

CHANGES IN TEACHERS' PRACTICES WHILE ASSUMING NEW LEADERSHIP ROLES

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This study explores the notion that as teachers develop their leadership skills their classroom practices gradually reflect a reform orientation. Within a systemic change project, an 18-month leadership institute was designed to nurture teachers' professional growth and to develop the skills and knowledge needed to plan and present mathematics reform recommendations to colleagues. Changes in teachers' practices were investigated using a case-study design by analyzing the questions asked, the cognitive demand of the instructional tasks posed, and the questions asked on formal assessments. Findings from this study suggest that teachers' practices change when they examine their own teaching practices.

Despite calls for reform in school mathematics by The National Council of Teachers of Mathematics (NCTM, 1980, 1989, 2000) classroom practices in United States during the last century have shown little change (Cuban, 1993; Stigler & Hieber, 1999). To support mathematics reform, NCTM (1991) described a need for mathematics teacher leaders who would become specialists "positioned between classroom teachers and administration" (p. 375) to assist with the improvement of mathematics education. These teachers would be responsible for building the content and pedagogical knowledge of colleagues, refocusing conversations from activities to an analysis of practice, and arranging collaborative investigations about student thinking.

Studies that examine teacher leadership are built upon the belief that, as teachers enhance their leadership skills and emerge as leaders, their practice also evolves (e.g., Louckes-Horsely et al., 1998; Swanson, 2000). It is assumed that as teachers develop their leadership qualities, they gradually assimilate a reform orientation and their practice changes. The current study extends the research base on teacher leadership and change by examining this assumption. More specifically, this study asked the following question: How do teachers' classroom practices, as evidenced by their classroom discourse, instructional tasks posed, and assessments, change while participating in a leadership institute designed to promote professional growth?

THEORETICAL ORIENTATION

The research question focused my attention on the psychological processes of teacher change within a mathematics classroom. Symbolic interactionism facilitates the interpretation of the interactions between people as indications of personally constructed meaning (Becker & McCall, 1990; Denzin, 1992). Communication is thought to be a symbolic process that consists of an ensemble of social practices (including language, intonation, gestures, and written symbolic representations) that portray an individual's private construction of knowledge. Thus, an individual's interactions can be analyzed and interpreted to indicate this constructed knowledge



(Becker & McCall). The character and new uses of verbal language by an individual during social interactions may indicate their assimilation of new ideas (Kumpulainen & Mutanmen, 2000). Kumpulainen & Mutanmen found that teachers' classroom discourse changed when their practice portrayed reform recommendations. In this study, I interpreted the symbolic interactions between teachers and their students to indicate the teachers' understanding of reform mathematics instruction. I analyzed the classroom discourse and the instructional tasks posed by the teacher to discern how teachers supported her students' development of mathematical ideas.

METHOD

Ethnography permits a researcher to examine and depict a social reality constructed through the actions of people (Gubrium & Holstein, 2000). Recently, ethnography was adopted to different disciplines and new forms of ethnography have emerged (Tedlock, 2000). A modified ethnographic methodology permits a researcher to select data sources, create collection methods, and report findings that respect the participants' perspectives and answer new research questions. In this study, I used a modified ethnographic methodology to develop a close relationship with three case-study teachers in their everyday lives to investigate the realm of meaning that they created as portrayed through their interactions with students.

Context

The Primary Mathematics Education Project (PRIME), a systemic change project, was a cooperative mathematics professional development venture between Illinois State University and a large, urban mid-western school district. A teacher leadership institute was created during the second year of the project to meet the concerns of teachers and project leaders for continued professional development after the project's conclusion. Ten teachers from different elementary schools joined the PRIME Leadership Institute and taught first through fourth grade.

The PRIME Leadership Institute was designed to nurture reflection and develop teachers' leadership skills. Teachers were involved in a lesson study during the first third of the 18-month leadership institute to help them deepen their content and pedagogical knowledge. Next, teachers created a list to describe high quality professional development and used these guidelines to plan and present reform mathematics recommendations to colleagues. The remaining leadership meetings explored how teacher leaders can support change in the social and political structure of schools.

Participants

Three teachers participating in the Leadership Institute were selected as case-studies and represented different levels of prior leadership activity within their school community. This research report describes the changes in the teaching practice of one case-study teacher, Ms. Edelweiss. Ms. Edelweiss was a third grade teacher who reported no leadership responsibilities in her school before joining the Leadership Institute (leadership application, June, 2001) and seldom spoke during faculty meetings (principal interview, May 3, 2002). During the 18-month Leadership Institute, Ms. Edelweiss began a mathematics study group at her school, planned and presented three

professional development sessions for her school district, and made two presentations at regional NCTM conferences.

I assumed the role of both a participant and researcher in this study. I answered Ms. Edelweiss's questions about mathematics content and reform pedagogy. During classroom observations I made field notes, asked students to explain their solutions, and sometimes posed a new question to extend the task.

Data Sources

Three data sources were used to investigate the changes in Ms. Edelweiss's teaching practice: monthly classroom observations, field notes, and formal assessments (graded assignments). Twelve classroom observations over an 18-month period of time were made of Ms. Edelweiss with a pre-lesson and post-lesson interview using a semi-structured interview protocol. The classroom observations were audiotaped and transcribed for analysis. Ms. Edelweiss collected the formal assessments that she utilized during three time periods: fall 2001, spring 2002, and fall 2002.

Analysis

The computer software, winMAX (Kuckartz, 1998), was used to manage the data, to code transcriptions, and to sort coded segments into categories. The classroom discourse was analyzed using constant comparative methods (Merriam, 1998) to determine the types of questions the teachers asked (Driscoll, 1999), to determine the cognitive demand of the posed task and instances when the cognitive demand of the task changed during instruction (Stein, Smith, Henningsen, & Silver, 2000). Three time-ordered conceptual matrices were constructed to collapse these data and compare for patterns of change (Miles & Huberman, 1994). A conceptual matrix was constructed for each of three assessment collection periods to display the types of questions asked by Ms. Edelweiss and the cognitive demand of them (Stein et al). Changes in the percentages of the questions with high cognitive demand were interpreted as evidence of change.

My field notes included student solution strategies and questions that I wanted to ask Ms. Edelweiss during the post-lesson interviews. These notes were analyzed for evidence of change. The classroom interactions and changes in the types of questions that Ms. Edelweiss asked on assessments were interpreted to indicate a different conception of what it means to teach and learn mathematics. Member checking (Merriam, 1998) was utilized to check my analysis and interpretations of classroom practices.

RESULTS

Ms. Edelweiss represents a teacher who assumed new leadership responsibilities while participating in a Leadership Institute designed to develop reflection, presentation knowledge, and an understanding of the change process. During the 18-month institute, she changed three aspects of her teaching practice: use of questions, level of the cognitive demand of tasks, and perceptions about teaching and learning. The following two excerpts provide an illustrative example of these changes in practice. Initially, Ms. Edelweiss used students' prior experiences to develop the context for an instructional task. She asked students to describe their family's garden and drew a square

on the board (observation, October 16, 2001). Then she asked how much fencing would be needed to protect it. One student suggested that a side could be 4 feet and Ms. Edelweiss asked other students in the class to define the length of the square's other sides. Then she asked, "What's the perimeter?"

- 1: Devon Sixteen feet.
2: Ms. E Are you sure?
3: Devon Sixteen feet.
4: Ms. E Are you sure?
5: Devon Yup.
6: Ms. E Randy, what's the perimeter of the square?
7: Randy Eighteen feet.
8: Ms. E Are you sure?
9: Randy Yes.
10: Ms. E Mitch.
11: Mitch Sixteen feet.
12: Ms. E Okay, we'll go with sixteen feet. Does anyone see an arithmetic problem here?
13: arithmetic problem here?
14: Mitch Eight plus eight.
15: Ms. E What did you do? (Pause 8 seconds)
16: Mitch Added those two sides (pointed at the opposite sides) and the other two.
17: other two.
18: Ms. E Were you thinking of adding fours? (Wrote $4 + 4 + 4 + 4$ on the board. Mitch nodded.). Were you thinking of adding the sides together? (Mitch nodded.)
19: together? (Mitch nodded.)
20: together? (Mitch nodded.)

During this lesson, Ms. Edelweiss maintained tight control of the classroom interactions by initiating questions and calling on individuals to respond. Ms. Edelweiss deviated slightly from a traditional discourse pattern (teacher initiates the interaction-student responds-teacher evaluates the response) when she solicited several possible solutions (lines 6, 10). She asked her students if they were sure (lines 2, 4, 8) but did not pursue the question. Ms. Edelweiss validated Mitch's response and then asked Mitch to state a procedure for finding the perimeter of a square (line 12). After he stated his strategy, she asked a leading question (line 18) and used his response to summarize the procedure that she expected them to use (line 19-20). In doing so, reduced the cognitive demand for the succeeding questions on the prepared worksheet.

Initially, Ms. Edelweiss asked me content and pedagogical questions. During the post-lesson interview, Ms. Edelweiss commented, "They understand perimeter but when we do area, they get them confused. What should I do?" (October 16, 2001). She considered the impact of curricular materials on student learning stating, "Well, this [textbook lesson] is so concrete that it basically tells you the answer... Reform curriculum there's more thinking and it's easier to ask questions... With the textbook there's just one way to think about it [mathematics]." While Ms. Edelweiss recognized the support reform curriculum provided to develop students' mathematical thinking, she continued to use the traditional textbook for the majority of her lessons. When I asked her about this choice she responded that the fourth grade teachers expected her students

to know the material in the textbook. I interpreted these responses and actions to indicate a conception of teaching and learning that students learn mathematics through repeated practice after being shown a procedure to follow.

Ms. Edelweiss participated in a lesson study during leadership meetings (September 2001-February 2002) to promote her own professional growth. Her group investigated how students make change during a monetary transaction. In January, they considered how the type of questions asked influenced both the information they gained about students' mathematical thinking and students' opportunity to learn (field notes, January 15, 2002). After this discussion, Ms. Edelweiss changed the kinds of questions that she asked and maintained the cognitive demand of the task. These changes of practice were portrayed on February 8, 2002, when students explained how they shared three brownies between four people. In the following illustrative example, Lizzie drew three brownies on her paper. Two of the brownies were cut in half and the third brownie was divided into fourths. Each person was given two pieces, a half and a fourth.

- 1 : Ms. E Okay, four people three brownies. How much do they all get?
2: Lizzie Three fourths.
3: Ms. E Okay, would you explain this one to me.
4: Lizzie One half plus one fourth (pointed at the half piece and then the
5: fourth).
6: Ms. E Okay, write it down. (Pause 3 sec) equals (pause 10 sec). One
7: half is the same as how many fourths?
8: Lizzie Uhmmm.. Two fourths.
9: Ms. E Why don't you write two fourths right there? (Pause) Plus one
10: fourth.
11: Lizzie Equals three fourths.
12: Ms. E Now what can we do so that the next time you have two
13: different denominators?
14: Lizzie Uhm. I could just divide them all into fourths and none of them
15: in halves.
16: Ms. E Do you need to divide them into fourths as you're working the
17: problem or divide them into fourths when you just trying to find
18: your final answer?
19: Lizzie Divide them into fourths as I'm doing the problem, it makes it
20: easier to add them up and see what it is.
21: Ms. E Okay.
22: Lizzie Yeah, make them all fourths and then divide them up. Then you
23: just see how much each gets. (She drew three brownies, divided
24: them, and drew lines to four people.
25: Ms. E But this way, you started with $\frac{1}{2}$ plus $\frac{1}{4}$ and you changed...
26: Lizzie To two fourths.
27: Ms. E So if you add $\frac{1}{2}$ and $\frac{1}{4}$, what did you do?
28: Lizzie You just make them all fourths and add them up. You don't
29: have to cut everything up, you just have to do that for one person.

Ms. Edelweiss asked Lizzie to reflect on her solution and explain her reasoning (lines 1, 3). Lizzie was told to record her solution using an equation and then Ms. Edelweiss prompted her to think about the relationship between a half and a fourth (line 6-7). Recognizing that Lizzie added two fractions of different size pieces, Ms. Edelweiss directed Lizzie to use the standard algorithm by representing one half as two fourths (line 9-10). She then focused Lizzie's attention on using common denominators to add fractions (line 12). Lizzie considered an alternative method of sharing the brownies by dividing all of them into fourths (line 14). Lizzie then proceeded to draw a model representing this strategy (line 23). Ms. Edelweiss redirected Lizzie's attention back to her original representation (lines 25, 27) and Lizzie made a connection between the two strategies (lines 28-29). Without a suggested strategy, this task represented a problem with high cognitive demand. Ms. Edelweiss maintained a task with high cognitive demand by providing Lizzie an opportunity to construct her own models for dividing brownies as she explored the concept of fractional pieces and operation of division.

Reflecting on the role of questions, Ms. Edelweiss reported that she asked questions out of her own curiosity, expounding, "If I don't ask them questions, I won't know where they are or what they are thinking" (interview, March 21, 2002). Questions were no longer posed to find out if they knew an answer but to reveal their thinking and assess their understanding. Her actions indicated a new conception of teaching and learning. She asked questions to discover students' mathematical understanding and then used those insights to make instructional decisions to develop their thinking.

DISCUSSION AND IMPLICATIONS

The changes in Ms. Edelweiss's teaching practice suggest a psychological change in her conceptions of teaching and learning. Initially, she asked questions that led students to describe a procedure that was used to solve subsequent problems and thus reduced the cognitive demand of the task. After participating in a lesson study, questions were used to help students reflect on their solution strategy, consider the relationship between mathematical models, and make a connection between the standard algorithm and alternative strategies. Thus, she maintained or elevated the cognitive demand of the task. Her perceptions about teaching and learning also changed after participating in a lesson study. Ms. Edelweiss ask students' to find out their understanding and used this knowledge to plan instruction that developed her students' mathematical ideas instead of teaching established procedures to solve problems.

These changes in practice occurred when she deepened her own pedagogical and content knowledge while participating in a lesson study. Changes in the other two-case study teachers also occurred during the same time period, suggesting that the three case-study teachers developed a new interpretation of reform mathematics recommendations while engaged in conversations about teaching and learning (Olson, 2003).

Ms. Edelweiss maintained these changes in practice during the remaining eleven months on the leadership institute but did not exhibit any new changes of practice. Assuming leadership roles that included informal discussions about mathematics reform with colleagues, planning and presenting professional development, and discussing the change process did not lead to additional changes in her practice. While Louckes-

Horsely, Hewson, Love, and Stiles (1998) suggest that teachers' practices will change as they develop leadership, this study indicates that teachers' practices do not necessarily change to reflect a reform orientation while they develop their leadership skills. I found that the three case-study teachers gradually assimilated a reform orientation using analytical frameworks that helped them to examine their practice from new perspectives.

Swanson (2000) and Snell and Swanson (2000) found that teachers developed their leadership over a long period of time while they gradually developed practices that reflect reform recommendations. On the contrary, study indicates that teachers can change their practices and develop leadership to support mathematics reform in a relatively short period of time. Ms. Edelweiss began the study with little influence in her school community. While participating in the 18-month Leadership Institute, Ms. Edelweiss demonstrated leadership growth in her school. She organized a mathematics study group and orchestrated professional development for her colleagues. Additional research is needed to determine whether teachers who gain leadership over a short period of time are able to maintain their influence and a reform orientation in their practice after professional support is reduced.

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References:

- Becker, H. S., & McCall, M. (1990). *Symbolic interaction and cultural studies*. Chicago: University of Chicago Press.
- Cuban, L. (1993). *How teachers taught: Constancy and change in American classrooms, 1890-1980*. New York: Teachers College Press.
- Driscoll, M. (1999). *Fostering algebraic thinking: A guide for teachers grades 6-10*. Portsmouth, NH: Heinemann.
- Gubrium, J. F., & Holstein, J. A. (2000) Analyzing interpretive practice. In N. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp 487-508). Thousand Oaks, CA: Sage.
- Kuckartz, U. (1998) *winMAX: Scientific text analysis for the social sciences*. Thousand Oaks, CA: Sage.
- Kumpulainen, K., & Mutanen, M. (2000) Mapping the dynamics of peer group interactions: A method of analysis of socially shared learning processes. In H. Cowie & G. van der Aalsvoort (Eds.), *Social interaction in learning and instruction: The meaning of discourse for the construction of knowledge* (pp. 144-160). New York: Pergamon.
- Louckes-Horsely, S., Hewson, P. W., Love, N., & Stiles, K. E. (1998). *Designing professional development for teachers of science and mathematics*. Thousand Oaks, CA: Corwin Press.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

- Miles, M. B., & Huberman (1994). *An expanded source book: Qualitative data analysis*. Beverly Hills, CA: Sage.
- National Council of Teachers of Mathematics (1980). *An agenda for action: Recommendations for school mathematics of the 1980s*. Reston, VA: Author.
- National Council of Teachers of Mathematics (1989). *Curriculum and evaluation standards for teaching mathematics*. Reston, VA: Author.
- National Council of Teachers of Mathematics (1991). *Professional standards for teaching mathematics*. Reston, VA: Author.
- National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- Olson, J. C. (2003). *Teachers' acceptance of new leadership roles and changes in classroom practice*. Unpublished doctoral dissertation, Illinois State University, Normal.
- Snell, J. & Swanson, J. (2000, April 24-28). *The essential knowledge and skills of teacher leaders: A search for a conceptual framework*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Stein, M. K., Smith, M. S., Henningsen, M. A., & Silver, E. A. (2000). *Implementing standards-based mathematics instruction: A casebook for professional development*. New York: Teachers College Press.
- Stigler, J. W., & Hiebert, J. (1999). *The teaching gap*. New York: The Free Press.
- Swanson, J (2000, April 24-28). *What differentiates an excellent teacher from a teacher leader?* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.
- Tedlock, B. (2000). Ethnography and ethnographic representation. In N. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp 455-486). Thousand Oaks, CA: Sage.