

FACTORS MOTIVATING REFORM: LEARNING FROM TEACHERS' STORIES¹

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In current study we interviewed 21 mathematics teachers who aspired to reform-based mathematics instruction. It was our hope to establish whether there were common traits among this teacher population, which could have influenced their supportive disposition towards innovative instruction. The participants shared several characteristics. (1) They were confident in their ability to control student learning and possessed a detailed vision of the type of teaching that could advance student learning. (2) They held strong philosophical views on the role of education in general and of mathematics in particular, they believed them to be apparatuses for social change. They assumed teaching as a moral and ethical act and themselves as change agents. (3) They viewed their implementation of the Standards as work in progress.

INTRODUCTION

Reform documents such as Professional Teaching Standards (1991) and Principles and Standards for School Mathematics (2000) suggest that mathematics teachers should engage all students in learning more and better mathematics. Despite the wide spread endorsement of these Standards by educational researchers, reformed practice remains a novelty in school settings (Wilson & Ball 1996). It is widely accepted that teachers' reluctance to conform to new methods of teaching is due to their limited knowledge of mathematics or deeply held beliefs about mathematics as a didactic discipline that is best learned through direct instruction (Putnam & Borko 2000). Current challenges in mathematics education include identifying those elements that facilitate teacher development, designing strategies that reach and impact teachers, and documenting the process of change as it occurs in school settings (Anderson 2001). Although there are significant gaps in our knowledge of the mathematics education reform process and intricacies associated with it, the one most profoundly visible is the absence of an understanding of those factors within the teacher that motivate their commitment to instructional change. Elsewhere we have argued that the available body of research in mathematics education represents the researchers' assessment of elements that contribute to the teachers' choice of pedagogy and their rationale for supporting or opposing mathematics reform (Author 2002). Research studies that reflect teachers' own perspectives on issues concerning standards-based practice are rare. A study of innovative teachers can provide insight into the phenomenon of teacher thinking and assist in isolating factors that enhance, rather than impede teacher development (Goodson 1996). The current research pursued this inquiry. The overarching goal of our research was to better understand mathematics teachers and their motives for supporting Standards-based practice. Two questions guided our inquiry:

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1. What features seem common among teachers who claim strong support of current efforts for reform in mathematics teaching?
2. What factors seem to contribute to the teachers' thinking regarding their support of reform recommendations?

METHODOLOGY

Participant selection

Initially and as a part of a much larger research study in which we aimed to elicit high school mathematics teachers' views on standards-based curriculum and instruction we surveyed 400 high school teachers in Michigan (Author 2002). We asked the teachers to rate their confidence with new instructional roles and techniques suggested for their practice. We also asked teachers to comment on their beliefs about practices supported by various reform documents. For the purpose of the current research we wanted to study only those teachers who were strongly supportive of Standards-based teaching. Following classroom observations of 39 teachers who met the criteria, we selected twenty-one teachers to serve as participants for this study. Seven of these teachers taught in rural, nine in suburban, and five in urban school districts. Eleven of the participants were male and ten were female. Four of the participants were of African American Heritage, three of Asian, and the remaining fourteen were white. The teachers' average teaching experience was fifteen years. Three teachers had less than seven years of experience.

Data collection and analysis

Data collection for the study was in the form of interviews with teachers. We met with each teacher individually and in her/his school. Each interview session lasted approximately four hours. Interviews were audio-taped and later transcribed. During the individual interview session, each teacher was asked to comment on two issues:

1. Their views on the recommendations of reform, what they found difficult to implement or those they found easy.
2. Factors that they felt contributed to their assessment of these recommendations

The subsequent discussions were guided by teachers' reactions to the topics listed above and as we tried to gain a better understanding of their motives and thinking. In carrying out the interviews and in analysis of data we used the method of essence (Goodwin & Witz 1998), a qualitative research approach. The aim of this methodology is twofold:

1. to develop deep analytical insight into the phenomenon of teacher's thinking situated in the teacher in connection with his/her practice
2. to develop portrait of the individual teacher to communicate the deep-seated coherent unified essence of one's actual practice.

The emphasis throughout the entire period of data collection and analysis is on sympathetic sharing, a commitment to seeing the phenomenon as it is and seeing its "nature" and "essence." The goal of this methodology is to compile themes that emerge from each interview and to build a theoretical model based on the common themes that surface from various data sources (Smith 1994). In accordance with this design, once all interviews were completed, teachers' responses were categorized according to the common themes that emerged from their discourse. Although those features that were unique to each of the teachers were noted, in preparation of the final report we relied solely on common attributes among the participants.

FINDINGS

The participants shared several characteristics. (1) They were confident in their ability to control student learning and curriculum. (2) They held strong philosophical views on the role of education in general and of mathematics in particular, they believed them to be apparatuses for social change. They assumed teaching as a moral and ethical act and themselves as change agents. (3) They viewed their implementation of the Standards as work in progress. These various aspects of teachers' thinking were deeply intertwined. In fact, intense interactions among them influenced the teacher's pedagogy and their instructional goals.

Confidence & vision

Studies of teacher efficacy—teacher's confidence in their ability to monitor student learning—have provided support for its positive influence on teachers' behaviors in classroom. There is evidence that confident teachers tend to be risk takers (Saklofske, Michaluk, & Randhawa, 1988; Hoy & Woolfolk 1993). It has also been reported that confident teachers experience greater success in maintaining high standards of practice (Spector 1993). The same personal traits were evident among all our participants.

All twenty-one teachers held a high level of confidence in their ability to control their curriculum and the learning of students. Regardless of the setting in which the teachers worked, each felt in control of the conditions of their schools. These teachers felt they were successful in providing learning opportunities that allowed students to overcome not only cognitive barriers to learning mathematics, but also the social and economic obstacles with which they struggled inside, and outside schools.

I know I can help them learn, I know it is up to me to help them grow into critical learners. I know I can do that. I have had students in my classes that everyone else had given up on and yet I could reach them. I taught them good mathematics. These kids wanted to know why things worked and retaliated against education when people refused to answer them. It is about making it work and I know all the years of experience I have with me is telling me that what I am doing is right, I don't care if the principal is not happy or the parents come here and complain. I can handle them. (James)

A number of my former students have gone on to Ivy league colleagues. They are successful in their careers and they call me even today and tell me that I had an impact on their lives. I know I work in a setting where it is easy to give up, to say these kids will never go to college, that in all likelihood they may not even finish high school, but as long as they are in my class I know I can teach them, and I can teach them good mathematics. I can teach them enough mathematics that if they choose not to go to college it will not be because they do not know their stuff. (Tom)

The teachers' confidence was substantiated by their trust in their own ability to make sense of mathematics. All teachers seemed to possess an imagery of the Standards-based classroom as well as those teaching actions that facilitated its creation. An articulation of these visions was a prominent part of the teachers' discourse as they described their own instructional practices and their goals. Although for six of the teachers these visions derived from personal and first had encounters with innovative instruction as learners, for others they were the result of a lack of satisfaction with traditional practice they had either experienced, or witnessed.

When I was in grad. School I worked with Pf. X who was a student of Moore. In his class we were expected to build mathematics, to state and prove theorems, he did not let us consult with references, he did not let us look at books, he wanted us to create knowledge. This was like 20 plus years ago. Even before Standards came about. After that experience I knew how I wanted to teach. I knew that was exactly what I wanted to do with my own students but it took me years to learn to make the change. When the Standards, the first set, came out I could relate to what they said, I had a vision of what they wanted to accomplish. That is what I strive for daily. Some days I am very successful, and some days I am not very successful (laughs) (Laticia)

My entire mathematics education was stand and deliver. When I started teaching almost ten years ago I did not know what kind of teacher I would be but I knew what kind of teacher I did not want to be. I knew I wanted to get my students to think. The problem then was that I did not have a lot of ideas, I mean strategies about how to do this. I know I made a lot of mistakes. I am still work in progress, you know. I still have a lot to learn, but knowing what I did not want to be, made me hungry for finding my own identity (Cara)

All teachers valued Standards for supporting their own visions of mathematics learning and teaching, and for providing curricular models they could use to realize these visions. The utility of the Standards for them, then, was not in their capacity for refining their views, but for enabling them to fulfill their own goals.

The teachers' view of self was profoundly influenced by their philosophies on the role of education in a democratic society. These philosophies also shaped their identities as mathematics teachers and the knowledge they considered worthy of sharing with learners.

Philosophical views on the role of education and children

Goodlad (1984) characterized teachers as stewards to schools and society. To him, teachers are stewards because they look after the school as an educational entity committed to the advancement of both its students and a larger human ecology. In this role, the teachers have responsibilities beyond their respective classrooms. Such interpretation of teaching determines, to a large extent, the capacity of teachers to renew themselves and to respond thoughtfully to the efforts of others to reform instruction. The teacher participants in this study espoused such view of teaching, and were driven by a "mission" to serve as change agents within their schools and in society at large.

All teachers appeared to assume educating children as a "calling," and a moral act. Their efforts at improving their own teaching were not motivated by professional expectations set by administrators, but by their personal philosophies on what it meant to be an educated individual and the role of schools in nurturing informed citizens. All teachers believed education should raise social awareness among learners. While for some of the teachers these philosophies were rooted in their religious beliefs, for others, they were provoked by their political interests. In both cases, these beliefs influenced what the participants considered as worthwhile mathematics knowledge for students to acquire. All teachers believed in mathematics as an apparatus for resolving social problems. They also viewed teaching mathematics as an act of membership in a community that had the power to alter social norms.

I think mathematics is the most powerful tool for helping people overcome challenges in life. Of course literacy is really important but it is with mathematics that one can analyze

decisions, political decisions I mean, the information they read in the paper, it is with mathematics that they can see through lies. We chose to neglect it for decades, we believed that only the elite needed to know mathematics, that only the elite could learn mathematics. Standards now are saying, hey this is for everybody, they are redefining the elite. (Travis)

Do you really think we would have as many problems in society as we do now if people knew more math? See, poor kids don't get to college because of math, so, what happens to them? They end up in minimum wage jobs, and the cycle of poverty continues. We refuse to accept that we have a problem- we have a class system, and whether we want to believe it or not mathematics contributes to this class system. I hear other teachers say that we makes no difference, that these kids will never go beyond the basics. They say let's teach them enough so they could balance their checkbooks. I say, hey that is not enough, we can do a whole lot more and that is what Standards are saying too. (Bobbiesue)

All teachers believed the primary function of their work was to help students develop the skills that either permitted them access to higher and better social standing, or greater social awareness. Naturally, the teachers' assessment of the Standards was filtered through these philosophical beliefs. Indeed, teachers' particular interests humanized the Standards to simultaneously serve two specific functions for them; an academic, and a political function. On the one hand, teachers seemed to have relied on the Standards to organize the curriculum they covered in class. On the other hand, they used them to legitimize their own choices in the presence of resistance or opposition they faced in their respective school.

This is the first time in education that we have made a commitment to educating ALL children, the first time ever. The 60s movement was not about all kids... But this one is. I support that. I am tired of all these people who think education is only for rich kids. I think a lot of teachers have used that statement to reduce academic standards and rigor. They say, "these" kids won't go to college, so they don't need this math class or that topic. Now, we have a document that says, hey it is your professional obligation, if nothing else, it is your professional obligation to teach "these" kids. That is the value of Standards for me. It gives me hope that we are finally talking about issues that matter.(Kyle)

Up till four years ago we used Saxon books in my school. I fought and fought trying to get them out of classrooms. No one listened. The excuse was that we were not up for textbook adoption, we can not endure the cost, we cannot do this, and we cannot do that. So, finally five years ago I was on the textbook selection committee. I went in having done my homework, I went in with the Standards and all, with examples from the addenda series. I said, this is what we ought to be doing, not Saxon. It took me a lot of campaigning to get the books changed. I must have called 500 people, from the superintendent's office, to parents, to school board—I mean everybody (laughs). We finally got new books.(Derek)

In discussing their views on the Standards all teachers shared stories of what they had observed of students' accomplishment in the presence of practices that paralleled them. In talking about students, they all conveyed a deep respect for children's ideas and their individuality, compassion for the students' need to be convinced and intrigued, and a conviction that by allowing children autonomy they would take ownership of mathematics.

I like giving my students choices, I like for them to think of this class as their own. So, if I ask them to do something and they say, no, I say, okay, how can we reach a healthy balance between what you want to do and what I think you should do. If we are serious about raising

critical thinkers, if we are serious about educating these kids then we must begin to reconsider how we interact with them. My students are more curious about learning, about mathematics than other teachers' students because they know I expect them to be curious.(Samantha)

A major problem in our society is that we think young people are incapable of making decisions. In my experience, in all the years of teaching, I have learned that if I provide fair choices, they want to learn. But if I try to force it down their throats then they retaliate. So, there are times that I tell them, hey you need to do this cause I say so. There are times that I say, hey you ought to do this cause my principle tells me you have to do it, and then there are times that I tell them: quite frankly I have no idea why you need to learn this—I have this relationship with my students, it is a give and take kind of relationship, like any other relationship in life. I tell them that too, that sometimes you have to do what you like and sometimes you have to do what you really don't like. We get beyond that quickly. They know I appreciate them and I know they appreciate me. (Laticia)

DISCUSSION

There is an increasing body of practitioner research and writing about the ways in which teachers' personal and professional selves evolve within the domain of practice. In mathematics education, examples of how the practitioners' evolving knowledge of children and how teachers' subject matter understandings change as they teach have been developed by teacher researchers (Ball 2000, Lampert 2001, Chazan 2000). This body of work portrays teacher as one who is sensitive to immediate needs of students while keeping an eye on a mathematical horizon (Ball 2000), the curriculum that needs to be shared and the opportunities for learning that need to be established for all learners. Moreover, this body of work portrays teaching as a complex network of decisions whose nature is dependent upon the teachers' ongoing assessment of cognitive and emotional needs of each individual learner, and the social dynamics of the classroom (Lampert 2001). The finding of the current work, while substantiating the theories of these researchers on the centrality of the teacher's reflective disposition on her ability to sustain innovative practice, extend their theses by proposing that analyzing teachers' work solely through the lens of their enacted curriculum, or mathematical goals may be limited.

Data indicated that political views and philosophies of teachers explicitly impacted their pedagogical choices, and the value they placed on the recommendations for reform as proposed by the Standards. Further, teachers' professional values and belief systems derived from a variety of sources, but especially from lived experiences as intellectual beings with missions and goals. The teachers' personal preferences defined their epistemological and pedagogical standpoints.

For the teachers in the study teaching was about learning, as much for them as for the learners with whom they worked. This view of teaching not only substantiated their confidence in their ability to influence student learning, but also their ability to be risk takers in classroom. This result certainly supports the findings of previous research which recognized teacher confidence as a powerful force in learning (Bandura 1982, 1997). We further argue that teacher confidence might be a significant variable in teachers' adoption of innovation. Moreover, based on the results of the study we propose that teachers' confidence might be closely tied to their philosophies about education. At this point,

much remains to be learned about this important aspect of teachers' work and how it develops in and through teaching.

These results have immediate implications for mathematics teacher education. In what follows we will elaborate on a few of these points.

TEACHER EDUCATION EFFORTS

Current design of many professional development activities perceive, and treat, teachers as consumers of a set body of knowledge about either a particular curriculum, or instructional technique, without taking into account their philosophies or personal interests and goals. Uniform inservice activities are designed and implemented without much attention to teachers' diverse orientations or intellectual needs. Discussions concerning reform frequently remain within a framework void of its social implications. This narrow approach to professional renewal naturally provides a superficial context for engagement or debate about reforming education. Perhaps, the lack of sensitivity to this fundamental issue accounts, at least in part, for the lack of widespread success of professional development activities designed for teachers. Professional development opportunities need to assume teachers as knowing agents who pick and choose aspects of reform according to the philosophies that inspire them. As Goodlad (1984) argued teaching can not be understood exclusively as instructing, as an activity that takes place behind the classroom door. Therefore, when we seek to change what teachers do behind the classroom door, we might experience far more success examining roles conceptually connected to instructing, rather than focusing exclusively on instructing itself. Professional development opportunities must provide teachers with an understanding of both the conditions under which, and contexts in which, innovation may enhance teaching, enrich children's lives, and cultivate a more profound social change.

Indeed, to fully appreciate the power of mathematics reform and of the Standards documents, a teacher must have a deep and thorough understanding of the nature and purpose of education in a free society. The Standards are less a matter of maintaining "active" classrooms, or demanding a more rigorous mathematics curriculum (although these are not unimportant features) than it is a matter of serving in the joint aspiration of making mathematics, and education, meaningful to children's lives. To have this understanding of the mathematics classrooms as a place engaged in education is to incur obligations beyond instructing. To help teachers develop such understanding, mathematics teacher educators need to go beyond accentuating the value of the Standards as sole academic documents, and expand on their capacity for social reconstruction.

The central tenet of the Standard documents is the need to increase mathematical literacy of children (Schoenfeld 2002). Inherent in the Standards' notion of mathematical literacy is the acquisition of skills required to live in civil and modern society, the competence to contribute to knowledge as well as benefit from it, the ability to think critically and act deliberately, the empathy that permits individuals to hear and thus accommodate others. The cultivation of these qualities make exceptional demands on teachers, demands that differ from those made on persons in most other occupations. Fulfillment of these demands requires that teachers understand the qualities of a citizen as well as the procedures of citizenship, and that they fully meet the conditions imposed by both. To

help teachers grasp these demands and to realize the vital role they play in productive functioning of our society must become a priority in mathematics teacher education at both preservice and inservice programs. This requires that those of us responsible for educating current and future teachers to expand our own horizon relative to the role and value of Standards in democracy. It also demands that we begin to think more systemically, and even harder, about what mathematics education reform is about and what the Standards are for.

In recent years much has been written on factors that impede teacher's ability to implement instructional change. In fact, some researchers have documented that even teachers chosen as exemplars of reform regress from the ideal, displaying the height of reform one day while regressing to traditional methods the next (Senger 1999). According to the teachers in our study, such was the case for them. However, they believed it naïve to judge their work as praiseworthy or blamable without taking into account their overall goals and long term plans. Indeed, it might be attractive to think that teachers should engage in innovations that make dramatic changes in their existing practices. Additionally, one might assume that the innovations that include maximum distance from traditional practice will have the greatest impact on student learning. However, innovations that are the most distant from the teachers' existing practices are less likely to succeed. Given these findings, we argue that to facilitate change in classrooms, professional development opportunities for teachers must take on, to put it in teachers' own words, an "evolutionary" approach to teacher education to have any impact on teachers' practice, or to be of any value to them. Moreover, teacher education must assist teachers to develop as evolutionary practitioners.

Evolutionary teaching is one that changes and evolves the teacher in profound ways, and over time. To view teaching as evolutionary, is to abandon the naïve pursuit of a rapid, fundamental transformation of one's practice but to see it as incessant process of refinement and growth. To be an evolutionary practitioner is to view learning new things, or old things in new ways, as a means to improve one's practice. In this role, the teacher sets out to learn something not only to teach that thing, but to change oneself in order to help students. For a teacher to be evolutionary is to understand how one's own learning impacts learners, not just inside the classroom, but in life. To fully embrace such view of practice, teachers must learn to view teaching as more than instructing children, and teaching mathematics as more than the act of sharing mathematical procedures. When we think of the teaching mathematics solely in terms of instructing, or exclusively about the transfer of subject matter, we may easily lose sight of the fact that the teaching is also about learning. By orchestrating situations in which the teachers recognize the value of evolutionary practice, and by assisting them in taking small and yet meaningful steps toward evolving their own knowledge, they will be in a better position to grasp the true meaning of reform, and will have a better chance of sustaining innovation in their classrooms.

References [Please contact the author at Azita.M@cmich.edu for a list of references]