

Examining the influence of learner-centered professional development on elementary mathematics' teachers enacted and espoused practices

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Abstract

This study examined the extent to which two elementary teachers' classroom practices were aligned with their intentions, self-reported implementation, and the practices emphasized during ongoing learner-centered professional development (LCPD) program designed to support the integration of learner-centered mathematical tasks and associated pedagogies. Data were collected through video recordings and observations of teachers' mathematics instruction. Data analysis indicated that participants' enacted practices did not align to the intended practices emphasized in the professional development. However, participants' enactments that were directly adopted from workshops or co-planned with project staff aligned more than enactments that were independently planned.

Background

American students continue to perform poorly on tests of mathematics achievement (National Center for Educational Statistics [NCES], 2000; 2004). Analyses of student scores on large-scale tests have gone beyond identifying student performance shortcomings, and have identified specific factors that influence student achievement. Studies have shown that students' mathematical learning can be positively influenced by allowing students to explore hands-on tasks that focus on students' higher-order thinking skills (Wenglinsky, 1998). Further, students' learning has been linked to specific pedagogies, such as posing questions about students' mathematical thinking (Fennema, Carpenter, Franke, Levi, Jacobs, & Empson, 1996). While these practices echo the recommendations for mathematics education reform (National Council for Teachers of Mathematics [NCTM], 1989, 1991, 2000; RAND, 2003; Schoenfeld, 1992), the enactments of these pedagogies are still rare in today's classrooms.

How do we support teachers' enactment of these pedagogies? A recent synthesis of research about teachers' enactments of mathematics curricula suggests that numerous teacher factors, such as content knowledge, pedagogical content knowledge, beliefs and their interpretation of the curriculum influences how learner-centered activities are enacted in classrooms (Remillard, 2005). Teachers must be given opportunities to develop an understanding about these pedagogies while also participating in experiences that develop each of the teacher factors mentioned above.

Professional Development's Role in Improving Student Learning

In the past decade, professional development leaders have presented theoretical perspectives about how teachers learn (Cohen & Ball, 1999; Putnam & Borko, 2000; Richardson, 1996) and recommended principles for effective professional development programs (e.g. Guskey, 2003). These recommendations include:

- focusing on issues related to student learning (Hawley & Valli, 1999);
- allowing teachers to take ownership of their learning (Hawley & Valli, 1999; Loucks-Horsley, Love, Stiles, Mundry, & Hewson 2003);
- addressing specific content and pedagogies (Desimone, Porter, Garet, Yoon, & Birman, 2002);
- providing opportunities for teachers to reflect and learn from their own practice (National Partnership for Educational Accountability in Teaching [NPEAT], 2000a, 2000b; Putnam & Borko, 2000);
- allowing teachers to collaborate with each other and with project staff (Sparks & Hirsch, 2000);
- and
- providing ongoing and comprehensive activities (Loucks-Horsley et al., 2003; Richardson, 1996).

In essence, these documents call for learner-centered approaches to professional development (NPEAT, 2000a, 2000b).

In mathematics education, promising approaches to learner-centered professional development (LCPD) have been advanced. These programs allowed teachers to focus on student learning by having them watch videos of their own classroom instruction (Sherin & van Es, 2005) examine student work samples (Carpenter, Fennema, & Franke, 1996; Fennema et al., 1996), collaborate with university faculty to develop and implement reform-based curricula into their classroom (Silver, Smith, & Nelson, 1995; Silver & Stein, 1996), and make instructional decisions based on their analysis of student work (Fennema et al., 1996; Schifter & Simon, 1992).

While learner-centered principles have been widely embraced, empirical research is needed to examine how LCPD programs influence teachers' classroom practices and their students' learning. Typically, professional development research includes only teachers' self-report about their perceptions, experiences and intentions to apply their new knowledge and skills in their classroom (Guskey, 2000). While this information is useful, teachers often overstate how they intend to use what they have learned from professional development in their classroom (Buck Institute for Education, 2002). LCPD research must study participants' enactments of pedagogies emphasized during workshops.

Methodology

Based on the need to examine teachers' enactments of pedagogies emphasized in a professional development project, I conducted a naturalistic study (Patton, 2002). Two research questions guided this research:

1. To what extent (and how) do teachers enact the practices emphasized in a learner-centered professional development during their mathematics teaching?
2. How do teachers' enactments of the practices emphasized during learner-centered professional development compare with their espoused and intended practices?

Context

Two teachers participated in this naturalistic, qualitative study (Patton, 2002). Both teachers taught in an urban elementary school located near the downtown area of a major city in the southeastern United States. Seventy-nine percent of students at the school qualified for free or reduced lunch. The participants, along with colleagues from other elementary schools in the district, took part in a professional development program designed to prepare them to integrate learner-centered mathematical tasks and associated pedagogies into their classrooms. During the program, teachers completed mathematical tasks while the project staff modeled learner-centered pedagogies, worked with related technologies, examined cases from the Developing Mathematical Ideas curriculum (Education Development Center, 2006) and discussed how to address the state mathematics standards by having students complete mathematical tasks.

Participants

Shantel. Shantel, an African-American female, has been teaching the 5th grade for 13 years. During the study, Shantel taught three departmentalized mathematics classes daily: one with students in the Early Intervention Program (EIP) and two with students at grade level (AGL-1 and AGL-2). During her baseline interview, she indicated her intention to use professional development-related practices in order to change her teaching in what she referred to as a "good way" to help her students learn.

Keisha. Keisha, an African-American teacher, has completed six years of teaching, including four years as a 4th grade teacher. Keisha finished her specialist degree in Educational Leadership in August, 2005, and described herself during her baseline interview as "a lifelong learner." In her first year, Keisha did not teach mathematics, so this year was Keisha's third year

of teaching 4th grade mathematics. Keisha frequently characterized herself as a “different” teacher because she used manipulatives, games, songs, videos and other instructional strategies to teach mathematics to her students.

Data Collection

Data were collected related to intended (i.e., what they planned to do), enacted (i.e., what they were observed doing), and espoused practices (i.e., what they believed they did). Teachers were observed when they indicated their intent to implement practices consistent with the professional development goals and were interviewed to identify their intended and espoused practices. During each implementation a video camera and a wireless microphone were used to record the classroom activity. Further, I recorded field notes about the students’ work and the teachers’ interactions with the students. I interviewed each teacher after the observations about their intended and espoused practices.

Analysis

The Video Analysis Tool (VAT; <http://vat.uga.edu>) was used to code instances of the six instructional practices emphasized during the professional development (i.e., tasks, questions, algorithms, technology, student communication, and mathematical representations) using a lens that codified the extent to which they implemented the pedagogies. The lens (Figure 1) was constructed based upon scales that were developed during prior research studies (Fennema et al., 1996; Hufferd-Ackles et al., 2004) and was refined after initial pilot testing. Interview data were analyzed using inductive analysis. The instructional practices in the scale were used as primary codes during the analysis of the interviews.

Figure 1: Sample scale

Practice	The teacher...
Mathematical Tasks	<p>0 - does not provide opportunities for students to work on mathematical tasks</p> <p>1 - provides opportunities for students to work on tasks that do not use resources (e.g. manipulatives or technology) and involve completing a procedure given by the teacher</p> <p>2 - provides opportunities for students to work on tasks in which students use appropriate resources and follow a procedure given by the teacher</p> <p>3 - provides opportunities for students to work on tasks in which students use appropriate materials, choose their own approach and provide a solution</p>

Findings and Discussion

Several patterns from the data analysis warrant further discussion: These are discussed in this section.

Little evidence was found to indicate that participants’ enacted practices aligned with the professional development intended practices. Consistent with prior research studies (e.g. Cognition and Technology Group at Vanderbilt [CTGV], 1997; Doyle, 1988; Henningsen, Stein, & Grover, 1996), a majority of the enacted tasks did not align with the professional development goals. Both teacher-participants implemented didactic tasks that did not include resources or used them for rote procedures rather than to complete the tasks. One explanation for teachers’ enactments of low-level tasks might be their desire for their students to have success in mathematics. Previous studies about the enactment of mathematical tasks (Doyle, 1988; Henningsen, Stein, & Grover, 1996; Kim & Stein, 2006; Tarr, Chavez, Reys, & Reys, 2006) found that teachers often provided rote procedures, skills-based practice problems and explicitly told students how to complete the tasks in order to ensure students’ success.

Subsequent implementations were more likely to feature learner-centered tasks and high-level questions. Professional development researchers examining teacher questioning of students’

mathematical thinking reported that teachers needed time to make substantive changes to their teaching practices (Richardson, 1994; Orrill, 2001) and to recognize instances where questioning would be appropriate (Sherin & van Es, 2005). In the present study, both participants asked more high-level questions during their latter enactments. The increase in high-level questions as the study progressed may be evidence of the cumulative impact of ongoing professional development activities. During the workshops, teachers observed high-level questioning strategies modeled by the professional developers, reading and watching teachers' implementation episodes and discussing questioning approaches. It seems likely that initial attempts to apply target strategies were influenced by limited familiarity and few opportunities to practice. Thus, with ongoing workshop and planning support, paired with prior opportunities to apply the methods with their students and emerging familiarity and comfort, teachers were more likely to demonstrate learner-centered practices in their classrooms.

Participants' espoused practices did not align with the professional development goals. During this study, teachers' interpretation of the professional development goals rarely matched the actual goals. While teacher-participants' reported that each of their implementations would align with the professional development goals, few were consistent with the project goals. Prior studies reported similar results: researchers observed teachers as they employed didactic instruction, but teachers' indicated they were implementing reform-based mathematics instruction (Peterson, 1990; Wilson, 1990).

Although scaffolding influenced classroom enactments, didactic components were evident even during highly scaffolded tasks. Tharp and Gallimore's (1988) application of Vygotsky's Zone of Proximal Development to teacher learning contended that teachers require extensive support and guidance when first learning new pedagogies. This support can be scaffolded and gradually removed when teachers are able to independently enact these new pedagogies. Studies of enacted curriculum (Remillard, 2005; Kim & Stein, 2006) found that teachers were more likely to implement learner-centered curriculum when instructional materials adequately supported instruction. The present study confirmed teachers' need for support; classroom implementations were most closely aligned with the professional development goals on tasks that were scaffolded by the professional developers (i.e., tasks the professional developer modeled or co-planned with the participants).

Implications for Future Research

Scaffolding implementation

While the scaffolding tended to increase the likelihood of learner-centered task implementation, the teachers did not receive the type of progressive guidance recommended by Tharp and Gallimore (1988). The workshops transitioned from directly adopted, to co-planned to independently planned tasks, but participants varied in the order in which they implemented those tasks in their classrooms. Participants may have been more likely to adopt the professional development practices if their first implementation was directly adopted from workshops and subsequently followed by co-planned lessons and independently planned lessons. Perhaps initial enactments might be more effective if focused on directly adopted tasks modeled during the initial workshops and scaffolded via on-site support. Research is needed to examine the benefits and tradeoffs involved in explicitly imposing and scaffolding tasks developmentally.

Clarifying links between the enactments and student learning

Future studies should examine how evidence of student understanding and measures of student learning, are influenced by the enactment of learner-centered tasks. The progressively scaffolded approach suggested previously may complement this line of research. Implementation of adopted tasks might promote consistent student learning outcomes (e.g., similar types of student-generated mathematical representations, communication about students' mathematical

thinking, and representations of mathematical work). As teachers assume increased ownership of the implementations by co-planning and independently planning tasks, and begin personalizing their approaches consistent with learner-centered tenets, student learning outcomes might then demonstrate greater variation. Research that attempts to link the implementation of learner-centered tasks to student learning outcomes must start by examining measures of student learning that are embedded within the tasks themselves.

Conclusion

This study provides evidence that scaffolding teacher's implementations increases the likelihood of the enactment of learner-centered tasks—especially after teachers gain greater familiarity through professional development workshops and have opportunities to practice the methods with their students. However, even highly scaffolded tasks were sometimes implemented didactically. Due to the inconsistency between teachers' self-report and their observed behaviors, in situ observations are needed to sufficiently examine participants' implementation of professional development practices. Further, professional development researchers must continue to examine the links between teacher learning, teachers' implementations of their new knowledge and skills, and student learning outcomes.

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