional strategy, they must acquire new knowledge about it and then weave this together with the demands of the curriculum, classroom management, and existing instructional skills” (p. 223). As teacher educators, then, our job becomes one of helping teachers manage this change process successfully.

Recognizing that meaningful technology use tends to be more readily aligned with a constructivist teaching philosophy (Becker, 1994), current professional development efforts are moving away from an emphasis on building teachers’ isolated technical skills. Instead, the focus is on developing these skills in the context of designing and facilitating learner-centered classroom activities. Because of the complexities of pedagogies demanded by learner-centered approaches (which may, in fact, be exacerbated by the use of technology), deeper and more meaningful professional development experiences are needed. To be effective, professional development experiences must be linked to new visions for teaching and learning, made possible with technology, rather than focused on developing user proficiency with specific software and hardware. At the very least, these new visions will require new roles for teachers and students, diverse strategies for engaging students, and innovative assessment practices.

In their description of effective professional development strategies, Putnam and Borko (2000) noted that
teacher learning and knowing were best supported when developed across a variety of situations. They suggested that effective models for professional development combine multiple contexts such as a summer workshop wherein teachers learn new theoretical ideas, followed by ongoing support that helps them know how to integrate those ideas into classroom activities. Additionally, research on teacher learning has delineated several core features of professional development that are likely to have significant impact on changes in classroom practice: focusing on content, promoting active learning, and fostering coherence across a broad range of teacher activities. According to Trotter (1999), professional development that focuses on the integration of technology in the curriculum, along with some basic technology skills training, supported greater use of digital content in the classroom.

Based on this rationale, in August 2000 we initiated a 5-year Challenge Grant project that focused on the development and implementation of a problem-based curriculum at the middle school level and that embedded both teacher technology development and student use within authentic problem-solving contexts. Our hope was to help teachers create classroom environments that promoted meaningful uses of technology within learner-centered pedagogies. In other words, teachers were expected to design and facilitate curricular lessons while engaged in authentic problem-solving tasks. This paper reports on the professional development activities we have used to support teachers’ implementation efforts over the last 3 years. We describe strategies that have and have not worked and discuss how our professional development activities have evolved to better support teachers’ efforts to change their classroom practice.

Project Background

Tech-Know-Build: Indiana Students Building Knowledge with Technology, funded by the U.S. Department of Education, combines two innovations within one project: the infusion of laptop and wireless Internet technology and the adoption of problem-centered, inquiry-based pedagogy. Project partners include the Crawfordsville (Indiana) Community Schools, Indianapolis Public Schools (IPS), Purdue University, and Indiana University Purdue University at Indianapolis (IUPUI). Due to proximity, Purdue works primarily with the Crawfordsville teachers, and IUPUI works with IPS on professional development activities. This paper focuses on the professional development partnership between Purdue University and the Crawfordsville teachers.

Evolving Professional Development Activities

Based on the overarching goal of the grant—to help teachers implement technology-supported, learner-centered pedagogies—we have introduced problem-based learning pedagogy through a semester-long professional development course (years 1 & 3) and/or a 2-week summer institute (years 2 & 3). The intensive professional development experiences provide teachers with opportunities to explore the use of both laptop technologies and learner-centered pedagogies, as well as to collaborate with other teachers to create problem-based units that use technology as a supporting tool. We believe that problem-based learning (PBL) offers a promising approach because it emphasizes student investigations of complex problems in authentic contexts (Levin, 2001). Additionally, technology is readily used as a tool for gathering information, analyzing and representing data, and communicating results.

To prepare teachers to use this learner-centered pedagogy we use a realistic modeling activity involving in-service teachers, pre-service teachers, and K-12 students. The activity is used to help teachers understand the problem-based learning process, the roles of teachers and students, and the use of technology as a tool. We involve pre-service teachers because they 1) bring a high level of technology competence, 2) can benefit from the experience themselves, and 3) provide a vehicle for initiating collaboration between pre-service teachers and K-12 teachers and students. We involve K-12 students because we want teachers to work with students as co-learners. A growing body of literature suggests that changes in teacher-student relationships can accompany technology integration (e.g., Ertmer & Hruskocy, 1999). Evaluation data have consistently shown that both teachers and students view this activity positively. In a short period of time, it conveys the nature and components of PBL to participating teachers.

After participating in this modeling activity, teachers work in teams to create their own PBL units, to be implemented during the semester/year following their involvement in the course or summer institute. The components of these units include a driving question; curricular objectives and links to curricular standards; possible
student investigations and other activities, materials, and resources; and assessment tools. Websites describing the teachers’ units are available at: http://research.soe.purdue.edu/challenge. Based on strategies recommended by Putnam and Borko (2000), we also provide teachers with additional training opportunities and on-going pedagogical support through project fairs, dinner seminars, classroom visits, and an online discussion board.

Despite these efforts, however, the number of teachers currently implementing PBL units in their classrooms is fairly small. Thus, we have adjusted our various emphases on technology and pedagogy and have implemented additional strategies to support teachers’ efforts. In the following section, we describe our evolving approach.

Changing emphasis on pedagogy and technology

Because of the grant’s commitment to the use of laptops, participants have had difficulty perceiving of the project as a PBL rather than a laptop-project. Despite teachers’ participation in the mini-PBL activity, described above, we have found the need to focus, more explicitly, on the ins and outs of PBL implementation. This has translated into the inclusion of more detailed instruction on how to: find a question, manage a PBL-classroom, coach students in the problem-solving process, and develop rubrics to assess students’ performances in a PBL-unit. In addition to making the pedagogy more explicit, we also have broadened our focus to include other forms of learner-centered pedagogy. Asking teachers to implement a true PBL approach from the start is intimidating as well as unrealistic. Thus, we have begun to emphasize the use of learner-centered strategies, including student-led inquiry, cooperative learning groups, and alternative assessment measures, which help move teachers toward a PLB approach.

Despite our efforts to present technology as a tool to support learner-centered approaches, teachers’ basic technological needs have often preempted their less immediate pedagogical needs. This is evident in the greater number of teachers who have attended technology skills sessions (n=204) compared to those who have attended pedagogically-focused workshops or courses (n=46). Additionally, first-order, technical barriers such as network problems can readily shut down tentative efforts to integrate these tools within daily instruction. However, as teachers’ technical competence and confidence have increased, so, too, has their tendency to use technology to create and support more meaningful learning experiences.

Preliminary Results

Addressing first- and second-order barriers

While we continue to aim for teachers’ implementation of technology-supported learner-centered pedagogies, we have found it necessary to address the reality of both first- and second-order barriers. In order to address first-order technical barriers, we have consciously embedded skills training into teachers’ development of course/workshop projects that support student-centered learning. To confront underlying second-order barriers, we have used 4 of the 5 strategies recommended by Ertmer (1999) including 1) creating a vision of learner-centered pedagogy through the use of selected texts (Jonassen, Howland, Moore, & Marra, 2003) and focused online discussions that allow participants to create a shared language and common understandings related to learner-centered pedagogies; 2) identifying instructional opportunities for implementation of that vision by having teachers create online courses and WebQuests to support current curricular topics; 3) making pedagogical resources readily-available by offering professional development courses on-site; and 4) supporting teachers’ use of authentic assessment measures of student learning through modeling and development efforts.

Discovering/celebrating pockets of learner-centered pedagogy

According to the evaluation report prepared by Rockman et al (2002), Tech-Know-Build teachers have begun experimenting with constructivist teaching practices such as fostering different approaches to classroom learning and allowing students to help define specific learning activities. Almost half the teachers reported consistently incorporating constructivist practices into their classrooms that allow for the emergence of students’ autonomy and student-to-student collaboration. In addition, teachers reported that the Tech-Know-Build project has increased
students’ interest in school and schoolwork and has sparked students’ sense of ownership and autonomy in the classroom. Almost all of the teachers reported significant improvements in students’ general technology skills. According to the project evaluators, the Tech-Know-Build project “has led to a number of gains in student learning, increased collaboration both within the classroom and at home, as well as shifts in teacher practice” (p. 35). While we recognize that we have not yet reached the project goal, these results suggest that we are making progress.

Furthermore, although we have not yet developed a critical mass of PBL-using teachers, “pockets” of pedagogy have developed. For example, four 7th grade teachers are implementing their PBL RainForest unit for the third time this year, providing a positive example for others just beginning to design PBL units. At the high school, a 12th grade English teacher collaborated on the development and implementation of a PBL unit with a physics teacher in Maryland after reading about him on his website. These types of loosely structured collegial support communities are nurturing what Rogers (1995) referred to as the reinvention phase of the adoption process. That is, as teachers grapple with adopting new pedagogies that challenge their current mental models of teaching and learning, they tend to “reinvent” the innovation so that it fits with what they are able to achieve. Obviously, there is no simple or direct path to follow. Rather there are a myriad of strategies that teachers creatively employ as they progress toward the implementation of these innovations. It is important for us to both recognize and celebrate these efforts.

Finally, we recognize that there is still a great deal of work left to do. As the project nears the end of its third year and prepares for the third iteration of the summer institute, we continue to strive to achieve our long-term goal, that is, to achieve successful implementation of problem-based learner-centered pedagogies, supported by technology, in the middle school classroom.

Conclusion
When technology is integrated into classroom practice in ways advocated by this project, Kerr (1996) warned that it will require “a radical shift in both teaching style and the teacher’s vision of what classroom life is all about” (p. 24). This project highlights the amounts and kinds of support teachers need as they attempt to incorporate more learner-centered approaches within their classrooms. As suggested by our ongoing results, formal professional development is not likely to have lasting effects unless it can provide continuity between what teachers learn and what goes on in the classroom. Professional development efforts must address teachers’ changing needs related to both technology and pedagogy.

References