

Examining the Barriers encountered when Planning and Implementing Technology-enhanced PBL in the Middle School Classroom

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Abstract: This research investigated the internal and external barriers teachers encounter when planning for and implementing problem-based learning (PBL) in the middle school classroom. Barriers occurring in the middle school studied were defined through the use of classroom observations, teacher surveys, and interviews with teachers and administrators. Based on the results of data analysis, barriers such as lack of feedback, rewards and incentives for PBL implementation and misalignment of vision between teachers and administration created difficulties for teachers trying to plan and implement a PBL unit. From these results appropriate performance interventions were selected and proposed to help teachers overcome the internal and external barriers.

Theoretical Framework

According to Market Data Retrieval (MDR, 2002) schools in the United States have, on average, a student-computer ratio of 4 to 1, and 98% of schools and 77% of classrooms have Internet access. Recent demographic data from the Integrated Studies of Educational Technology (ISET; U.S. Department of Education, 2003) showed that 81% of teachers have either moderate or high levels of access to instructional computers. Yet, despite these high levels of access, the integration of technology into our schools has been less successful than anticipated.

Meaningful technology use tends to align with a constructive teaching philosophy (Berg, Benz, Lasley, & Raisch, 1998) and student-centered learning beliefs (Becker & Riel, 1999). According to Sage (2000), a problem-based learning (PBL) approach can provide a meaningful and effective way to integrate technology into the classroom. Because PBL uses ill-structured problems to provide opportunities for student learning, technology is a critical tool for information searching, modeling task or content decision-making, and presenting solutions. As a result, technology-enhanced PBL can be a meaningful learning experience (Ertmer, Lehman, Park, Cramer, & Grove, 2003; Jonassen, Howland, Moore, & Marra, 2003).

There are many reasons why teachers have not embraced technology-enhanced PBL to its full potential including lack of preparation time, limited resources, lack of administrative support, and limited class time to implement PBL in the curriculum (Park, Cramer, & Ertmer, 2004). Other reasons are that teachers may have difficulty adjusting to a more guiding role and helping students to become more self-directed (Brinkerhoff & Glazewski, 2004; Brush & Saye, 2000; Land, 2000). These external and internal barriers, as explored by Ertmer, Addison, Lane, Ross and Woods (1999), have different characteristics.

External, or first-order barriers, include a lack of access to things such as computers, software, planning time, or administrative support. Internal barriers, called second-order barriers, relate to teacher beliefs about instructional technology, traditional teaching methodologies, and willingness to make changes in classroom practices. First-order barriers are more easily recognized and readily fixed, while second-order barriers may require major changes in teachers' beliefs and daily teaching methods.

Purpose of the Study

Many studies that have documented strong evidence of the effectiveness of Problem-Based Learning (PBL) approaches. However, many teachers have highlighted the difficulties and challenges when designing, developing, and implementing PBL. This study was designed to examine the internal and external barriers teachers encounter when planning for and implementing PBL in the middle school classroom.

Efforts are currently being made to use performance support systems to define barriers and supports in technology integration in order to address the development and resource requirements in teacher education programs (Wedman & Diggs, 2001; Schaffer, Richardson, & Park, 2004). This approach is based on the assumption that various components within an individual teacher's work environment combine to support or hinder teachers' technology practices in the classroom.

Some researchers have identified barriers related to planning for and implementing technology-enhanced PBL (Ertmer et al., 1999; Ertmer et al., 2003; Park, Cramer, & Ertmer, 2004). However, using a performance support systems approach can provide a more holistic view of the supports teachers need to be successful. This study was designed to examine the internal and external barriers teachers encounter when planning for and implementing PBL in the middle school classroom using a performance support system approach. Specifically the research questions are:

- What internal barriers (e.g., motivation, knowledge and skills, capacity) do teachers encounter when planning and implementing PBL in the middle school classroom?
- What external barriers (e.g., tools, expectations, rewards) do teachers encounter when planning and implementing PBL in the middle school classroom?
- What kinds of interventions will support teachers when planning and implementing PBL in the middle school classroom?

Method

Three types of data were collected during the fall of 2004 to identify the internal and external barriers teachers encounter in the PBL process. These include data from observations in classrooms during PBL lessons, a survey of teachers' perceptions of the barriers encountered while planning for and implementing PBL, and face-to-face interviews of teachers, administrators, technology support staff, and PBL support faculty.

Procedures

For classroom observation, a checklist was developed to capture teachers' practices related to implementing PBL. The checklist includes observable teacher practices in the PBL classroom based on literature reviews and previous observations of PBL classrooms. Then the items identified were reviewed by PBL experts. The checklist is categorized by pedagogical approaches, technology use for higher-order thinking, planning & organizing techniques, classroom management skills, collaboration, and professional development. The checklist was used during 13 class-hour observations of PBL lessons. Also, the teachers were identified either as 'highly-experienced' or 'beginner' based on their experiences of implementing PBL, classroom management skills, or attendance of professional conferences. Experienced teachers were identified with the following criteria: 1) experiences of 3-4 previous PBL units, 2) attendance of at least one professional conference, and 3) acknowledgment of both school administrators (a superintendent, a principal, a project manager) and PBL support faculty. Then the differences between the two groups were

observed. To examine the barriers leading to potential gaps between the two groups' practices, a survey and interviews were used.

The survey, developed based on Wedman and Graham's (2004) performance pyramid, was used to determine various barriers that teachers encounter during the PBL process. The factors included are knowledge and skills, capacity, motivation, environment and tools, expectations and feedback, and rewards and incentives. The survey includes nine closed-response questions and one open-ended question. For the closed-response questions, teachers were asked to indicate whether certain supportive factors were perceived as being present during their PBL efforts, with response options of 'true', 'false', and 'unsure'. (e.g., "Expert PBL support is available in a timely and helpful manner in our school" and "I have received explicit expectations regarding the implementation of problem-based learning (PBL) in my school."). The number of 'false' and 'unsure' answers indicate overall inadequacy of current support structures while the number of "true" answers indicates which supports are perceived as currently being in place (Schaffer, Richardson, & Park, 2003). In addition, teachers were asked to list any specific barriers that they perceived as being personal barriers to PBL implementation.

Interviews were conducted with a school superintendent, a middle school principal, a project manager, two technology support staff, and eight teachers to examine the perceived barriers to implementing PBL from different view points. Interviewees were asked about the current and ideal status of both the organizational support and the current PBL practices of the teachers, with the questions adapted from both Robinson and Robinson (1995) and Wedman and Graham (2004). Example interview questions included "What do you believe you are expected to do with PBL?", "In what way do you think you and your students will benefit from the use of PBL?", and "What motivates you to implement PBL?".

Results

After observing 13 class hours of PBL instruction using a PBL checklist, the authors discussed and reached consensus regarding interpretations of the classroom observation. The classroom observations indicated that there were qualitative differences between experienced and beginner teachers in practices related to pedagogical belief, collaboration, and planning and organizing techniques. Experienced teachers used strategies related to student self-evaluation and self-reflection more frequently than beginner teachers (e.g., self-evaluation rubrics, journaling, and schedule checking rubrics, etc.). In addition, experienced teachers were also more likely to collaborate with other teachers and share their ideas. Another practice that experienced teachers exhibited more frequently than beginner teachers was in organizing and breaking down the whole PBL process into different PBL stages such as problem formation, data collection, brainstorming solution, selecting solutions, and evaluating solutions. A survey and interviews were followed in order to figure out the barriers to bring out the gaps between two groups.

Twenty-one teachers attending a required PBL workshop completed the survey in October, 2004. Teachers attending the workshop represented a wide range of previous experiences with PBL, from minimal (less than 1 year) to skilled (more than 4 years). The survey results indicated that the most serious barrier teachers perceived was the lack of feedback about how well they were meeting expectations regarding PBL implementation. Seventy-six percent of the teachers (16 out of 21) indicated dissatisfaction with the current levels of feedback being received. The second barrier most frequently cited was the lack of rewards and incentives for PBL implementation in the school. Fifty-seven percent of teachers (12 out of 21) indicated dissatisfaction with rewards and incentives in implementing their PBL lessons.

The other barriers identified by the survey were motivation (29%), knowledge and skills (29%), expectations (19%), and capacity (19%). Although motivation and knowledge and skills occupied the same percentage in the total, there were noted differences in the level of teachers' responses. Half of the teachers who indicated motivation as a barrier answered 'false,' that they were not motivated to implement PBL in their classes. On the other hand, on the knowledge and skills question, all teachers responded that they were 'unsure' that they had the knowledge and skills needed to implement PBL.

Between November and December 2004, the Superintendent, the Principal, the PBL project manager, 2 technology support staff members, 2 PBL experts, and 8 teachers were interviewed regarding barriers they find in the process of implementing and supporting PBL. According to the interview results, it was found that the lack of vision-sharing could be one of the problems. School administrators and PBL support faculty prioritized the vision differently. While PBL support faculty focused on the use of PBL in

order to move towards student-centered learning, school administrators emphasized on the use of technology for the same purpose. Accordingly, a number of teachers expressed confusion and frustration in vision-sharing. One teacher said, "I'm not sure what they are trying to accomplish."

Another barrier that was found was a lack of feedback and expectations. Seven out of 8 teachers interviewed expressed strong concerns on the lack of the feedback and expectations, since currently there is no feedback system for teachers. One teacher said, "I don't think I get any feedback. I don't know if they even know if I did it or not. I don't know what consequences there will be for not doing it."

Other area that many expressed problems was a lack of motivation. While most of teachers expressed that they were motivated by students' ownership and engagement, 2 out of 8 teachers expressed that they implemented a PBL unit because they were told to do so, which indicated a lack of internal motivation. One of the teachers said, "I think it [the toughest part in PBL] was the fact that they said that you have to do this."

While teachers indicated the barriers described above, 2 PBL experts and administrators expressed that teachers' knowledge and skills were the main barriers in implementing PBL.

Discussion and Implications

The data collected through classroom observations, the survey, and the interviews of teachers, PBL experts, and the project manager were all used by the authors to prioritize the barriers teachers encountered in planning for and implementing PBL.

The lack of feedback and expectation was the main barrier that teachers encounter, and the lack of knowledge/skills and motivation are followed. For these barriers, the following are some of the solutions suggested:

- Mentoring system (peer-mentoring)
- Coaching system (advanced PBL teacher and novice PBL teacher)
- More involvement of administrators (e.g., classroom observation, monthly administrative meeting, etc.)
- Team preparation time
- PBL meeting time for exemplary teachers to share their experiences with other teachers
- Video library of exemplary PBL units
- Setting a clear goal at the beginning and sharing with teachers
- Acknowledgement of teacher's exemplary PBL use (a monthly or trimester award)

Through collaboration with other teachers, teachers can have more opportunities of feedback and sharing ideas to motivate them. In addition, with exemplary PBL units and administrators' feedback, teachers can have more clear expectations about their PBL practices in the classroom and extend their knowledge and skills related to PBL.

The recommendations and research data provided in this study can be used to help identify some of the key areas in need of performance improvement related to PBL. We encourage the use of this information to further research the solutions we have documented and also to use them as a basis for improving any other performance issues that the teachers find in implementing PBL units.

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