Running Head: Need to Know

WHAT TEACHERS AND ADMINISTRATORS "NEED TO KNOW" ABOUT

PROJECT-BASED LEARNING IMPLEMENTATION

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Background

Although the research on Project-based Learning (PBL) reports many positive outcomes related to student learning in the areas of content knowledge; skills including collaboration, critical thinking, and problem-solving; and engagement, the literature on the implementation process is limited. This paper presents findings drawn from a mixed-methods research study that examines how a professional development workshop on PBL was sustained by school, district, and higher education support structures, and how these structures affected teacher perceptions of the PBL implementation process in their classrooms, at their schools, and across their district. The findings illustrate that PBL implementation is a complex process requiring educators, students and their families, policy makers, and community members to redefine beliefs and expectations about teaching and learning.

This study is a follow-up to a summer project-based learning institute sponsored by two universities and a local school district in a Midwestern state. About 250 educators from across the state attended the three-day institute, during which middle school and high school teachers, school and district administrators, and higher education faculty members engaged as learners in the PBL instructional approach. The institute began with an overview of PBL, followed by the formation of beginner and advanced groups where attendees collaborated to create driving questions, entry documents, workshops and other scaffolding activities, and assessment rubrics that they would use during the upcoming school year. Administrators collaborated to develop school or district action plans, working with groups from their school or district to determine what types of support structures teachers would need to implement PBL in their classrooms. This study tracked a group of teachers after the institute to determine their effectiveness in implementing a PBL plan and the support structures that facilitated the process. Specifically, the

following research questions were addressed: (1) How are teachers implementing (or not) PBL in their classrooms? (2) How supported (by all stakeholders) do teachers feel during the PBL implementation process? and (3) What are the challenges to implementing PBL?

Literature Review

Hmelo-Silver (2004) describes *problem*-based learning as a process whereby students work collaboratively to "identify what they need to learn in order to solve a problem that does not have a single correct answer" (p. 235). Teachers facilitate the process as "students engage in self-directed learning (SDL) and then apply their new knowledge to the problem and reflect on what they learned and the effectiveness of the strategies employed" to solve the problem (Hmelo-Silver, 2004, p. 235). Similarly, Thomas (2000) describes *project*-based learning as a process whereby students explore and learn content via authentic, problem-based projects essential to the curriculum. Thus, for the purpose of this study, *problem*-based learning and *project*-based learning are considered the same process, and literature on both has been reviewed.

Research indicates that PBL: (a) has a positive effect on student content knowledge and the development of skills such as critical thinking, problem solving, and collaboration; (b) benefits students by increasing their motivation and engagement; and (c) is challenging for teachers to implement, leading to the conclusion that teachers need professional development, school and district support, and opportunities to collaborate in order to plan and enact PBL effectively while students need support including help setting up and directing initial inquiry, organizing their time to complete tasks, and integrating technology into projects in meaningful ways (Brush & Saye, 2008; Krajcik, et al., 1998; Toolin, 2004; Wilhelm, Walters & Sherrod, 2008).

Compared to traditional classes, students in PBL classes performed better on assessments of content knowledge (see Barron, et al., 1998; Mioduser & Betzer, 2003; Peck, et al., 1998; Penuel & Means, 2000; Stepien, et al., 1993) and emerged with useful, real-world content knowledge that they could apply to a variety of tasks (Boaler, 1997). In addition, students with average to low verbal ability and students with little previous content knowledge learned more in PBL classes than in traditional classes (Mergendoller, et al., 2006; Mioduser & Betzer, 2003). Similar results apply to the use of PBL instruction with pre-service teachers specifically, who experienced greater content knowledge of multimedia technology (Seo, Templeton & Pellegrino, 2008), and mathematics and science concepts (Wilhelm, et al., 2008) via PBL instruction in higher education courses.

Students who participated in PBL also benefitted from improved critical thinking and problem-solving skills (see Mergendoller, et al., 2006; Shepherd, 1998; Tretten & Zachariou, 1995) as well as collaborative skills (see Belland, et al., 2006; ChanLin, 2008). In particular, one study of PBL showed a positive effect on low-ability students, who increased their use of critical-thinking skills including synthesizing, evaluating, predicting, and reflecting by 446% while high-ability students improved by 76% (Horan, et al., 1996). Low-ability students also demonstrated initiative, management, teamwork, and conscientiousness as they worked in groups (Horan, et al., 1996). Further, during PBL, students showed initiative by utilizing resources and revising work, behaviors that were uncharacteristic of them before they engaged in PBL (Barron, et al., 1998). Other studies reported that students learned scientific investigation skills (Baumgartner & Zabin, 2008) and creative thinking skills (Doppelt, 2009) although one study found that students had difficulty adapting to the PBL structure, which negatively affected their learning of problem-solving skills (Beringer, 2007). Aside from skill-based learning, students

reported that they enjoyed PBL because it gave them opportunities to interact with their friends and make new friends through cooperative projects (Belland, et al., 2006; Lightner, et al., 2007). Positive results also were reported at the higher education level where pre-service teachers learned reflection skills via PBL instruction, which helped them develop more astute teaching philosophies (Seo et al., 2008). In addition, Yiping and MacGregor (2004) reported that between-group mentoring and review facilitated growth in collaboration skills for university students engaged in PBL. Baumgartner and Zabin (2008) also found that collaboration among students contributed to the growth of a "scientific community" (p. 97).

PBL has resulted in high levels of student engagement (Belland, et al., 2006; Beringer, 2007; Brush & Saye, 2008; Ravitz & Mergendoller, 2005). A study reported that PBL had a positive effect on student motivation to learn (Bartscher, et al., 1995). According to elementary teachers, who reported using 37% of their overall instruction time on PBL, students' work ethic improved as well as their confidence and attitudes towards learning as a result of PBL (Tretten & Zachariou, 1995). Beringer's (2007) findings indicated that although there were high levels of engagement with the content, the lack of structure caused some students to focus on technical skills rather than higher level thinking.

Despite the overall benefits to students, PBL is challenging for teachers to implement. For example, one study found the following barriers to successful implementation of PBL: (a) projects were time-consuming, (b) classrooms felt disorderly, (c) teachers could not control the flow of information, (d) it was difficult to balance giving students independence and providing them supports, (e) it was difficult to incorporate technology as a cognitive tool, and (f) authentic assessments were hard to design (Marx, et al., 1997). In addition, the authors found that teachers generally focused on addressing one or two of these challenges at a time and moved back and

forth between old habits and new ideas, incorporating the new information gradually and with varied success (Marx, et al., 1994; Marx, et al., 1997). Another study cited the challenge teachers face of incorporating a new instructional approach that requires them not only to reformulate the structure of their classrooms, but also to create alternative assessments (Doppelt, 2009). Teachers also may struggle with entrenched beliefs when attempting to implement PBL (Ladewski, et al., 1991). Higher education faculty also faced implementation constraints as cited by Karaman and Celik (2008) whose study found that faculty who provided scaffolding and benchmarks made the difficult process of PBL more manageable for their students (Wilhelm et al., 2008). Thus, there is a need for PBL-specific professional development as well as school support structures for teachers engaged in the PBL implementation process (Toolin, 2004).

Methods

The guiding approach for the project was the concurrent triangulation mixed methods design (Creswell, 2008). Quantitative and qualitative data were collected at the same time, utilizing qualitative methods suggested by Creswell (2008) and Carspecken (1996) including observations, focus groups, and document review, and quantitative survey methods found in Fowler (2009). Mixed methods were selected because there was a need to both follow up with the summer institute attendees as well as to further explore the specifics of the implementation process within a particular school context. The study consisted of three parts: (1) a case study of a school where PBL has been adopted as part of a school transformation plan; (2) a case study of summer institute attendees who registered for a follow-up PBL graduate course; and (3) a follow-up survey of teachers who attended the summer institute.

School Case Study

Site. The school selected as the site for the case study is located on the fringe of a large Midwestern city, and has an enrollment of about 4,000 students with about 275 teachers. The school has been engaged in a teacher-led school transformation process for the last three years. Given the task of developing a school improvement plan, teachers began searching for a model or approach that would offer a more relevant curriculum and focus on skill development as well as content rigor. After researching various options, the teachers selected three foci for the school improvement plan: Literacy, PBL, deep implementation of professional development, and advisory homeroom. During the first year of implementation, teachers signed up to participate in a professional learning community (PLC). Three options were offered: PBL, literacy, and lesson design, with the majority of the staff (95) choosing PBL. During the second year, teachers in the PBL PLC continued in a newly-formed advanced PBL learning community while those who had been in the literacy PLC had the option of joining beginner PBL or a collaboration skills PLC. The literacy PLC was offered again for teachers new to the district or to the teaching profession. Six of those who signed up for the PBL community during the first year became the PBL "teacher leaders" and received training with one of the authors. Also in the second year of implementation, the PBL focus was adopted district-wide for secondary schools, and one of the instructional coaches at the high school became the PBL coach for the district. To facilitate the implementation process, structures were put into place including weekly time allocated for PLC meetings where teacher leaders and the PBL instructional coach facilitated professional development for teachers enrolled in the PBL communities. However, the school remains on a traditional schedule (as opposed to a block or other alternative schedule) and few courses are integrated, two structural changes that would better facilitate the PBL implementation process. Also, only about one-third of all teachers have joined the PBL communities to date.

Participants. Recruitment of participants for the school case study began during fall 2009 with an email message explaining the project and continued with site visits to the school. During these visits, members of the research team shadowed the PBL coach, who introduced us to teachers utilizing PBL in their classrooms. We then invited these teachers to participate in the focus group and some classroom observations. Five teachers, with between three and 10 years of teaching experience participated in the study. Four out of the five were designated "teacher leaders" for the PBL implementation process at the school and therefore, received release time for professional development workshops where they met with one of the authors (a university faculty member), who facilitated their learning about PBL and the development of PBL units they planned to implement in their classes, as well as helping them plan for school-wide professional development activities. The "teacher leader" participants had also served as "facilitators" at the summer institute, working with groups of teachers new to PBL to help them construct unit plans. The district's PBL instructional coach, a student teaching intern placed at the high school, and an administrator at the high school also participated.

Data Collection. Observations included shadowing the instructional coach, classroom visits, and attending professional development activities taking place within the context of the PLC. The PBL instructional coach was shadowed for two days, and two teachers were observed implementing PBL units at the beginning, middle, and end of the unit. In addition, a professional development planning session convening the teacher leaders was observed as well as a school-wide PLC session. The observations totaled 26 hours over a five-month period.

A focus group discussion was conducted with the teacher leaders, and interviews were conducted with the instructional coach, the student teaching intern, whose cooperating teacher had been implementing PBL in her class, and a school administrator. Sample probes included:

"What kinds of support have you been given or provided during the implementation process?"; "How have colleagues helped or hindered your implementation of PBL?"; "How is technology utilized in PBL units?"; and "How has PBL affected student learning?" Interviews were audio recorded and transcribed by a professional transcriptionist prior to analysis.

Lesson and unit plans including calendars, entry documents, benchmark sheets, assessment rubrics, and samples of student work were collected for document review in order to understand the PBL implementation processes and evaluate teaching objectives. These were collected during classroom observations and professional development planning sessions.

Analysis and Validity Checks. Qualitative data were analyzed using the constant-comparative method (Glasser & Strauss, 1967) to allow researchers to use the initial results of one method to extend or clarify the results from another method. As data sets from each of the various sources were obtained, sample pieces were initially coded by several members of the research team to determine common patterns within the data and develop a code list and preliminary themes. Next, each researcher utilized the code list to code a particular set of data. Throughout data collection activities, researchers built upon existing data to inform the collection process. Additionally, data previously collected and analyzed was shared with participants for member checking in order to solicit feedback on analyses. Negative case analysis and peer debriefing increased validity of the findings.

Graduate Course Case Study

Site. The graduate course was offered through one of the universities that sponsored the summer institute, and occurred during the fall semester following the institute. Five teachers registered for the course, which provided further support in the development and implementation of a PBL unit. Students were required to construct a new PBL unit or expand on the unit they put

together at the summer institute. Then they had to implement the unit in their classroom. During this process, students kept a reflective journal.

Participants. Of the five teachers registered in the course, three chose to participate in the study. They represent a diverse group with between three and 14 years of teaching experience as well as one with administrative experience. They were invited to participate by the instructor of the course, who is also a member of the research team. She assured them that their grade was not contingent upon participation and we feel confident that no student felt pressured to participate, but rather viewed participation as a way to further contribute to what is known about PBL.

Data Collection and Analysis. Four reflective journal entries were collected from each participant. Queries for these were developed by the instructor with the research questions in mind. For example, students were asked to reflect on what they had learned at the institute, their successes and challenges with the PBL implementation process, and the types of support structures they believed were necessary to facilitate the implementation process. The entries were analyzed using the same process describe above; validity checks including member checking, peer editing, and negative case analysis were also conducted.

Summer Institute Follow-up Survey

Participants. Of those who completed the survey, 48.7% were high school teachers, 17.1% were middle school teachers, 14.5% were university faculty, 13.2% were pre-service teachers, and 6.5% were administrators. The teachers taught primarily English/Language Arts (33.9%), science (29%), math (16.1%), and social studies (9.7%). Most teachers had one to five years of teaching experience (23.8%) or 11 to 20 years of experience (23.8%) with 17.9% having six to 10 years, 15.5% at 21 to 30 years, and 9.5% having taught for more than 30 years. Also, 9.5% were pre-service or novice teachers with less than one year of teaching experience. When

asked about level of experience with PBL, 69.5% identified themselves as beginners while 20.7% said they were intermediate and 9.8% said they were advanced. The educators represented schools and districts considered urban or urban fringe (59.3%), suburban or small city (22.2%) and rural or small town (18.5%). Finally, 70.4% of respondents had attended the summer institute as part of a school team.

Data Collection and Analysis. Online surveys were disseminated at mid-year to 250 educators who had attended the summer institute including the participants of the two case studies explained above. These surveys were designed to probe the research questions. They began with eight information questions, which allowed the team to compare results for a variety of groups. Next, respondents completed a set of statements utilizing a Likert scale (1=strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly agree). These statements were designed to probe the following areas: learning about PBL, collaboration with colleagues pertaining to PBL, implementation of PBL components, support structures provided for PBL, and overall confidence with the PBL instructional approach. The final section of the survey included six open response questions that gave respondents the opportunity to share PBL units they had taught during the fall semester, comment on the strengths and challenges of implementing PBL, and specific types of support offered to them at their individual schools and districts.

A total of 84 institute attendees completed the survey, resulting in a 33.6% return rate. Means and frequencies were reported for the Likert scaled statements. In addition, groups were compared using crosstabulation. All open responses were analyzed as qualitative data utilizing methods described for the case studies.

Findings

Analysis revealed three themes related to teacher learning in relation to PBL implementation. First, teachers repeatedly discussed the implementation process itself including ways they managed the process, how they modified curriculum to include the teaching of 21st Century skills, and achieving authenticity in assessments. Second, teachers talked about support structures necessary to PBL implementation such as collaboration opportunities and "grass roots" professional development. Finally, teachers brought up challenges to implementation.

Implementation Process

Three questions on the survey probed teachers' overall feelings concerning the implementation process. These asked teachers to rate their confidence and experience in designing and teaching PBL units. Fifty-one (69.9%) and 47 (63.5%) educators agreed or strongly agreed that they felt more confident about designing and implementing PBL respectively while 62 (83.8%) agreed or strongly agreed that they have experienced the PBL planning process. In addition, three subthemes emerged: Managing the process, 21st Century skills, and authenticity, which are discussed in greater detail below.

Managing the Process. Discussions around how to balance the need for structure in the classroom with the need for flexibility were common among participants. For example, during a teacher leader training session, participants discussed how requiring students to meet specific benchmarks during a PBL unit helps students manage their time and gives teachers an idea of how students are progressing. On the other hand, these teachers felt they needed to be flexible in order to be responsive to students' needs from day to day. Managing PBL implementation was complicated further for participants by school and/or district policies as well as the need for authenticity. For instance, a teacher pointed out that "even if you are the most flexible teacher and you are used to moving deadlines but we scheduled an authentic audience to be there, that

makes it really hard to be flexible when it comes to the final project." Moreover, the high school

that was part of the case study had a mastery learning policy that provided students great

flexibility in regards to deadlines whereas PBL emphasizes work ethic, which teachers defined at

least partly as meeting deadlines; thus, teachers felt torn between complying with the policy and

grading students on 21st Century skills such as collaboration, oral communication, and work

ethic. Teachers utilized various scaffolding techniques, typically monitored through the "need to

know" process whereby students construct a list of what information or skills they already know

or possess to complete the project and what information or skills they still need to acquire. The

"need to know" list appeared in every classroom we observed. It was also modeled during PLC

time. Specifically, teachers were observed meeting students' needs via workshops on group

collaboration processes, using open-ended questions to engage student thinking, and explaining a

content knowledge principle in the context of an authentic task.

21st Century Skills. Teachers referred to most of the 21st Century skills including those

that the PBL coach identified:

> That is not even scratching the surface of all of the skills that [students] have to
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> learn and grow in and gain confidence in through the [PBL] process: The skill of
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> using technology and growing in their digital age literacy; the skill of
>
> collaborating; the skill of managing impulsivity. Those skills and habits of mind
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> make it that much more challenging and you even throw the content knowledge
>
> and understanding in, it is a difficult process.

Teachers referenced technology use more often than any other 21st Century skills, however. They

shared many examples of how they specifically utilize technology in their PBL units. For

example, students used computers for word processing, researching, and presenting most often.

The teacher leaders discussed the importance of students utilizing technology to complete

projects, but identified several issues that have occurred with technology that disrupt learning.

For instance, one teacher shared a story about a time when students became frustrated because

the computers were freezing. They rebooted over and over, but still the computers were

malfunctioning and eventually they became so frustrated that they just shut down, refusing to

work that day. In response to the survey question probing technology use, 43 (58.9%) educators

agreed or strongly agreed that they have used technology in new ways for PBL. Educators also

talked often about teaching collaboration skills with 48 (64.8%) reporting that they agreed or

strongly agreed that they have facilitated student collaboration in their PBL units and 12

mentioning the teaching of collaboration skills on the open-response questions from the survey.

Authenticity. Two elements were discussed by participants in regards to authenticity:

formulating authentic assessments and convening authentic audiences. Participants recognized

these as interrelated. For example, teacher leaders discussed the difference authenticity made for

students in regards to the final product being something that will be utilized outside of the school

context by professionals working in the field. This difference was observed in one classroom

where students read a letter presumably written by a director at PBS. After reading the letter, one

student asked if the CEO would be assessing their final projects as if a real audience would

motivate him to produce a better final product. Teachers shared frustrations with the time it takes

to recruit an authentic audience, however. One teacher also revealed the anxieties teachers feel

with inviting outsiders into their classrooms: "it's scary to kind of ask those people in...You have

to teach them what PBL is and what their role is. It is so different than anything they've ever

been asked." However, when teachers were able to connect with professionals, students

benefited. For example, the instructional coach shared that "students at [the high school] got an

opportunity to collaborate with two of the [state] Supreme Court justices during a PBL unit in their government class," which had a positive effect on their learning. Survey results revealed that 54 (73.0%) educators agreed or strongly agreed that they have used authentic assessments to evaluate their students while only 26 (35.6%) agreed or strongly agreed that they have collaborated with community partners to implement PBL.

Support Structures

Teachers identified the importance of administrator involvement in creating support structures conducive to successful PBL implementation. For instance, a teacher leader said:

> We are very lucky in [our district] because the technology, even though we complain about it, we're above and beyond a lot of schools. We have great coaches who bring us amazing resources. Our administration is extremely supportive. [Teacher leaders] are out a lot because they want us to go to these [workshops] to learn how to do [PBL] better. I can't think of what we need more. I mean they give us time. They give us time to plan.

Although some of the necessary structures were indeed in place at the case study high school, respondents to the survey as well as teachers in the graduate class indicated that they did not have adequate time to plan and implement PBL. A teacher in the graduate course said she "did not realize how much harder [she] would really work" while 19 educators indicated on the survey open response section that they did not have enough time to plan, implement, and learn about PBL. Moreover, teachers enrolled in the graduate course believed that administrators need to understand PBL, learning about it along with teachers and working to educate parents and community members about PBL to garner support for teacher learning and project authenticity. Analysis revealed two additional subthemes: Collaboration and professional development.

Collaboration. Many teachers identified collaboration as essential to successful PBL

implementation and recognized that time to collaborate was an important support structure. The

teacher leaders, whose school did have collaboration time in place, met several times during the

year to work together on PBL unit development and implementation issues as well as to plan for

the PLC sessions they led. A teacher leader said:

> This past week with the technology kind of failing on me, I had three different
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> people I could go to technology wise and have responses immediately. . .I just
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> feel like there is so much support and there are so many people that you don't
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> keep wearing down the same person. I think when you are the only one, you can
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> feel really overwhelmed. Now that we have so many people who are experts in
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> PBL, [we] kind of can share the wealth.

Teachers also noted the need to have "critical friends" within their school as well as outside of

the school to grow and support PBL implementation. For example, a teacher in the graduate

course talked about how helpful university faculty had been to her as she designed and

implemented her first PBL unit, and how much more helpful it would have been had she had a

"critical friend" at her school who was also working on PBL. Like the teacher in the graduate

course, the teacher leaders showed commitment to building a PBL network external to the

school. For instance, one teacher volunteered the teacher leaders to serve as an authentic

audience for a PBL unit that one of the authors was implementing with her pre-service teachers.

In response to survey questions probing collaboration opportunities, 57 (78.1%) educators agreed

or strongly agreed that they have had opportunities to collaborate to pursue their learning about

PBL, and 46 (61.3%) agreed or strongly agreed that they have collaborated with colleagues to

implement PBL. Educators also reported that they have facilitated implementation of PBL across

their school with 33 (44.0%) educators who agreed or strongly agreed that they have helped their colleagues implement PBL. In addition, 34 (47.2%) educators agreed or strongly agreed that they have received useful critical feedback from their colleagues.

Professional Development. Teachers recognized the need for professional development opportunities and the support structures that allow teachers to participate in these. Teacher leaders in particular noted that making an effort to build internal capacity in addition to allowing teachers to attend external workshops facilitates the PBL implementation process. For example, one teacher noted that "since everybody here is kind of in this giant conversation, I feel like we're accelerating at this much faster than you would if you were bringing somebody in once a month to speak to the staff….It is just like every day that we're all this collective vision." The teacher went on to explain that supportive administrators who are willing to allow teachers to learn from mistakes facilitate growth in their ability to implement PBL successfully. Another teacher leader stated that "the whole professional development model is different than anything I've experienced. I mean just the way the grass roots approach and the way that professional development is implemented. You blazed that trail." In response to questions probing professional development, 60 (80.0%) educators agreed or strongly agreed that they have had opportunities to build on what they already know about PBL, and 39 (54.1%) agreed or strongly agreed that they have had further professional development opportunities during the school year.

Transition to PBL

Teachers found the transition from traditional instruction to PBL difficult at times. They struggled to redefine their role in the classroom by moving from expert and authority figure to facilitator. For example, when students read the loose structure of PBL as freedom to do what they wanted including leaving their group to socialize with students in other groups, a teacher

seemed overwhelmed by the effort to keep them on task and working with their group members, and resorted to the role of authoritarian to restore order. The instructional coach pointed out that "PBL is difficult because it is really releasing responsibility to students. It's difficult to maintain classroom management in many cases. It is difficult to really become that facilitator as opposed to a direct instructor." However, teachers believed they were better able to meet students' individual needs via PBL instruction despite their recognition that differentiating the learning was challenging. For example, a teacher leader said:

> When you have different levels of kids you want to push some…which is great about PBL. It allows us to do so but you have to think of the ways you can scaffold the process…as a facilitator, not as an instructor where you are doing direct instruction. You have to come up with tools you can use to facilitate the student getting to that end product. At the same time you don't want to over scaffold for those students that need the challenge to think of it on their own.

Teachers also resisted redirecting their planning focus from content standards to a driving question. This conflict was observed as teachers discussed their units during PLC sessions at the high school or in the reflections teachers wrote for the graduate course.

Teachers noticed that students likewise struggled to discern their roles and responsibilities in a PBL classroom. For instance, the instructional coach commented that "when a student has been exposed to traditional education for eight, nine, or 10 years and they get to high school and all of a sudden they're in a PBL class, there is going to be some push back." One of the teachers in the graduate class also shared that she felt students were uncomfortable with the "fact that the teachers are learning." Moreover, teachers felt burdened by the task of not only modifying their own expectations and beliefs about teaching, but also changing students' and

parents' expectations and beliefs. Conversely, teachers noticed that their relationships with students became more personal when they moved to PBL.

Discussion

This research was conducted in an effort to gain insight into what happened when 250 teachers and administrators participated in a three-day Project-based Learning Institute and then went back to their school settings for 9 months. The design of the research included two surveys of the entire group of participants, a case study of an exemplary high school where implementation efforts were supported by a professional learning community model, and a case study of a graduate course designed to support the implementation of PBL by individual teachers in different schools. These different views generated an interesting cross-section of findings that provide useful insights into the impact of the institute and the PBL implementation efforts of the teachers and administrators who attended.

Overall, the impact of the summer intensive professional development was positive. Nearly 70% of the respondents felt more confident about designing and implementing PBL units; 78% agreed that they had opportunities to collaborate to pursue their learning about PBL; and 80% reported they had opportunities to build on what they learned once they returned to their school contexts. The reflections of case study participants echoed this positive stance. Teachers reported being energized by planning for more authentic learning and by opportunities to collaborate with their colleagues. They appreciated the ways PBL let them get to know their students better and differentiate instruction to meet the students' individual learning needs.

In every context, there was also a flip-side to the positive PBL experience. The educators struggled with challenges as a result of their efforts to implement PBL. They pointed out that PBL teaching takes *more* time to plan, *more* curriculum and technology resources, *more* day-to-

day problem solving about how to scaffold student growth and success in their project work, *more* effort to authentically assess student learning, *more* communication with persons in the community, *more* support from the administration in terms of suitable scheduling and curriculum alignment, and *more* opportunities to collaborate with their teaching colleagues. The teachers and administrators could see the value of PBL, but in their more tentative moments, they felt that PBL demanded more than might be humanly possible given the very real constraints of time, facilities, budgets, schedules, and accountability faced in their schools, districts and state.

Our findings illuminate in detail some specific struggles inherent in the PBL implementation process. Teachers discussed how hard it was for them to balance structure and flexibility in their instruction. They structured their units of study by assigning assessment benchmarks and setting deadlines, but those had to be adjusted as students proceeded through their project work. The timeframes for units of study were also complicated by the need for authentic audiences and pre-arranged dates for students to make presentations to invited community members. In addition, teachers had to teach 21st century skills for the first time and many reported that their tentative attempts to teach collaboration, technology use, and the control of impulsivity were met by student resistance.

Support structures were another area where the schools were in new territory. The high school we studied was exemplary in terms of support for teachers. This large school had gotten a third of its teachers involved in a professional learning community focused on PBL implementation. This school had a PBL Coordinator and PBL Coach from a nearby university. A teacher leadership group met on a regular basis, and teachers had a period of collaborative planning and reflective time built into each week. In this context, teachers talked about feeling supported to make changes. They had the buy-in of their administrators and coaches and

opportunities to serve as critical friends for one another. This was not a common experience, however, among the 250 educators who attended the summer institute. Teachers taking the graduate class as a follow-up to the summer institute wished for administrators who understood how to support PBL. Their schools did not provide time and collaborative opportunities or in some cases, accept any variance from standards-based instruction and assessment. These teachers were burdened with introducing PBL to everyone in their contexts— administrators, students, parents, and community members. Only their appreciation for the high-quality engagement and learning of their students gave them the courage to keep going.

The findings of this study reveal ways the transition to PBL is complicated and difficult for teachers and administrators. PBL represents a significant change in the ways schools work, and teachers reported falling back into their traditional roles when they faced challenges. The teachers struggled to write entry documents that asked driving questions they could not answer because they felt accountable to deliver standards-driven curriculum and knowledge and skills to be measured by end-of-course and standardized tests. Sometimes, the straw that broke the proverbial camel's back was an overcrowded room or a janitor who moved the desks back into rows every evening, despite repeated requests to have the room ready for group work.

The Project-based Learning Institute under study was designed by a consortium of educational organizations with a shared vision for PBL in the middle and high schools of their state. The planning team consisted of members from a school district, local universities, and an educational leadership institute. The findings of this research will be invaluable to their continuing efforts to plan the next cycle of professional development for the emerging PBL network in their state. In addition, this study has implications for the general sustainability of PBL elsewhere. This study suggests that the change to PBL requires commitment from a wide

variety of partners who are willing to change their paradigms of education along with the students, teachers, and administrators in schools.

These partners need to include professional development providers who can educate the teachers and administrators. Schools need to belong to professional development initiatives that sustain active learning communities which conduct action research to develop new knowledge and practices. Such professional development organizations can stay current and relevant over time, providing ongoing, long-term education for teachers and administrators who need continuity of focus and depth of knowledge to master something as complex as PBL.

In addition to professional development providers, the teachers and administrators trying to implement PBL need new kinds of instructional leadership. PBL asserts that authentic driving questions without pre-determined answers should be the basis for students' collaborative project work. This frame for instruction is very difficult to align with standards-based pacing guides and narrow measures of student learning. Districts that want teachers and administrators to embrace PBL need to create alternative models for curriculum planning and assessment. It is not fair to ask teachers to straddle two paradigms of instruction and assessment. If this reform is going to take root, new instructional accountably systems will have to be engineered.

Schools of education at universities need to partner with PBL professional development providers and schools too. They can support the efforts by preparing new teachers who understand PBL and collaborative ways to improve teaching. Universities can support mentor teachers of student teachers who are trying to implement PBL and offer coursework for novice and advanced PBL teachers. Hopefully, university faculty in other disciplines will also get involved and make PBL part of their teaching so that more learners in general have experience with authentic collaborative project work.

PBL educators have to also find partners in their communities who are willing to become actively involved in the support of student projects. These partners from business, community services, or any other form of meaningful involvement need to become comfortable bringing their problems to the schools and working with students to create solutions. As this model for engaging youth becomes more common place, schools will not have to work so hard to construct dependable bridges between the school and the community. Superintendents and school boards, as well as community organizations, have big roles to play in building these relationships between school-based participants and the community. Parents need to be meaningfully involved as stakeholders in the process as well. They can only support their adolescents as students if they know what the school is doing and why.

Many teachers in the study mentioned the importance of technology to their PBL teaching. Students need to be using the same technology as real world problem solvers so their results are valid and up-to-date. Better technology may eventually be part of the answer to the question of how teachers can be supported to do the more complex and time-consuming work of PBL teaching.

It is interesting to note that given dynamic, ongoing professional development plus a high degree of administrative and collaborative peer support, the teachers in the exemplary high school still struggled to implement PBL. The changes within the school were significant, but clearly PBL was not fully implemented. To move steadily toward PBL, administrators and teachers need help from all kinds of partners—professional development networks, professional organizations, parents, community members, universities, technology consultants, business and commerce, district administrators, policy advocates, and more. Individual schools cannot create all the needed support systems for PBL on their own, rather they have to look to the community

outside their doors for support in many forms and co-create support systems that empower them

to do PBL in their classrooms.

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