LEARNING THROUGH IDENTITY: A NEW UNIT OF ANALYSIS FOR STUDYING TEACHER DEVELOPMENT

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Here we develop a unit of analysis for our study of new teacher development across varied communities of practice (Lave and Wenger, 1991). We do so by combining Shulman's (1987) heuristic of important teacher knowledge with Wenger's conception of learning as identity development while practicing in community. To align ourselves with the view that learning takes place across a spectrum of locations from in-the-mind to socially-embedded (St. Julien, 1997), and with Lerman's call for researchers to consider a unit of analysis that is "person-in-practice-in-person" (2000, p. 38), we develop the overlapping aspects of self-in-mind and self-in-community. These span the spectrum of the cognitive-social continuum, and comprise what we consider to be a person's mathematics teacher identity.

THE STUDY OF LEARNING

How people learn is clearly an open question, and for good reason. Learning how to do things like cry to get what one wants as an infant, add in one's head, participate productively in a work environment, and split atoms certainly are complex and involve many forms of thinking. These can be viewed as happening in different contexts with different intentions, and done within different relationships between physical and social surroundings and mental effort. The learning of developing teachers – which entails the areas of content, pedagogy, and professional participation, and which happens in many contexts including university classrooms, school classrooms, and professional community interactions – involves a large cross-section of the various modes of thinking. As such, it presents a particularly difficult challenge to researchers of learning. This paper presents a framework that we are using to study this complicated landscape of things to be learned by mathematics teachers and ways to learn them.

Researchers have studied learning in mathematics along a broad spectrum of modes of thinking, from the abstracted types that happen largely in one's brain, to those that happen in relation to a very specific context of use. Such work has been productively undertaken using various theoretical frameworks and different units of analysis. Carpenter and Fennema (Carpenter, Fennema et al., 1988) used a fully cognitive model to understand young people's learning of basic addition and subtraction of integers. Greeno (1994) expanded somewhat on the focus of strictly cognitive studies by adding aspects of the physical/structural environment as factors affecting individuals' mental processes. Cobb and his colleagues (Cobb and Bauersfeld, 1995) moved further away from wholly psychological accounts of learning to include interactions between groups of individuals learning mathematics in classrooms, and the norms of interaction that develop. Taking a further step away

from the individual as a unit of analysis are situative theorists, led by Lave (1988), who have studied everyday mathematics and the ways that the learning and usage of such mathematics is completely tied to the embedding contexts.

Such research provides a continuum of entry points for studying learning. However, there has been much debate among leading scholars about what can be learned from each perspective (Anderson, Reder et al., 1996; Greeno, 1997). We agree that there are valid concerns. However, we follow others (Greeno and MMAP, 1998) in our belief that the different perspectives on this continuum each offer potentially valuable information about learning. The problem seems to be that in order to be truly useful for educators, cognitive studies need to consider more of the texture of specific contexts, and sociological studies need to provide a more specific analysis of individual cognition (Kirshner and Whitson, 1997). This paper presents our attempt to conceive a unit of analysis, mathematics teacher identity, that will provide us a means of considering a broader swath of the cognitive-social continuum than is normally taken into account in studies of mathematics teacher development. In doing this we draw on the work of situativity theorists, as well as on previously established ideas about what types of knowledge are important for teachers to develop.

OUR RESEARCH AGENDA

Our work focuses on the learning of soon-to-be and new mathematics teachers attempting to become teachers of reform mathematics in the United States. Teaching in schools is a form of social participation that takes place within distinct contexts of classrooms. Classrooms, and the teachers leading them, are themselves embedded in school and societal community contexts, and in relation to professional education communities. Each of these contexts provides different, sometimes competing, constraints and affordances (Greeno and MMAP, 1998) for teachers to make sense of and work within. To learn to teach, then, involves the coalescing of an individual's history of interacting in other communities playing other roles – student in the classrooms of one's own schooling, student in academic teacher education communities, and intern in other teachers' classrooms – into a new role as professional teacher in its various attendant contexts (Bohl and Van Zoest, 2001). The interconnected nature of participation in pre-teaching communities, combined with multifaceted relationships between the various communities within which practicing teachers participate, makes for a highly complex web that previous studies and sets of learning theories have been unable to fully illuminate.

In our own attempts to understand how learning takes place within and across these contexts and communities, we have been faced with the need for a theoretical framework capable of providing (a) a sufficiently detailed framework for our qualitative case study analyses, and (b) a sufficiently broad view of the social embeddedness of teachers' practice to provide a full and textured accounting of their development. Lerman (2000) has explicated the need for such a framework for the field of education in general, as well as the motivation behind an overall move to a

social direction in mathematics education research. Our work is consistent with that direction, although it is couched in our study of the learning of teachers rather than the learning of mathematics.

LEARNING, IDENTITY, AND DIMENSIONS OF KNOWLEDGE

Wenger (1998) provides a social theory of learning within communities of practice that lends focus to our work. He posits that to learn is to develop an identity through modes of participating with others in communities of practice. Such communities are both defined and cohered by shared goals, mutuality in working to achieve them, and a shared set of social and physical resources to achieve them with. As an individual grows and learns, she develops an identity. Wenger's (1998) take on identity is broader and more socially-oriented than the colloquial term, which tends to focus on the idea of self-identification and on the existence of a personal cache of characteristics. For Wenger and others (Holland, Lachicotte et al., 1998; Boaler and Greeno, 2000), identity is, in the biggest sense, the who-we-are that develops in our own minds and in the minds of others as we interact. It includes our knowledge and experiences, but also our perceptions of ourselves (i.e., our values, beliefs, desires, motivations, and self-identifications), others' perceptions of us, our perceptions of others, and our perceptions of others' perceptions of us that develop as we participate in communities with one another. As such, our identities exist not only within ourselves, but are also strung across a continuum between ourselves and others. They are defined as we interact with others and react or reformulate our participation in response to others' reactions to us. This development of identity in practice is done through "negotiated experiences of self" (Wenger, 1998, p. 150). These are experiences wherein people develop beliefs, commitments, and intentions with regard to the form and content of a particular community and how they ought to interact within it. They give individuals a sense of who they are in relation to the community and its goals, how they might best participate, and where they belong and what they are becoming in the community.

We take Wenger's proposition that development of identity is the same as learning within communities (Lerman, personal communication, December 2001) as the basis of our analytic framework. However, like much work in situative theory, this characterization leaves something to be desired in terms of concrete reference to individual cognition (Kirshner and Whitson, 1997) as well as in terms of reference to particular areas in which people develop. Taking a measure of mathematics teacher development in terms of effective competence requires a set of explicit dimensions upon which to focus. We use Shulman's (1987) broadly accepted conceptions of important teachers' knowledge as a starting point.

For Shulman, the areas in which competent teachers learn fall into seven categories: 1. content knowledge, 2. curricular knowledge, 3. general pedagogical knowledge, 4. pedagogical content knowledge, 5. knowledge of learners, 6. knowledge of educational contexts, and 7. knowledge of educational ends. For our purposes, we

have fit these forms of teacher knowledge into three broader dimensions. First, content knowledge and curricular knowledge both deal what is to be taught. We collapse these two into one new domain we call the content area and curriculum dimension. This dimension relates to the types of knowledge that cognitivists might be most likely to focus on because it is relatively clearly defined. Next, pedagogical knowledge, pedagogical content knowledge, and knowledge of learners all relate to who is to be taught, and how they should be taught. We combine these three into a domain called the pedagogical dimension. This dimension relates to the competencies required for participating as the leader of a classroom community and orchestrating activities to ensure the broadest possible development of student understanding. This is the dimension of teacher knowledge that most directly impacts students, and thus is most often the focus of studies in mathematics teacher education. Finally, we encompass knowledge of educational contexts and knowledge of educational ends into a broader domain we call the professional participatory dimension. This dimension includes the arenas of knowledge required to participate productively within the various communities outside of the classroom that are related to the act of teaching. These communities include one's own mathematics department and school communities, as well as the broader professional and university communities that support one's efforts to teach. This dimension is key to our research since we are studying the impact on teacher learning of individuals' participation across a range of communities.

The above understanding of Wenger's conception of identity and list of particular dimensions across which to track development form the foundation for our construction of a unit of analysis. In the remainder of this paper, we attempt to wed the conception of identity development as learning with ideas about the things that mathematics teachers in particular must learn.

IDENTITY AS ASPECTS OF SELF-IN-MIND AND SELF-IN-COMMUNITY

Lerman (1998) suggests that a unit of analysis for educational research must allow one to zoom in and out, changing one's focus to take into account the full spectrum of locations of cognitive development, from in-the-head to socially dependent. Bernstein's conception of identities as composed of "relations within" as well as "relations between" suggests endpoints on such a continuum of locations for identity development (2000, p. 205). Bearing this in mind, Shulman's delineation of knowledge types is problematic as it does not address the relational nature between knowledge and social context. That is, it leaves open the possibility that all the knowledge referred to is entirely "in-the-head" (St. Julien, 1997, p. 267). We believe that many of the bases for teachers' everyday participatory decisions are fully socially connected and value based, and fall outside of what one might term "objective knowledge" (of the type "if I curse at a student, I will be disciplined"). Thus it is appropriate to distinguish a continuum of types of cognition (not unrelated to that of identity) from largely in-the-head to largely socially-negotiated (St. Julien, 1997). For that reason, we will use the term knowledge to refer to ideas that are

universally socially accepted (or nearly so) and not open for public debate (although socially constructed). We refer to ideas that are not universally held and thus are subject to public debate as beliefs. Beliefs include values and conceptions founded on values, and provide justifications for action in particular ways in response to particular types of knowledge in given situations. The place for these in Shulman's heuristic is unclear. Other important types of cognition that are clearly not included are commitments and intentions. These encompass one's desires to either act or not in response to particular situations, as well as impetus and justifications for doing so.

Thus it is not only the development of teachers' knowledge across three dimensions that is important, but also the development of their beliefs, commitments, and intentions with regard to them. This is a fundamental aspect of our formulation of identity: each dimension relating to teacher development consists of aspects of knowledge as well as parallel aspects of beliefs, commitments, and intentions. Taken together, we refer to these as aspects of self-in-mind. Figure 1 provides a depiction of this part of identity as the portion within the single bolded border.

To illuminate this we offer an example of the contents of the table in Figure 1 that represents aspects of self-in-mind. Consider the row Pedagogy Dimension. Related knowledge that teachers ought to have is a variety of means of orchestrating classroom activity. This might include an understanding in the broadest sense of what "small group work" and "lecture" are. These fall under the Knowledge column. Related to this knowledge, teachers hold beliefs (e.g., what types of discourse patterns are most effective during small group work), commitments (e.g., promoting those discourse patterns), and intentions (e.g., to improve student understanding). These related concerns fall under the Beliefs, Commitments, and Intentions column. Knowledge (or lack thereof) of different means of orchestrating the classroom can impact what one believes, commits to, or intends to achieve. Likewise, one's Beliefs, Commitments and Intentions affect the knowledge that one seeks. This is represented by the dual-direction arrows between the columns.

The aspects of self-in-mind related to the contents of the three dimensions make up the cognitive portion of a person's identity. In keeping with his desire for a unit of analysis that allows an adjusting of zoom from individual to social, Lerman suggests the "person-in-practice-in-person" (2000, p. 38). As a step in this direction, we introduce another aspect of teacher identity that we call aspects of self-in-community. In Figure 1, these are encompassed within the double bolded border. Part of competent practice is reaction and adjustment based on our perceptions of others, and of their perceptions, in practice. As one becomes more familiar with the modes of participating that are productive and/or acceptable in the eyes of others, one adjusts to those perceptions by either modifying one's actions, or changing one's beliefs, intentions, or commitments. Perceptions, and the adjustment to feedback from them, are depicted as the large back and forth arrows positioned across the community of practice (the shaded oval), and represent Wenger's negotiated experiences of self. It is important to note the overlap in the aspects of self-in-mind

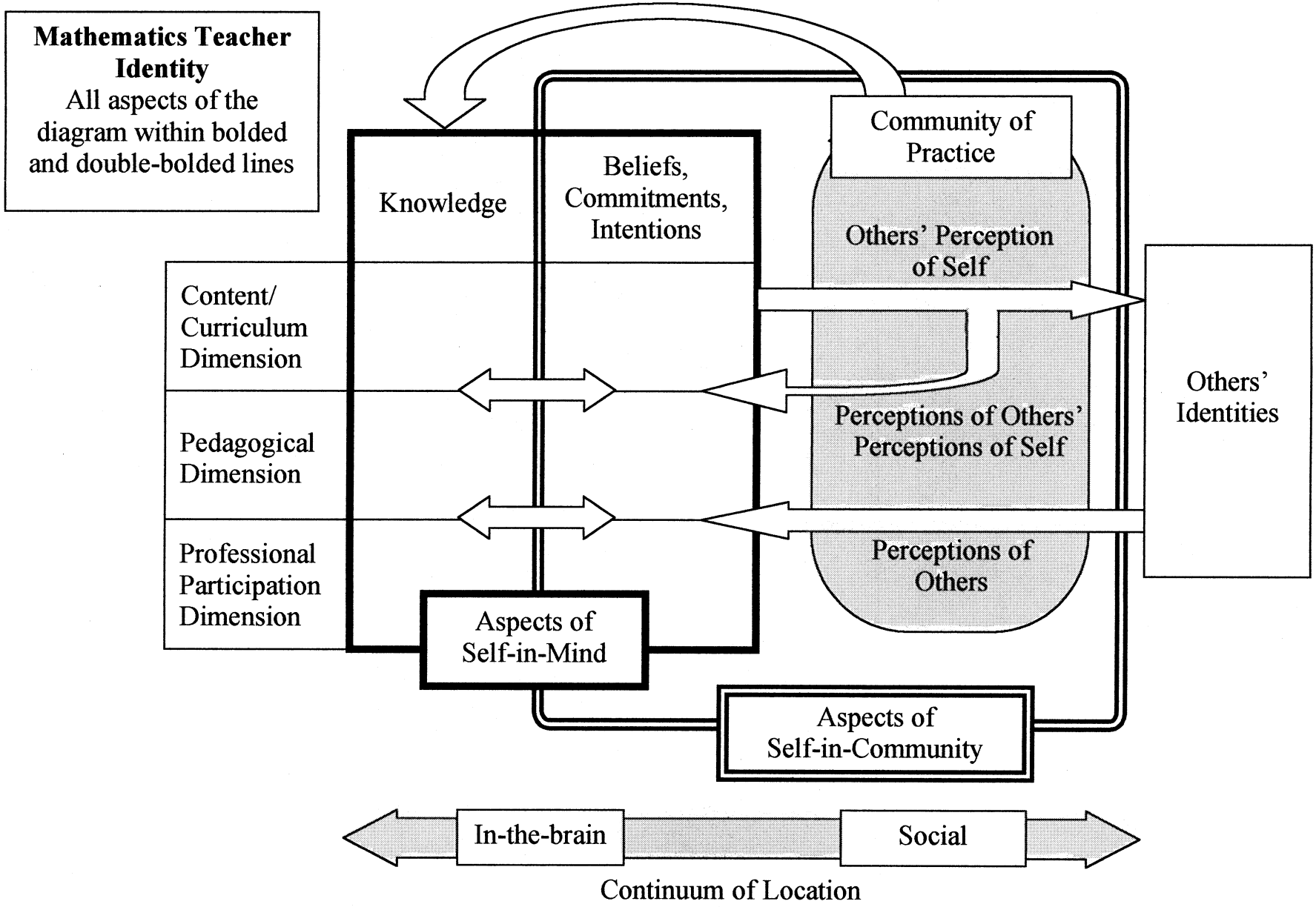

Figure 1: Identity as Combination of Aspects of Self-in-Mind and Aspects of Self-in-Community

and self-in-community in the area of Beliefs, Commitments, and Intentions. This is the arena in which we conceive of the cognitive aspects of thinking as being stretched over and into the social sphere. Also, as people learn to participate productively (or not), their knowledge is affected. This is depicted by the arching arrow at the top of the diagram from the community of practice to knowledge.

As an example, consider a teacher whose beliefs, commitments, and intentions related to effective discourse patterns in class do not align with those of the school in which she is newly employed. Depending on the strength of her commitments, and on the types of feedback she receives through her perceptions of others' (e.g., students, peers, administrators) perceptions of her own practice, she may adjust her beliefs to align with those of the community, or may work to convince the community that her preferred discourse methods work. In either case she learns in the process, and her identity changes as a result.

A further critical concern for studies of learning in practice is its embeddedness in greater social spaces. Lerman (in preparation) points to the need to zoom out further than depicted in our diagram so as to understand the impact of broader social factors. Such zooming can help answer questions such as "How are the accepted practices within a community impacted by other communities and broader social structures that overlap or subsume the community in question?" Such communities and structures would be depicted in the diagram as more shaded ovals overlapping and/or subsuming the depicted community of practice. Thus, they can be understood as intertwined with, and in some ways defining, practices within the local community. The effects on individual identities of such other communities and social structures could then be considered by studying the constraints and affordances (Wenger, 1988) they help make available to participants in the local community.

Our conceptualisation of mathematics teacher identity as aspects of self-in-mind and self-in-community within a practice spans the continuum from in-the-brain to socially embedded learning. We believe that this will allow us to zoom our analytic gaze further out as we attempt to describe the various factors impacting the development of our subject teachers across multiple communities.

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