

Towards Culturally Relevant and Responsive Teaching of Mathematics

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Five teachers from an inner-city elementary school, Grades 1 through 5

Four OISE teacher candidates from the Inner City cohort

ABSTRACT

Teacher learning related to the teaching of mathematics in a culturally relevant and responsive way was investigated across various professional development (PD) contexts. The research team examined which of the PD ideas teachers took up and what contradictions teachers faced across multiple PD contexts. This study focused on four major PD efforts in which five teachers participated during one year. Ethnographic methods of participant observation, document collection, and interviews were used, and three main ideas were identified: (a) the importance of developing awareness of students and their communities, (b) teaching strategies to scaffold students'

development of mathematical proficiency, and (c) strategies for structuring student-driven, inquiry-based learning for mathematics. A significant research finding indicates that multiple contexts of professional learning presented contradictory messages. Thus, the teachers took up some ideas and left others behind, and they sometimes took up ideas that served conflicting goals of education. An outcome of this study indicates that future studies of teacher PD should focus on the teachers' perspectives and on the role of individual PD programs within the broader context of multiple professional learning situations.

PROJECT CONTEXT AND FOCUS

Recent research on teacher professional development (PD) emphasizes the importance of ongoing PD that supports the development of a school or professional community (Westheimer, 2008); that engages with artifacts of practice from teachers' classrooms (Borko, Jacobs, Eiteljorg, & Pittman, 2008); and that focuses on helping teachers inquire into the details of teaching and learning, rather than training them in a particular approach (Sherin, 2007). These recommendations are even more critical for PD that deals directly with potentially sensitive issues around equity and social justice. For a group of teachers to seriously engage with these issues, there needs to be some level of trust, long-term commitment, and a willingness to accept that there may not be quick fixes or easy answers (Foote, 2010).

Although many studies focus on both the implementation and the impact of the PD, the project

team could not locate studies that considered any one PD program as just one of many contexts of teachers' professional learning. Since many teachers participate in multiple PD efforts during a single school year, we cannot consider individual PD programs as separate from the rest of the teachers' responsibilities.

Consequently, we partnered with a local elementary school to collaboratively develop capacity for teaching mathematics in a culturally relevant and responsive way, and we investigated all the various forms of professional development at their school. We considered teachers' opportunities to learn in and across all of the various PD contexts, and we asked the following questions: What ideas do teachers take up as they participate in multiple contexts of professional learning? What contradictions do they face in these multiple contexts? This report outlines the major PD efforts that the teachers participated in during the year and describes what teachers learned from their efforts.

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STAGES OF THE PROJECT

During this research two university instructors and a doctoral candidate collaborated with teachers from an inner-city elementary school. Prior to this project, the research team had been involved with the school for a one-year PD pilot project that we called the Radical Math Study Group. We had worked with teachers once a month to develop and implement inquiry projects in which they investigated equity issues in their mathematics classrooms. We had planned to continue the study group for one more year, but the teachers asked us to support them by becoming involved in two additional PD efforts: a seminar they were attending that focused on culturally relevant and responsive pedagogy (CRRP), and their Ontario Ministry of Education mandated Teaching-Learning Critical

Pathways (T-LCP) model. During the year we attended many of the PD sessions and worked to support teacher learning informally. The details of these PD efforts will be reported under data analysis.

The particular elementary school had been identified as serving a high-needs population in an inner-city context. The school served approximately 450 students, with at least 30 languages represented among the students' families. Five teachers, from Grades 1 through 5, volunteered to work with us. We attended and video recorded many of their PD sessions at various locations, and conducted interviews with the teachers.

DATA COLLECTION AND ANALYSIS

The study drew on ethnographic methods of participant observation, document collection, and interviews. Over the year, we participated in as many PD sessions as we could (for a total of 18 sessions in four different PD efforts), and documented these sessions through video recordings or field notes. We visited each participating teacher's classroom 12 to 14 times between October and May. We also conducted three interviews with each teacher (at the beginning, middle, and end of the year) to learn more about how they conceptualized equity in their classrooms and how they felt their PD supported their learning. We reviewed field notes and documents to ascertain the major goals of each PD context and the major activities for teachers.

This report will focus on two types of data: the data on the PD efforts themselves, and the teacher interviews. We draw primarily on a set of interview questions that elicited teachers' reflections on each of the different PD efforts and also on what they learned through their participation. For the teachers' descriptions of what they had learned, the relevant sections from the interview were transcribed. We first collected all comments related to teachers' perspectives on a single PD effort into a single group; we then looked across groups to search for themes—the similarities and differences in the ways the teachers talked about the various PD efforts. We selected statements that highlighted the most common assertions teachers made about what they had learned in the PD.

Focal PD sessions

In this section, we present brief descriptions of the four major PD efforts that teachers participated in during the year of the study. We focus on the goals and the major activities of each PD to set the context for the teachers' comments about what they had learned.

CRRP Seminar series and Participatory Action Research

Teachers in our study were part of a larger group of 30 teachers from six schools who participated in the Culturally Relevant and Responsive Pedagogy (CRRP) Seminar series. They attended sessions that took place approximately once a month for a total of eight

sessions. The CRRP Seminar series was designed to provide a forum to examine participants' social identities, to raise awareness of power imbalances in schools and society (e.g., racial dynamics in student access to learning opportunities), and to create and implement culturally relevant curriculum and resources that reflect the lived experiences of students in the school.

The CRRP Seminar series also included a full day of training in Participatory Action Research (PAR) as well as three half-day follow-up sessions to support the school's PAR projects. The guiding principle of PAR is that the people most affected by an issue should be involved directly in the design and process of the research. Teachers were charged with collaborating with their students or school communities to develop a research project on an important community issue. The initial training introduced the PAR process and included a brainstorming session to discuss areas of concern at schools. Three follow-up PD sessions included (a) a three-hour meeting with all PAR participants to share their initial work with students, (b) a three-hour meeting with the PAR facilitator to review how the project was evolving in their schools, and (c) a final three-hour meeting with other school groups to share each school's PAR projects.

The teachers in our study focused on issues around recess and introduced PAR through a social mapping activity in which students "mapped" recess to indicate areas where they enjoyed playing and where they did not. This initial activity allowed students to express their concerns about recess at the same time as they were developing mathematical concepts such as measurement and visual spatial awareness. Students identified areas of the playground that they didn't enter because they didn't feel safe, or because those areas were seen as belonging to a particular grade level. They also measured areas of the playground using standard and non-standard measurement as a starting point to explore concepts of perimeter and area. Teachers embedded PAR further in their data management lessons by having students conduct surveys and create graphs based on their issues of concern about recess.

JUMP math

The JUMP math program is based on the belief that every student is capable of learning mathematics and of reaching high levels of mathematical proficiency through an abundance of practice and praise. The JUMP approach breaks mathematical concepts into manageable steps that children practise and master before going on to the next step of a lesson. Lessons are delivered to the whole class in a highly interactive way, with the teacher illustrating examples of a procedure or concept. The teacher then provides incremental challenges and encouragement to build student confidence through small successes and to develop mathematical understanding. JUMP provides lessons for educators that focus on procedural and conceptual learning concurrently and that build in opportunities for students to practise with many similar questions.

The workshops included (a) two lunchtime sessions which provided an overview of the JUMP philosophy and a series of examples of teaching using the JUMP method; (b) one after-school workshop, where the founder of JUMP demonstrated how mathematical concepts could be broken down into a series of small, sequential steps; and (c) an opportunity to observe JUMP's founder teach students in four separate classrooms in the school.

Dr. Eric Jackman Institute of Child Study

The teachers who participated in this project attended a half-day PD session at the Dr. Eric Jackman Institute of Child Study (Jackman ICS), a laboratory school affiliated with OISE. The PD focused on Jackman ICS's inquiry-based philosophy of teaching and learning, centred on mathematics. The teachers toured the school, spending the morning visiting classrooms and

observing inquiry-based teaching in action. They had opportunity to speak with classroom teachers, to clarify pedagogical choices teachers made, and to examine student work and other artifacts of practice.

Teaching-Learning Critical Pathways (T-LCP)¹

The T-LCP process is an Ontario ministry-mandated process in which school staff examine the school's Educational Quality and Accountability Office (EQAO) standardized data; they focus on areas of growth and choose specific expectations from the curriculum, with the goal to improve overall student and school performance in those curriculum areas. The T-LCP model is designed as a professional learning community and involves three or four meetings per term for each grade-level group of teachers.

Using a Backwards Design Template to develop common curricular content, teachers outlined the Essential Question for the unit and the Enduring Understanding that they expected the students to gain. They then designed the culminating activity and a set of six or eight subtasks they could use to teach the skills required for the culminating activity, as well as a pre-assessment, mid-assessment and post-assessment activity. During the term, grade-level teachers gathered to examine evidence of student growth, obtained by means of a scoring rubric that assigns an achievement-level score to student work. The goal of this PD was to generate professional dialogue, to develop common language among teachers for the assessment of student work, and to focus on curriculum development to improve student achievement.

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¹ The T-LCP was inspired by the work of Carmel Crevola, Peter Hill, and Michael Fullan in their book *Breakthrough*, particularly the idea that classroom practice can be organized in a “practical, precise and highly personalized manner with the outcome being increased student achievement” (Hine & Maika, 2008, p. 16).

FINDINGS

The research findings discussed below correspond to the two underlying questions for this project: What ideas do teachers take up from their experiences in multiple PD contexts, and what contradictions do they experience between multiple PD contexts?

Ideas taken up by teachers

Through analysis, we identified three main themes that reflect the ideas that teachers had taken up from their experiences in the multiple forms of PD: (a) the importance of developing awareness of students and their communities; (b) teaching strategies to scaffold students' development of mathematical proficiency; and (c) strategies for structuring student-driven, inquiry-based learning for mathematics.

Importance of becoming aware of students and their community

The main message teachers gleaned from the CRRP Seminar Series was the importance not only of seeing students as coming from diverse families and communities but also of building relationships with students and communities. One teacher said, "I think it [CRRP] helps your teaching because it makes you more aware of the kid that you've got in front of you, makes you more aware of the issues that they're dealing with." Another teacher explained how she began to view students as individuals coming with unique background experiences: "CRRP ... has definitely opened my eyes with students that have different perspectives and where they're coming from ... so kind of seeing kids with their families before seeing them as your students." Both quotes exemplify the teachers' awareness of students' lives outside of school and the importance of considering the diversity of their classrooms. However, as one teacher pointed out, there was little concrete connection to actual teaching practices, especially for mathematics; so teachers struggled to manifest these ideas in their mathematics teaching.

Teaching strategies to scaffold students' development of mathematical proficiency

Another key idea taken up by teachers was the importance of scaffolding in mathematics teaching. Teachers described JUMP PD as an important support

in helping them do this. For example, some teachers in this study described JUMP as providing a way to reach students who struggled in mathematics. One teacher described JUMP as "allowing them [the students] to begin at maybe two grades below on the scale or concept and to work their way towards their grade level, and there's advance pages for them to go beyond as well." This teacher also said that JUMP could free up the students from the excessive writing that can occur if a mathematics program relies solely on a textbook. Teachers reported that JUMP was most effective when they used the teacher guides provided with the program; this is because JUMP "gives you three or four different ways that you can teach" math concepts, and the JUMP approach "weaves strands of math that are usually taught as separate units." The teachers also reported that the opportunity to observe a skilled teacher in action with their students was an effective form of PD.

One of the messages that teachers took up from JUMP was the importance of practice for students in learning mathematics. For one teacher, the message was that "the brain can learn just about anything if you work hard enough at it." Another teacher argued that the amount of practice afforded by JUMP helped her students develop mathematical skills, which helped them feel more confident in math, and "our discussions were richer because they had more practice." Thus, teachers came to believe that a foundation of computational fluency enriched students' abilities to participate in mathematical discussions.

While teachers praised the JUMP approach and the PD that helped them learn it, they did not uncritically take up all of the ideas associated with this approach. For example, although teachers reported appreciating JUMP's efforts to minimize student writing, they felt that an emphasis on writing down only the answer limited students from drawing pictures, adding information, or making their thinking visible to the teacher. Teachers also reported using some JUMP units, such as fractions, but not others, such as long division. In this way, rather than JUMP being the focus of their mathematics program, it became a component of the teachers' varied toolkit of mathematics teaching ideas and approaches.

Strategies for student-driven, inquiry-based learning

One of the major ideas that teachers took up from PAR and Jackman ICS was the importance of building on students' interests, ideas, and issues in order to design engaging learning environments. One teacher's conceptualization of equity was directly related to the student-driven, inquiry-based principles of PAR: "Equity would be to have the children doing a large part of creating the direction" for their mathematics coursework, and she expressed a preference for having "the focus come from them [students] instead of me." Other teachers voiced similar thoughts and argued that PAR was powerful because it allowed students to express their interests and to work towards positive change at the school.

Although the Jackman ICS PD session was not explicitly focused on issues of equity, teachers commented on the similarities between the PAR approach and an inquiry-based approach that capitalizes on student interests. They also commented on the significance of having models of this type of instruction. They noted the importance of building on student interests and argued that as a result, students were more deeply engaged in classroom activities and exhibited higher level thinking.

Contradictions between multiple PD contexts

In our observations of the varied examples of PD, and in our interviews with the teachers, we found that the multiple contexts of professional learning presented contradictory messages. In the work of teaching, contradictions are perhaps inevitable because teachers struggle to achieve competing goals that are at times incommensurable. For example, the teachers spoke often of the tension between designing instruction based on student interests and needs and the requirement to meet standardized curriculum expectations. Such competing goals of education were taken up differently in the different PD efforts, resulting in the contradictions that we discuss here.

Even within a single type of PD, the teachers sometimes displayed contradictory responses. A teacher could describe the same idea as both positive and negative. For example, in regard to the Teaching-Learning Critical Pathways (T-LCP) model, one

teacher expressed concern that teachers were "so limited" because they had to use the same themes, tasks, and assessments as all teachers in their grade-level group. On the other hand, the same teacher later commented positively on the way the T-LCP helped everyone to develop a "commonality of language" and how "moderated marking helps in our planning together." Thus, although the T-LCP PD was mandatory for teachers to follow, their contradictory responses meant that they did not carry the T-LCP process further than required.

When we examined the ideas that teachers enthusiastically took up across the various PD efforts, we encountered further contradictions. Teachers uniformly reported wanting to build inquiry-based classroom activities based on student interests, as they had seen in the PAR and Jackman ICS PD. However, because they had to do the same activities as all the other teachers, they found that the T-LCP prevented them from following their students' interests. Further, teachers expressed high levels of enthusiasm for JUMP, even though JUMP was not designed to be student driven, and this meant following a set schedule of activities.

These contradictions were also evident in our classroom observations. For example, we found some teachers dividing their 50-minute mathematics period into two distinct approaches to teaching: a teacher-directed JUMP approach for the first 20 minutes of a lesson, followed by an inquiry-based PAR approach for the remaining 30 minutes. In the interviews, teachers could express support for seeing students as autonomous and individual: "Like seeing them more as complete individuals that need some guidance to shine and not trying to make them all the same." Yet in the same breath, they could describe how difficult it was to address students' individual needs. For example, one teacher who taught in a split-grade classroom described how she assessed her students: "I'm giving them a quick geometry test with faces, vertices and points.... And I have the same test for everybody because I didn't have the time to go and find a Grade 3 test." Thus, we observed evidence of the contradictions between various forms of PD, both in what teachers said about their practice and what they had learned, and also in what they did in their classroom teaching.

“For principals and school boards anxious to support teachers’ professional learning, and for teachers who are struggling to make sense of multiple PD contexts, we suggest capitalizing on the PD contradictions and discussing them explicitly. Either independently or as a school community, practitioners can debate and discuss the contradictions that they face, in hopes of resolving them or lessening the distance between what they learn in the PD setting and what they practise in their classrooms.”

IMPLICATIONS AND NEXT STEPS

In this study, we focused on the complexity of teachers’ professional learning related to implementing equitable and effective pedagogy within an inner-city elementary school’s mathematics classes. While this school and these teachers might have been unusual in the sheer volume of PD made available to them, it is certainly the case that countless teachers face similar situations. They participate in the various forms of PD made available to them at the school, the board, professional associations, conferences, university courses, and so on. Although most research studies of PD have considered only single forms of PD and investigated the hallmarks of effective PD, we have considered the role that multiple forms of PD may play in a particular teacher’s professional life. While individual forms of PD may have been of high quality, the multiplier effect for the teachers was contradictory. Teachers were not supported in making sense of the differences in the PD they were being offered.

This finding raises questions about the importance of coherence across the PD programs in which teachers participated. The teachers themselves did not complain

to us about a lack of coherence in their PD. Instead, they took up some ideas and left others behind, sometimes taking up ideas that served conflicting goals of education. We suggest that future studies of teacher PD should focus on the broader context of teacher learning across the school year. This type of research is necessary not only to understand how to implement effective and high-quality PD as an integral part of teachers’ professional lives but also to support teachers in making sense of contradicting perspectives and practices.

For principals and school boards anxious to support teachers’ professional learning, and for teachers who are struggling to make sense of multiple PD contexts, we suggest capitalizing on the PD contradictions and discussing them explicitly. Either independently or as a school community, practitioners can debate and discuss the contradictions that they face, in hopes of resolving them or lessening the distance between what they learn in the PD setting and what they practise in their classrooms.

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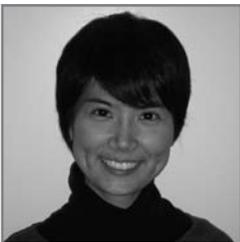
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