Becoming a teacher of mathematics: Wenger's social theory of learning perspective

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While the origins of Etienne Wenger's social theory of learning are located in organisational learning, Graven and Lerman (2003) suggested that a worthwhile challenge would be to relate Wenger's powerful ideas about learning to the process of becoming a teacher of mathematics. In this paper I attempt to address this challenge by using Wenger's theoretical discourse to interpret the scenario of Casey, as described in the introductory chapter of this symposium. As such, the role that identity plays in becoming a teacher of mathematics is foregrounded to account for a crucial aspect of what enables learning (or not) in mathematics teacher education programs.

Wenger's social theory of learning: foregrounding identity

Wenger's (1998) social theory of learning builds on his initial work with Lave (Lave & Wenger, 1991) to emphasise learning as situated in particular physical and social contexts and distributed across the individual, other persons, and tools within communities of practice. The conceptual framework for Wenger's (1998) social theory of learning — communities of practice — encompasses four components: *meaning* — learning as experience; *practice* — learning as doing; *community* — learning as belonging; and *identity* — learning as becoming. The construct of identity creates a partnership between the social and the individual that highlights the person within the practice of teaching and emphasises the importance of knowing who we are and what we believe as teachers.

Identity is characterised by Wenger (1998) as "a constant becoming" that defines who we are by: "the ways we participate and reify our selves; our community membership; our learning trajectories (where we have been and where we are going); reconciling our membership in a number of communities into one identity; and negotiating local ways of belonging with broader, more global discourse communities" (p. 149). In this way, Wenger sees identity and practice as "mirror images of each other" (p. 149) so that one "inherits the texture" of the other (p. 162). This notion of identity is defined just as much by the practices we engage in (participation) as the practices we do not engage in (non-participation).

Guided by Wenger's conception, learning in teacher education is evidenced when there is increased participation in: mutual and meaningful activities; negotiating and making meaning; and developing a sense of becoming and belonging within multiple communities of practice. These ideas resonate strongly with Sfard's (1998) conception of learning as "a process of becoming a member of a certain community" (p. 6). Thus, becoming a teacher of mathematics is a deliberate term that implies an evolving process of identity formation that is always under construction.

Becoming a teacher of mathematics

Perhaps the most salient feature of Wenger's theory in terms of identity is his description of three modes of belonging and sources of identity formation (becoming) — engagement, imagination and alignment. *Engagement* is all about mutual participation (and

choosing not to participate) in meaningful activities and interactions. *Imagination* refers to an open-minded disposition that requires a willingness to explore, take risks, and make connections in order to create new images of the world and ourselves. *Alignment* describes a process of coordinating perspectives and actions and finding a common ground from which to act.

Casey's scenario

Wenger's theory has potential as a framework for theorising the scenario outlined in the introductory paper because it provides a language that foregrounds identity formation and transformation as crucial aspects of teacher learning. The idea that identity formation is ongoing suggests that becoming a teacher necessarily involves a nexus between one's past, present and future experiences. Along similar lines, Fieman-Nemser (2001) suggested that teacher learning occurs along a professional continuum that begins long before university and continues long into the future. In this short paper three spaces for learning (communities) along a professional learning continuum are explored.

Casey's cumulative classroom experiences learning mathematics in school settings created one influential space for learning. These years of cumulative classroom life can often lead to perceptions of mathematics as a formal and structured set of rules and procedures requiring rote memorisation of facts and right or wrong answers. The nature of these experiences would have shaped Casey's beliefs and images of teaching and contributed to the construction of her identity as a prospective teacher by the time she arrived at university. In Wenger's terms, such beliefs and images would have been produced according to the extent to which: the mechanics of mathematics was privileged over meaning making; mathematical meaning was negotiated and owned rather than transmitted; and an identity of participation was nurtured. While these experiences would have been shaped from a learner's perspective, Casey's teaching identity would have been re-shaped by her experiences learning *about* teaching and learning *to* teach. There is strong evidence to suggest that these established beliefs about teaching and learning, that often conflict with current reforms, affect how prospective teachers interpret their teacher education experiences (Brown & Borko, 1992; Feiman-Nemser, 2001).

Casey's experiences as a learner in a university setting within a teacher education course created a second space for learning that continued to shape, and re-shape her mathematical teaching identity. There is no denying that specific agendas for learning about teaching mathematics exist in all university courses. Teacher educators often have more freedom, and even confidence, than school teachers to negotiate their own curriculum approaches, most of which reflect "reform" visions of teaching and learning mathematics that are theoretically and empirically based. The content, structures and processes within teacher education programs determine how prospective teachers like Casey embrace these reform visions of pedagogy. If they are introduced and nurtured by effective teacher educators it is easy to see how these visions of practice would resonate strongly with ways of *imagining* teaching. However, other spaces for learning also have a profound impact on the development of a teaching identity.

In most teacher education programs, a series of planned, school-based professional experiences create a third space for learning that is highly influential. These experiences give insights into aspects of a teacher's world as prospective teachers develop learning relationships within school settings. School-based professional experiences, or practicums,

attempt to link theory with practice as prospective teachers go into schools to gain experience learning *to* teach in classroom settings. In Wenger's terms, even though prospective teachers like Casey are willing to *imagine* themselves practising reform methods of teaching, many factors influence their sustained engagement in such practices. These factors of influence include the balance of support or challenge experienced in school settings and the extent to which university and school-based learning experiences can be reconciled.

Wenger (1998, p. 160) suggests that one of the most significant challenges faced by learners who move from one community of practice (or space for learning) to another is the reconciliation of "forms of accountability" from those communities into one nexus. Identities are formed and transformed through this process of reconciliation. The extent to which prospective teachers like Casey can straddle across different boundaries and coordinate the multiple perspectives they have been exposed to during their years at university will affect their identities as teachers in the future. Even if prospective teachers leave university with a professional commitment to reform visions, a lot will depend on whether or not their visions of practice *align* with the values of the school communities they will teach in.

A middle ground for teaching

There is little doubt that identity is inextricably linked to learning to teach and becoming a teacher of mathematics. A logical progression from this line of thought is to suggest that mathematics teacher education programs need to create a learning space that allows for a middle ground to be established by prospective teachers where multiple identities and forms of accountability can be aligned. A middle ground for teaching and learning refers to the creation of a personal position where different ways of knowing and being can coalesce in productive ways. Learning to align a diverse array of experiences and beliefs seems a critical pursuit in any teacher education program.

Teacher education programs need to create learning structures and spaces that allow prospective teachers to align their university-based learning with the styles and discourses of the settings they have engaged in, and will engage in, when they are teaching in the future. We must focus our attention on planning opportunities for the transformation of identities where identity involves choosing what to know and becoming a person for whom such knowledge is meaningful. From this perspective, becoming a teacher of mathematics is a continual and dynamic process of reconciling who we are as teachers, what we think we know about teaching, and discerning what we think we should know to become effective teachers in schools.

Learning to teach relies heavily upon prospective teachers developing a teaching identity that empowers them to make professional judgements about teaching by reconciling forms of accountability from different contexts. When prospective teachers observe and enact practices *other than* what they have been exposed to as part of their university learning, their belief in the "gap" between theory and practice is compounded. For mathematics teacher educators, the implication is that we need to offer opportunities for prospective teachers to make timely connections between what is learned at university and how such learning can be enacted in school-based contexts. We need learning structures that create opportunities for prospective teachers to practise progressive pedagogical approaches, experience the positive and negative consequences and then share and critique

their experiences in a collegial way.

To develop a middle ground for teaching, prospective teachers would need to feel secure in their own identity so that they can take risks and imagine the teaching of mathematics as if it could be otherwise. A number of researchers have begun to explore how frameworks such as Wenger's can account for learning in mathematics education. A number of chapters in Boaler (2001); Fennema and Nelson (1997); and Watson (1998) are examples. In particular, Graven (2004) has dealt explicitly with Wenger's ideas to frame the nature of inservice mathematics teachers' learning and Smith (2002, 2003, 2004) has explored the use of narrative practices that create a pedagogical middle ground for transforming prospective teachers' identities as teachers of mathematics.

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