

EDUCATIONAL POLICY AS A VEHICLE FOR TEACHER LEARNING

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Educational policies aimed at improving school mathematics education have proliferated in recent years. Investigating how teachers make sense of these policies is imperative, for teachers ultimately decide what mathematics students learn and how they learn it. This research followed a group of 14 middle school mathematics teachers as they studied a particular policy document, Principles and Standards for School Mathematics (NCTM, 2000), tracing the ideas teachers developed about the policy and the impact on their beliefs, priorities, and practice. Analyses revealed teachers developed 5 different perspectives on the document, and these perspectives were aligned with particular features of teachers' local contexts. Results suggest documents like Principles and Standards can be generative – they can stimulate productive conversations among teachers, and such conversations can serve as fruitful sites for teacher learning.

The past two decades have witnessed an unprecedented increase in efforts to develop and disseminate educational policies aimed at improving school mathematics education. This policy proliferation is exemplified by the release of “standards” for school mathematics by the National Council of Teachers of Mathematics (e.g., NCTM, 1989, 2000). What impact these efforts might have hinges on if and how various constituents decide to implement the policy recommendations, and these decisions depend largely on constituents' interpretations and understandings of the policy (McLaughlin, 1987; Spillane & Callahan, 2000). Understanding how classroom teachers take up and make sense of instructional policy recommendations is particularly crucial, for teachers are the “final brokers” (Spillane & Callahan, 2000, p. 401) of instructional reform. Regardless of the various forces that aim to influence instruction, teachers are the ones who ultimately decide what mathematics students learn, and how they learn it.

Researchers have investigated the ideas that district policy makers construct from state science standards (Spillane & Callahan, 2000), the attempts of school sites to align mathematics instruction with the NCTM *Standards* (Ferrini-Mundy & Schram, 1997), and the efforts of an elementary mathematics curriculum committee to translate state standards into a district curriculum framework (Hill, 2001). However, there have been few efforts to understand how teachers gain access to and make sense of policy documents like the NCTM's *Standards*. This research followed a group of 14 middle school mathematics teachers as they studied one of the NCTM's most recent policy documents, *Principles and Standards for School Mathematics* (2000). In particular, this study investigated the following research questions: “What ideas do teachers develop about the policy – its purposes, messages, and perspectives?” and “How does engaging in the work of making sense of policy influence teachers' beliefs, knowledge, priorities, and practice?” This report will present selected results from this investigation.

Theoretical Perspectives

This study is situated within a broader framework conceptualized by the National Research Council (NRC, 2002) for investigating the influence of documents like *Principles and Standards*. This work focuses on a particular channel of influence identified in the framework – teacher

development. In particular, this research takes up two guiding questions posed by the NRC: “Among teachers who have been exposed to nationally developed standards – How have they received and interpreted those standards? What actions have they taken in response?” (p. 35).

This research draws upon both cognitive psychological (Borko & Putnam, 1995) and situated perspectives (Putnam & Borko, 2000) on teacher learning and professional development. Teachers’ knowledge, beliefs, values, and past experiences shape how they perceive and what they learn, and these in turn influence how they act (teach). Cognition also has a social component and is situated in particular contexts. Teachers’ learning is influenced not only by their personal orientations, but also by their interactions within various social communities.

Methods

A professional development project was designed to provide middle school mathematics teachers with an opportunity to study *Principles and Standards*. Interested teachers were invited to apply with a partner from their school. From the pool of applicants, 14 middle school mathematics teachers – 6 school-based pairs and 2 individual teachers who agreed to team up – were selected to form a study group to read, discuss, and analyze *Principles and Standards*. Teachers were chosen so as to maximize diversity in terms of years of teaching experience, certification level, mathematics curriculum, and incoming familiarity with the NCTM *Standards*. Teachers met for a total of 16 sessions over 6 months, with each session lasting 3 to 6 hours. The central activity of each study group session was analysis of selected readings from *Principles and Standards*. To situate their study of the document in the activities of teaching, the group also worked on mathematics tasks, read teaching cases, viewed videos of mathematics teaching, and analyzed student work. Each teacher also maintained a journal in which they responded to prompts aimed to support them in reflecting on the readings and clarifying their ideas.

Data on teachers’ developing ideas about *Principles and Standards* and the impact of teachers’ study of the document on their beliefs, knowledge, and practice were collected from multiple sources. The primary data source was teachers’ discussions of the policy document during the study group sessions. All 16 study group sessions were audio-taped and videotaped, and transcribed. Other sources of data included teachers’ journal entries, interviews with teachers, teachers’ discussions on an electronic listserv, observations of each teacher’s classroom, and entry and exit belief surveys. In addition, all documents produced or shared during the study group sessions were collected and photocopied.

Analyses of the study group discussions were conducted in two phases. The first phase consisted of a turn-by-turn analysis of each teacher’s individual contributions to the conversations. In this stage of the analysis, a conversational *turn* was the unit of analysis, and the goal was to trace the ideas that individual teachers were developing over the course of the project. The second phase consisted of a more global analysis of the discussions in which each study group transcript was chunked into distinct conversational *episodes* characterized by a shift in the topic under discussion. In this stage, an episode was the unit of analysis, and the goal was to characterize the nature and content of the group’s discussions. Using principles from grounded theory (Strauss & Corbin, 1998), a coding scheme was developed to capture the ideas teachers were developing about the policy document and the major themes that emerged in the study group conversations. Two categories of codes emerged through this process: codes that captured the variety of ways teachers came to view the document and its purposes, and codes that captured the key issues that teachers were identifying in the document and grappling with in their

discussions. Case studies of individual teachers were then developed to investigate the influence of each teacher's study of the document on their beliefs, knowledge, priorities, and practice.

Results

Analyses revealed teachers developed five different perspectives on the nature and purposes of *Principles and Standards*, and individual teachers were capable of assuming multiple perspectives. The ways in which teachers came to view the document were aligned with particular features of their local contexts. Case studies of individual teachers captured the ways in which their efforts to make sense of the policy influenced their beliefs, priorities, and practice.

Teachers' Views of the Policy

Teachers came to view *Principles and Standards* from five different lenses – as a warrant for their current beliefs or practices, as a lever for effecting change, as a vehicle for their own learning, as a springboard for rich discussions with colleagues, and as a tool for analyzing mathematics curricula. The discussion below illustrates three of these perspectives.

Policy as warrant. One of the most common perspectives was that of the document as a *warrant*. From this viewpoint, teachers envisioned using the document to defend their current beliefs or practices. For example, many teachers saw themselves using the document's stance on technology to defend the ways in which they used calculators in their mathematics instruction.

Brian: Ok. I'll risk it, I'll say it. I liked on p. 32, "When teachers are working with students on developing computational algorithms, the calculator should be set aside."

Janelle: I agree with that, too.

DB: Where is that, Brian?

Brian: It's on page 32, at the very bottom, the last sentence. I guess I saw it as *giving permission* [italics added] to do some back-to-basics type of instruction, or what would be seen as back-to-basics by the parents. I know that there's always a sigh of relief at open house when I say, "And sometimes this year your kids will not be allowed to use calculators. Please look out for that and don't let them." (5th Study Group Session)

Brian sees the document as authorizing him to put the calculators away when he is developing computational algorithms, a practice already in place in his classroom. Mimi also foresaw herself using the document to defend her use of technology.

I do know that in reading the selections, I was certainly encouraged, especially in regard to the calculator use. I can use segments with this parent (and others) to clarify the issues, knowing that I have, in this document, the support of a large body of educated mathematicians and educators. . . . The document did repeatedly speak to the use of calculators and computers as tools that are a reality in the home and the workplace, and we cannot be considered responsible and simultaneously not use these tools in our classrooms. (3rd Journal Entry)

In this passage, Mimi anticipates how she can use the document to make a case to parents and "others" (identified later as school administrators and fellow mathematics teachers) for the importance of calculator use in mathematics instruction. In addition to their use of calculators, teachers foresaw the document as a sanction for other instructional decisions. For example, Mimi described referring to the document during a recent phone conversation with a parent to defend her practice of having students collaborate on mathematics problems.

And that's what I'm working on with a couple of parents who have bright children. They don't want [their children] to share their knowledge. "My kid figured it out and I don't think

it's her job to pull this other student along." That's a seventh grade parent calling me today in fact. Well, I tell this parent that Communication is one of the standards, too. And to say that that one is not as important as algebra, I don't think is fair. (6th Study Group Session)

Policy as lever for change. A second perspective assumed by teachers was that of the document as a *lever for change*. In contrast to viewing the document as a warrant for their existing beliefs and practices, teachers who viewed the document as a lever for change saw the document as a tool for brokering for new practices or resources. For example, some teachers envisioned using the document with administrators to lobby for more professional development opportunities. "They [the Writers] really pushed the issue of professional development. I thought, 'Oh this is a part that should be photocopied and given to my principal!'" (Dara, 3rd Study Group Session). Other teachers saw potential in using the document as a lever for catalyzing other teachers in their district to improve their mathematics instruction.

Brian: So, that was kind of nice to be able to go on and actually read some of that stuff [the Standards for Grades 3-5] about what would be a high expectation of them [elementary grades]. I think that our district is feeling a lot more of the pressure to push the elementary school more, so it's nice to have a little more evidence of that.... I plan to have a meeting with our assistant superintendent and tell him what we [the study group] are doing and provide him with additional ammunition on this to push the elementary schools. (Interview 1)

Recognizing that his district is planning to raise expectations of its elementary school teachers, Brian sees *Principles and Standards* in terms of its potential to be used as "ammunition" for compelling those teachers to respond. Similar notions of the document's potential as a lever for change were explored by Tim:

I also hope to obtain enough evidence from these sources to help back up my claims about how students in our building should be educated. As it stands now, I have had a difficult time convincing the other math teachers in my district about the things they should and should not be doing in their classrooms. Having a respected source to refer back to should help me greatly. (2nd Journal Entry)

In this entry, images of the document as a warrant and as a lever for change are intertwined. Tim foresees using the document to support his current views about how and what students should be taught; he also sees the document as a crucial tool in convincing other teachers of his ideas.

Policy as vehicle for teacher learning. A third perspective exhibited by teachers was that of the document as a *vehicle for their own learning*. From this perspective, teachers viewed themselves as learning not only *about* the document, but also *from* the document. For example, consider Joyce's reflections on her study of the document at the end of the project:

I think that the document will have a different impact on each reader depending upon their particular situation and needs. Reading it again next year will probably affect me in different ways than it has this past year. Even as I reviewed sections of it in preparation for our presentation, I found new understanding (and questions) that I did not find the first time I read it. I view it as a learning tool that can be a continual resource for teachers who are interested in growing professionally. I hope that we can encourage other teachers to invest their time in its reading. (9th Journal Entry)

In addition to learning about the document's recommendations and perspectives, Joyce and other teachers saw themselves learning new ideas about mathematics teaching and learning. They also saw the document as an instrument for analyzing their practice and becoming more explicit about their beliefs and values. These views of the document as a "learning tool" emerged during

several study group conversations. For example, during the beginning of the second session, teachers shared their overall reactions to their first readings from the document:

Monique: It seems like it [the document] is common sense and nothing was so technical that you read something and were like, “Huh?” I mean, it seemed like it was kind of reconfirming what you already do or what you already thought.

Kayla: I found myself almost reading it too fast because of that, and not thinking about it as hard as I should. Because I read through it and I thought, “Oh yeah, oh yeah, I do that. Oh yeah, I’ve thought about that.” And then when I went back and read it again, I stopped to think about it and talked to another teacher in my building about it. I don’t necessarily do what I thought I was doing. I don’t know how to say it. The first time I read it through I thought, “Oh yeah, this isn’t [anything new].” And then when I went back through it again and eventually, this is about my fifth time reading it since I got it last April, I thought there was a lot more here for me to think about. (2nd Study Group Session)

This passage reveals two very different perspectives on *Principles and Standards*. Monique reports that the document’s recommendations align with and confirm what she already thinks and does, reflecting a notion of the document as warrant. Kayla admits to having the same initial reaction, but in reading the document more carefully and discussing it with a colleague, she finds the document leading her to reexamine her practice. In doing so, she realizes that, “I don’t necessarily do what I thought I was doing”. Studying the document helps Kayla become more aware of and explicit about her beliefs and practice.

Teachers also saw the document’s inclusion of controversial recommendations and non-traditional perspectives as a catalyst to confronting their own ideas about school mathematics. For example, the teachers took up a conversation of what “algebra” should be for middle school.

And that's why I thought reading this [the document], it shakes up what algebra is. If algebra at the middle school isn't just x, y, and equations, then what is it and what do we need to be doing? I thought this was really pushing at us to think about algebra differently for sixth, seventh, and eighth graders. (Kayla, 3rd Study Group Session)

Kayla characterizes the document’s stance on algebra as provocative, as “shaking up” what algebra is. By taking a more radical stance, she feels that the document is “pushing at” teachers to reexamine their ideas about algebra for middle school. Teachers revisited this notion of the document confronting their thinking later during their discussion. The passage below opens with Brian inquiring about the document’s discussion of the various meanings and uses of variable.

Brian: It just felt much more explicit than some of the other stuff I read in the chapter. It takes up quite a bit of the chapter. . . . When I read it I also thought it was *trying to push people outside of their little box* [italics added], because most people would just think of, you know, a variable stands for a number that you find the answer for. And this was a way to push people a little bit further.

Kayla: I think it's even more staggering if you have a chance to go to the 3-5 [grade band] and look at how they talk about the use of variable and starting it in grades three through five and looking at the different ways variables are used in a situation. I think it would make things so much smoother, flow better, but I don't know that . . . if all elementary teachers have the math background to be able to see that. . . .

Janelle: Maybe that's part of this too, is that this document is a teaching tool as well. It's not just setting up standards, but teaching. Because I really put myself in a learner situation and I actually learned a number of things that I didn't know before, that I hadn't thought about in this way. So, I kind of like that, I absorb it. (3rd Study Group Session)

Brian and Kayla see the document as attempting to broaden teachers' understanding of variable to meanings other than variable as placeholder or missing value. Janelle builds on this discussion by suggesting that the document has been developed to do much more than just disseminate standards – it has been designed to serve as a catalyst for teachers' learning.

Alignment of Teachers' Views and Contextual Features

Results suggest that the ways in which individual teachers came to view the document were aligned with particular features of their local contexts. Important contextual features included the school or district's norms for teaching and for professional growth, the level of support for innovation from administrators and community, and the physical, financial, and human resources available to teachers. For example, teachers like Mimi who taught in districts where their mathematics curriculum was highly contested by parents and community members tended to see the document as a warrant for defending their instructional decisions. In contrast, teachers like Janelle who worked in more supportive, less contentious districts where they felt respected and trusted by parents and administrators were less likely to view the document as a warrant. These teachers felt free to experiment with new instructional approaches and were more likely to envision the document as a vehicle for their own learning.

Policy's Impact on Teachers

Case studies of individual teachers portray the educative potential of engaging teachers in the work of making sense of *Principles and Standards*. For Brian, reading and discussing the document pushed him to reexamine his beliefs about the use of technology in mathematics instruction. Before participating in the study group, Brian had experimented with various instructional technologies in his classroom but was not a strong advocate of them. In early study group discussions and journal entries, he shared feelings of frustration toward the demands posed by technology use. Over the course of the project, Brian's perspective on the role of technology began to shift. He became more explicit about his practice and dissatisfied with his limited use of technology. Gradually, his beliefs about technology became more balanced, and he began to recognize and espouse the advantages afforded by instructional technologies.

I would like to think my classroom is fairly well aligned with the PSSM, but I have come to recognize several areas where I come up short: 1.) Use of technology: Although we use the graphing calculator, it is our only regular application of modern technologies available to us. . . . I hope to use more technology during the year. I am hoping to incorporate some of the examples from the NCTM website, as well as the Geometer's Sketchpad. (6th Journal Entry)

Consequently, Brian took steps to incorporate more technology into his classroom. He formed a partnership with his school's computer specialist to develop and implement a series of web-based lesson plans, including one designed around an electronic example in the document. Even after the professional development project ended, Brian continued to design, implement, and revise mathematics lessons incorporating technology, posting messages to the electronic listserv informing the other study group members of his progress.

For Janelle, reading and discussing the document helped her identify and reexamine a particular feature of her practice, namely her tendency to immediately provide students with an algorithm for solving a given problem. Study group discussions of two of the document's claims— mathematics concepts should be developed before procedures, and effective teachers are able to support students without doing the thinking for them – encouraged Janelle to reconsider her approach. "One of the biggest changes in my thinking is about giving the algorithm then

solving problems, rather than thinking about things first without the rule or formula. I have to work at this a bit because I've learned it the other way" (4th Journal Entry).

Gradually, Janelle began to experiment with adopting this new "explore first" approach in her classroom.

How has new NCTM knowledge changed my teaching? The #1 biggest way has to be in the "non-algorithm first" way. "Here, I'll show you how – then practice!" It will take me some time to reverse the engines, but I am committed to the change. One of the boys in my class who was doing sixth grade for the second time said that he now loved math and had been very unsuccessful before. It moves me to get lots of kids to that place. (6th Journal Entry)

As Janelle allowed her students to solve problems in their own ways, their attitudes toward mathematics began to improve. Collecting this type of evidence was compelling to Janelle, and strengthened her commitment to the approach. Indeed, toward the end of the project, she cited it as the most important thing she had learned through studying the document with the study group.

"This one is the most important to me. I learned that the algorithm first then practicing is not the best way. Research supports the notion that doing the conceptual understanding and exploration first is more powerful and leads to deeper learning" (9th Journal Entry).

Concluding Remarks

Results from this investigation suggest documents like *Principles and Standards* can be generative – they can stimulate productive conversations among teachers, and such conversations can serve as fruitful sites for teacher learning. Further research is needed to shed light on how to effectively engage teachers in making sense of policy, and what ideas they develop by engaging in this work. Such research could inform the development of future educational policy.

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