

# Research as praxis, en route theory/practice teacher- researcher collaboration: a self-study

SHARADA GADE

This paper relates to project related instructional interventions, conducted via teacher-researcher collaboration in a Grade Four mathematics classroom. Drawing upon cultural historical activity theory or CHAT perspectives, such conduct exemplifies research as praxis. While CHAT perspectives argue for a theory/practice approach, enabling practitioners to act on their reflexivity and address contradictions found in ongoing practice; research as praxis views practitioner reflexivity as central to pursuing openly ideological work and practising in empirical inquiry what one preaches in theoretical formulations. Such pursuit led to our becoming stakeholders in each other's professional practice and the conduct of interventions becoming the shared object of both teaching and research. In teacher-researcher collaboration realising expansive learning activity, it was possible to question modernist assumptions which view abstract theory as applicable to any concrete practice and take political action in dialectic with theory.

This paper discusses my extended collaboration as researcher with the teacher Charlotta at her Grade Four mathematics classroom in Sweden. Our joint conduct of instructional interventions in this collaboration, enabled us to realise what Patti Lather (1986a) terms *research as praxis* – a democratised manner of social and human inquiry that is characterised by negotiation, reciprocity and empowerment. The term praxis is here understood as practical self-creative activity by means of which one creates the world, enabling us to reevaluate ourselves, the situations we find ourselves in, and take political action in dialectic with theory. Such dialectic parallels a central perspective of cultural historical activity theory (CHAT), which conceives theory in terms of bringing about change or transformation within ongoing practice. To account for both developments, in this paper I deploy teacher-researcher collaboration as the main unit of analysis

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**Sharada Gade**

*Umeå university*

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and shed light on the nature of challenges teachers and researchers face as they attempt to bridge theory and practice within classroom instruction. Two writings, taken as point of departure, guide this examination. The first is CHAT literature, which asks practitioners to act upon their reflexivity while conducting research (Seeger, 2001) and transform societally significant practices like those in mathematics classrooms in a theory/practice manner (Chaiklin, 1993). The second is CHAT driven close-to-practice research within teacher education, which enables teachers to theorise by their examining the affordances and constraints of theoretical frameworks utilised (Edwards, Gilroy & Hartley, 2002). Taken together these perspectives allow examining the manner in which Charlotta and I were together able to realise three vital aspects. First, we drew upon reflective as against instrumental rationality and became stakeholders in each other's professional practice. Building on the mutual trust we gained over time, such a stance had potential of speaking to the knowledge bases of both teaching and research (Krainer, 2011). Second, our interventions became the shared object of our respective practices of teaching and research. Realising this within our collaboration led us to intervene and transform Charlotta's ongoing instruction (Gade & Blomqvist, 2016b). Third, we came to engage with newer patterns of work in the history of our collaboration. Inclusive of analysing data and co-authoring research reports about the interventions we conducted, our collaboration exemplified expansive learning activity (Engeström, 2001). My present reflections on the nature of intersubjective relationships which enabled us to realise these very aspects constitutes researcher self-study (Bullough & Pinnegar, 2001). Such a stance enables me to examine the boundaries of practitioner knowledge and research, besides question modernist assumptions that view abstract theory as applicable to any concrete practice. In light of the above I ask, in what manner did acting on practitioner reflexivity in a theory/practice manner exemplify research as praxis, and how does researcher self-study extend such efforts to inform wider debate vis-à-vis theory and practice in mathematics education research?

Contemporary research in mathematics education seeks a productive relationship between educational theory and instructional practice. While Niss (2007) argues that obtaining a complete understanding of how learning takes place is its most formidable task, Schoenfeld (2013) points to a lack of studies which address major problems that persist in routine instruction. Towards meeting these aims, research on one hand seeks greater engagement between teachers and researchers on projects of mutual interest in extended learning communities (Arbaugh et al., 2010). On the other hand, the professional development of teachers is sought in relation to professional learning tasks, enabling mathematical

content, pedagogy and students' thinking to be viewed in an integrated manner (Silver, 2009). More recently, Leinwand, Brahier and Huinker (2014) seek the professionalism of mathematics teachers, in terms of their being able to partner with knowledgeable others and question the prevailing status quo. Research in teacher education, in particular, highlights weaknesses found in modernist assumptions, where the aim of theory and empirical research is to understand the world, which when arrived at, is considered suitable to apply to any practice. Given the kind of uncertainties teachers deal with in their everyday lives, Edwards et al. (2002), who seek close-to-practice research, argue that agreements between theory and practice are not only difficult to achieve but also short lived. The ability of practitioner self-studies to grasp immediate realities and question modernist assumptions is found useful here and drawn attention to by Pinnegar and Hamilton (2011). Favouring knowing in narrative forms as researchers collaborate with participants in their studies, their arguments agree with my own finding of practitioner knowing and ontology to be inextricably linked while conducting research (Gade, 2016). Finally, two writings speak to political implications of such a combined view. Firstly, Gutierrez (2013) argues that an explicit focus on the identity and race of participants in mathematics education research enables studies to do more than merely tinker with existing instructional arrangements in schools. Secondly, D'Ambrosio et al. (2013) argue that since identifying a researcher's position in any study is revealing of his or her own identity, its acknowledgement is neither adopted by all nor problem free. Taken together, these perspectives guide my current reflections and self-study on my collaboration with Lotta, as Charlotta is known. I now detail the CHAT perspectives which facilitate my deployment of a theory/practice approach.

### Theoretical perspectives: CHAT

In contrast to dualistic assumptions in modernist research, a dialectical theory/practice CHAT approach asks that research produce scientific or theoretical knowledge that has immediate bearing on the societal practices being studied. The potential of such a strategy, Chaiklin (1993) explains, lies in its ability to not only grasp ongoing practices but also incorporate such a grasp in the continued investigations that practitioners conduct. Since such an approach views development of practices in terms of resolving contradictions found within them, Chaiklin underscores the need for researchers to attend to moral as well as political aspects embedded therein. Researcher thinking is thus determined by the practices being studied, as was the case in my collaboration with Lotta

in her classroom. Chaiklin (2011) argues practices can be viewed as traditions of action which satisfy generalised needs in wider society. Aimed at realising specialised products, these practices need to be intervened with by researchers in processes of coming to understand them. The truth of empirical, historical and wholistic analysis sought in such an approach is thus found *within* practices, the development and transformation of which is the objective of CHAT research. The manner of transforming ongoing societal phenomena is next elaborated by Stetsenko (2010) who argues that adopting a dialectical CHAT stance in one's study precludes two common errors – of applying preconceived and ready-made categories towards grasping ongoing practices and of making empirical observations with facts that lie outside the context of inquiry. In parallel with Chaiklin, Stetsenko considers researcher theorising to be intrinsic to the practice being studied and highlights three features: (1) any researcher's practical-political actions need to follow a practice-theory-practice cycle, (2) conceptual categories utilised to conduct empirical observations need to be those which are not external but internal to the practice being studied, and (3) the taking of such actions helps researchers ascertain contradictions whose resolution leads to change and transformation of the practices being intervened.

Two additional arguments corroborate the manner in which researchers can act while intervening in any study. First, Newman and Holzman (1997) distinguish a tool-for-result approach as deployed in more conventional science, from what they term as tool-and-result approach. Under-scoring the fact that Vygotskian based interventions are activity based and not cognition driven, Newman and Holzman argue that CHAT based methodology is one that is practiced in relation to the phenomena being studied, and not derived from theory as in modernist assumptions. In their words,

*Practicing method* simultaneously creates the object of knowledge and the tool by which that knowledge might be known. Tool and result come into existence together; their relationship is one of *dialectical unit*, not instrumental duality.

(Newman & Holzman, 1997, pp.78–79).

As an example, in our intervention in response to the faulty use of the equal sign by Lotta's students, we neither searched for incidences of students' faulty use of the sign nor brought about resolution of faulty use by means which lay outside her instruction (Gade, 2012a). In line with a tool-and-result approach, we devised and conducted a four part action cycle that doubled up as method, one we practiced and did not apply. Second, Seeger (2001) points out that any practice of method implies

that both theory and practice are found complementary by practitioners, the simultaneous grasp of which contributes to their reflexivity. Having knowledge of theory and practice has potential besides to become psychological knowledge, one capable of mediating prospective thinking and action. Helping realise the Marxian premise that the educator must herself/himself be educated, Seeger summarises implications of practicing method as follows,

- (1) the complementarity of theory and praxis is an essential feature of meaning making in the social sciences
- (2) the basis of this complementarity is reflexivity in a double sense: in the sense of self-application of theoretical/research results and in the sense of the necessity to take the reflexivity of the subjects into account
- (3) praxis is guiding theory (e.g. through requiring that the totality of the situation be grasped in a theoretical/scientific analysis).

(Seeger, 2001, p.51)

I find Seeger's notion of praxis to parallel Lather's notion of world creating activity, one brought about by conducting the four part action cycle in Lotta's classroom. My grasp of the faulty use of the equal sign by her student Jan while initiating this process, was both reflexive and psychological knowledge I utilised for its design and conduct. Seeger's arguments thus elaborate how practitioners can exercise a theory/practice stance (Chaiklin, 1993), implement a practice-theory-practice cycle (Stetsenko, 2010), conduct close-to-practice research (Edwards et al., 2001) and adopt a tool-and-result approach (Newman & Holzman, 1997). Such a unified stance provided Lotta as teacher an opportunity to theorise and realise her autonomy. As researcher, I too found such a stance to keep alive the relationship between theory-which-informs and theory-being-built, besides existing-practice and steered-practice in my studies (Gade, 2012b). I now turn to methodological aspects of my current study.

## Methodology and method

Patti Lather's arguments for research as praxis build on feminist, neo-Marxian critical, and Freire's empowering approach, and have two democratic and methodological aims. First, they seek researchers to practice in empirical inquiry what they might preach in their theoretical formulations (Lather, 1986a). For praxis or world creating activity to be possible, the frameworks that researchers use need to illuminate the struggles and lived experiences of social groups being worked with, by using post-positivist and humanistic methods. In agreement with the theory/practice approach of CHAT, Lather stresses the role of reflexivity, by means of

which researchers can conduct openly-ideological work. Second, Lather (1986b) asks researchers to commit their empirical research to achieve a more just world and social order. Arguing for increased awareness and pursuit of those contradictions that lay hidden in everyday practices, as in CHAT, Lather identifies four aspects which enable researchers to act on their reflexivity and take situated action: (1) triangulate methods, data sources and theoretical frameworks, (2) document researcher assumptions, helping them arrive at reflexive subjectivity, (3) establish face validity by sharing emerging analysis with one's participants, and (4) realise catalytic validity by supporting the activism arrived at within. In parallel with Stetsenko's practical-political stance, Lather's (1991) research as praxis identifies intersubjective relations between oneself and another as central. Rejecting researcher neutrality in addition, such a stance promotes self-determination of participants concerned. In parallel with Newman and Holzman's concern for practice of method, Lather (2001) argues for constitutive validity as well. As against regulatory validity where borders between science and non-science are policed, Lather seeks validity by creating a wider sociality within which the legitimacy of knowledge claims can be assessed. By critiquing practices being studied and situating them historically, pursuing constitutive validity is an emancipatory practice whose aims agree with Gutierrez's (2013) guidelines: (1) exercise transparency by making taken-for-granted rules of the unjust social order explicit, (2) understand participant subjectivity as not fixed but defying analytical categories, and (3) sponsor participant agency and voice as they negotiate meaning in prevailing discourse. I turn finally to Brian Fay (1977), who seeks an educative, as opposed to instrumental model of correlating theory and practice within research. Fay asks research to promote self-understanding and aim for participant enlightenment, enabling practitioners to achieve self-determination and autonomy via their situated actions. In addition, Fay's educative model agrees with Vygotsky's (1997) conception of what is educational, in terms of the building by teachers of purposeful psychological relationships with students, enabling them to *lead* students in their zone of proximal development (Gade, 2010a).

To arrive at constitutive validity in research, as argued by Lather, and to practice one's method, as argued by Newman and Holzman, I deploy researcher narrative to both portray the history of events in my collaboration with Lotta and to trace the significance of their development over time. I stand guided by Donald Polkinghorne (1997), who argues that practitioner narratives have the ability to present the conduct of one's research as a practice, the diachronic and historical portrayal of which enables researchers to be the protagonist while recounting events as they unfold over time. Such a stance enables researchers to factor in

particulars of place, person and circumstance, besides voice experience and express one's personal understanding. Researcher narrative enables me to respond also to the *why* question Leone Burton (2002) raises in mathematics education research, aimed at clarifying why any study had *that* focus, was designed *that* way and used *those* particular methods. Drawing upon Lather (1991) as I do, Burton argues that objectivity in research is gained via internal consistency and coherence in a practitioner's narrative, whose robustness resonates with experiences of those working with other perspectives. I have myself found that as unit of analysis, narratives have the ability to nuance the first person within education and question common-sense notions embedded in various practices (Gade, 2011a). The empirical data I draw upon to construct my researcher narrative in this paper was gleaned from field notes of my regular visits to Lotta's classroom, audio-recordings of her whole class instruction, and written inscriptions of her students as they took part in the interventions we conducted. As such my narrative is methodological in spirit, enabling me to reflect on various practitioner actions taken across the history of our extended collaboration. I turn finally to self-study research which centrally recognises the potential of practitioner narratives to question and inform more mainstream research by portraying educational landscapes and the nature of change that can be brought about (Clandinin & Connelly, 2007). In agreement with the centrality of change recognised in CHAT perspectives, research as praxis and activist agendas within mathematics education, such a grasp speaks to three strengths highlighted in self-study research. First following existential perspectives, is their ability to critique the expectations wider society has of teachers by examining what it means to be a practitioner (Feldman, 2005). Second, is their ability to let ontological issues in any study to address epistemological ones, by creating a dialogical space in which the past, present and future can coexist (Pinnegar & Hamilton, 2011). Finally, their being in a position to question the authority of university-led teacher education programs, by creating a hybrid or third space that could inform knowledge bases of both teaching and research (Zeichner, 2010). I now turn to portray one such collaboratively lived, dialogic and third space.

### Researcher and project pilot

Introduced by a colleague who worked at the local municipality, my association with Lotta began with her cohort of Grade Six students, prior to our collaborative work with Grade Four. My attempts to grasp perspectives of narrative inquiry as researcher at that time led me to examine narratives of Lotta's students as they solved problems and learnt



the mathematics expected of them (Gade, 2010b). Serving as a pilot in the realisation of our collaboration to come, this participation involved sitting at a table at the end of the classroom, puzzles in hand, inviting students to share their many narratives with me. On successful realisation of this approach, Lotta asked if I could give personal attention to a student for whom she did not have adequate time. By creating such conditions in which Lotta could empower her own instruction, I initiated realisation of an educational model of relating theory and practice (Fay, 1977). Sharing drafts of my ongoing analysis of her students' narratives, one which I presented at a conference, I drew upon face validity, honoured our reciprocity as practitioners, and facilitated our agency and voice (Lather, 1986b).

The development of professional trust between us led Lotta to consent to my continued association with her Grade Four students in the academic year ahead. Over summer and taking my collaboration for granted, she took the initiative to obtain project funding from The Swedish National Agency for Education (Skolverket Dnr 2009:406). Focused on co-relating mathematics and communication, Lotta's project goals set the agenda for our subsequent collaboration, which began with another pilot that initiated her students in using talk to both understand and construct mathematical knowledge (Mercer, 2004). Despite hesitation, Lotta led this pilot in relation to number properties. Listing numbers of various magnitude on the whiteboard, she questioned students about, say, place value or sum of digits (*siffersumman*). This was followed by her conducting the game of *Yes or No*, which were the only two responses she gave to students' guesses about numbers she concealed from them. Upon increased familiarity with the game, Lotta guided students to conduct the game themselves, the why of which lay in wanting to shift teacher-pupil talk within instruction to pupil-pupil talk (Burton, 2002). This move led to two vital outcomes. First, Lotta was able to hand over part of the authority she held as teacher to her students. Second, she was able to gauge and appreciate how her students became more active learners in such conduct. For example, we found that a particular student began to play *Yes or No* with her father and younger sibling at home. I argue such actions to have catalysed Lotta's instruction and enabled her students and her to participate with agency (Lather, 1986b), in contrast to working in a routine manner from their textbook.

Our conduct of both pilots prepared the ground for the first of three interventions we conducted, which took the form of action research, since its inception was steered by events in Lotta's classroom. Allowing me to intervene and understand ongoing teaching, this move accommodated Lotta's curricular demands, and by intent caused minimum



disruption to her instructional routines (Burton, 2002). Given the aims of her project and my presence, Lotta expected me to help rectify the faulty use made by her student of the equal sign (Gade 2012a). Our conduct of a four part action cycle here drew upon the CHAT theory of explicit mediation (Wertsch, 2007). As with the game of *Yes or No* before, we used slips of paper or *lappar* with inscriptions on them, whose role as cultural tools helped externalise and explicitly mediate students' mathematical thinking. As I shall shortly detail, such conduct drew on our reflexivity as practitioners, and our use of *lappar* went on to become a leitmotif in subsequent interventions as well (Gade, 2015a). Many aspects of a theory/practice approach took root at this time. For one, explicit mediation was not a dead construct but a theory-which-informed practitioner action, one that Lotta and I utilised to realise steered-practice (Gade, 2012b). In doing so, we conceived the theory of explicit mediation and Lotta's instructional practice in dialectical unity (Newman & Holzman, 1997), one that enabled our ongoing praxis to become world making for her and her students (Lather, 1986a).

### Acting upon practitioner reflexivity

The importance of using analytical categories which were internal and not external to the practice being investigated (Stetsenko, 2010) led Lotta and me to realise individual reflexivity across both theory and practice (Seeger, 2001). Two instances are illustrative, the first in relation to the action cycle we conducted, and the second in relation to my search as researcher for perspectives that could be deployed across classrooms. In my first reporting of the action cycle being discussed, I had identified reflexivity as self-awareness and dynamic interaction between my participants, myself and data on which I based my decisions (Etherington, 2006). I presently extend this conception to include the psychological grasp of practical and theoretical knowledge, which facilitated practitioner action by both Lotta and me (Seeger, 2001). The faulty use of the equal sign by Lotta's student Jan was the disquieting practical knowledge which, when reported to me, initiated our action cycle. My own actions lay in approaching Jan to ascertain the nature of his use. Responding to a question which sought the number of days 20 eggs would last a family of four, if each consumed an egg every day, the inscription which Jan offered was "20 - 4 - 4 - 4 - 4 - 4" as "= 5". In arriving at his solution, Jan orally counted down 20 in steps of 4 as 16, 12, 8, 4 and 0 and resolved that the answer to the problem was five days. Such practical knowledge became the basis for conceptualising a theoretically driven action cycle, one we realised in a practice-theory-practice manner (Stetsenko, 2010).

Sample inscriptions in figure 1, present evidence of the manner in which Lotta's students filled in various blanks that sought accurate use of arithmetical operations besides the equal sign in the four stages of the cycle. Lotta's reflexivity was called upon a second time in deciding if we should have her students work alone or in pairs at each stage. Lotta's long-standing experience that students had greater trouble with the reciprocal relationship between multiplication and division led to conducting that particular

Handwritten mathematical work by students, showing various arithmetic operations and relationships between addition, subtraction, multiplication, and division.

Top section:

$$200 = 150 + 50$$

$$200 = \underbrace{1+1+1+1+1}_{5} + \underbrace{1+1+1+1+1+1+1+1+1}_{9} + 190$$

$$200 = 190 + 10$$

$$200 = 8 + 192$$

Middle section (left column):

$$25 + 25 = 50$$

$$60 - 10 = 50$$

$$30 \cdot 3 = 90$$

$$100 - 10 = 90$$

$$90 + 0 = 90$$

$$100 - 20 = 80$$

$$80 \cdot 1 = 80$$

$$50 + 30 = 80$$

Middle section (middle column, labeled "Gängek"):

$$2 \cdot 3 = 6$$

$$5 \cdot 6 = 30$$

$$9 \cdot 10 = 90$$

$$2 \cdot 4 = 8$$

$$2 \cdot 6 = 12$$

$$5 \cdot 8 = 40$$

$$5 \cdot 3 = 15$$

$$1066 = 66$$

Middle section (right column, labeled "delat"):

$$\frac{2}{12} = 6$$

$$\frac{30}{6} = 5$$

$$\frac{20}{4} = 5$$

$$\frac{6}{3} = 2$$

$$\frac{8}{4} = 2$$

Bottom section:

$$10 \cdot 1 = 8 + 2$$

$$11 - 2 = 27 \div 3$$

$$20 - 11 = 27 \div 3$$

$$25 \cdot 1 = 20 + 5 = 30 - 5$$

$$25 \cdot 1 = 15 + 10 = 40 - 15$$

$$5 \cdot 5 = 20 + 5 = 50 - 25$$

$$3 \cdot 5 = 10 + 5$$

$$3 \cdot 5 = 3 + 12$$

$$3 \cdot 5 = 7 + 8$$

Figure 1. Sample inscriptions of students' attempts in the four stage action cycle

stage with student pairs. This enabled students to guide one another and *lead* peers in their zone of proximal development (Gade, 2010a).

My own reflexivity related to two aspects whose theoretical need I found while conducting the action cycle. First was my search for perspectives which could guide my conduct of instructional interventions not just in Lotta's Grade Four, but with students across all school going ages. Second was my search for a rationale that could explain why, during conduct of the action cycle, a student called Nelly broke down in tears while working at the mathematics expected of her. I have since found the two aspects interrelated. For the first, I came upon the CHAT construct of *leading activity*, one specifying the nature of instructional activity which when conducted led to maximum developmental changes in students. Karpov (2003) identifies such activity to be emotional communication with caregivers in infants, object-centred joint activity for toddlers, socio-dramatic play in early childhood, teacher mediated activity during middle school years and interaction with peers during adolescence. In line with leading activity, our conduct of the action cycle was appropriate in enabling Lotta to guide and specifically mediate her students' use of various mathematical signs. Vitality such opportunity was activity based and not cognition driven (Newman & Holzman, 1997). Yet and during our conduct of the cycle, a student, Nelly, broke down in tears, unable to answer questions that Lotta had set in a paper and pencil test relating to multiplication tables (Gade, 2011b). While Nelly was suitably comforted, we noticed her participation in the action cycle to also be means by which she rebuilt her self-confidence. More recently, I understood Nelly's predicament in terms of the developmental crisis most children routinely face when transiting from one developmental age to the next. While leading activity informed the design of instructional activity, I was here drawn to the construct of the *social situation of development* (Vygotsky, 1998). This construct recognises the social reality of students as their basic source of development, whereby their social becomes individual. I was able to factor in students' emotional experiences within instructional activity, their internal positions with respect to those conducted, besides social positions expected of them in wider society. Greater clarity on the ubiquity of such an issue came to light upon finding similar data in relation to a student Brian attempting to learn mathematics at his Grade Four in the USA (Saran & Gade, 2016). Even though my theoretical grasp of the crisis faced by Nelly and Brian is as yet exploratory, the practical knowledge that pertained to both students *lead* my search for scientific constructs which helped conceptualise their crisis. This search once again exemplifies my practice of method as researcher, since my object of knowledge creation and its potential to explain empirical facts came into existence in dialectical unity (Newman & Holzman, 1997).

## Expansive learning activity

The two instances of practitioner reflexivity discussed above exemplify the manner in which our study began to address both practical and theoretical contradictions that lay within Lotta's practice. Yet, the conduct of the action cycle being discussed was also followed by two other interventions – one related to mathematical problem posing by students (Gade & Blomqvist, 2015), and the other to their use of exploratory talk in examining their understanding of everyday measures and measurements (Gade & Blomqvist, 2016a). In line with Lotta's project aims relating to mathematics and communication, we continued to use *lappar*, slips of paper with inscriptions on them, to explicitly mediate her students' thinking in these interventions. While the instructional practice initiated in each case was thoughtfully designed and understandably different (Blomqvist & Gade, 2013; Persson, Blomqvist & Gade, 2016), these interventions built on the trust we had gained and qualified teacher-researcher collaboration in three ways. First, we drew on reflective rationality and were able to realise stakeholderhood in each other's professional practice (Krainer, 2011). This enabled me to intervene in Lotta's instruction and her to aid with my research. Three aspects are worthy of note herein. First is our ability to sustain shared interest throughout the academic year. On hindsight our long-drawn collaboration while daunting on occasion, was based on the progress we made during conduct of two pilot studies and three successive interventions. Second, this conduct drew upon two relevant theoretical frameworks – that of explicit mediation (Wertsch, 2007) and exploratory talk (Mercer, 2004). It was combined import of their perspectives that enabled us to deploy a practice-theory-practice cycle across their historical conduct (Stetsenko, 2010). Finally such conduct paved way for our being able to view Lotta's pedagogy, students' thinking, and mathematical content in an integrated manner (Silver, 2009). In fact by the time we reported students' use of exploratory talk in our third intervention, we were able to collate recognised categories of teaching, talk, pedagogy and students' learning in a single landscape (Gade & Blomqvist, 2016a). I argue this third or hybrid space to have potential to inform existing knowledge bases of both teaching and research in addition (Zeichner, 2010).

The second manner in which our interventions qualified teacher-researcher collaboration was the way in which their conduct was not an a priori given, but one that *became* the shared object of teaching and research in the course of our work. I have here found it useful to conceive the practice of teaching and research as two independent yet collaborating activity systems in line with Engeström (2008). By this I mean that while analytical categories of subject, rules, community,

division of labour and instruments in either activity system were different, the shared object and outcomes of both activity systems were the same (Gade & Blomqvist, 2016b). Such analytical clarity leads me to identify the dialectic realised between our stakeholder and our successive conduct of instructional interventions. It was this realisation that enabled us to reconceptualise existing relationships of teaching and learning in Lotta's classroom and transform the status quo in her instruction (Leinwand et al., 2014). Finally, Lotta's professional work and mine developed in significant ways over the duration of our extended collaboration. Our building of trust, sharing the instruction of students, conducting pilot studies and deploying instructional interventions was accompanied by Lotta's reading of research literature, facilitating design and conduct of interventions, and lending voice to analysis of data and scientific reporting. Each of these shifts went beyond obtaining face validity, supported activism, and brought about desired catalytic change (Lather, 1986b). This progression of work enabled Lotta to theorise as a teacher in conducting close-to-practice research (Edwards et al, 2002), just as the very trajectory of the collaborative work came to characterise what Engeström (2001) terms expansive learning activity. By this I mean that the many forms of work just outlined were not anticipated beforehand, but grew and expanded during the course of teacher-researcher collaboration (Gade, 2015b). One can also not say how these developments might evolve in the future.

### Educative/political dialectic: conclusion

In reflecting on the educative, political and transformation seeking nature of my study, I first discuss guidelines offered in mathematics education research, second discuss Fay's educative model of relating theory and practice, third speak to issues raised within self-study research, and finally debate Lather's arguments in relation to research as praxis. Towards the first I respond to D'Ambrosio et al. (2013), who argue that identifying the positions that researchers adopt in their studies is neither pursued by all nor problem free. My study offers two solutions in this regard. First, by collaborating with Lotta, it was possible for me to carry out interventions in consultation with her. This precluded my overstepping ethical, moral and intersubjective aspects, which as a teacher she was able to gauge with greater authority. Second, the dialectical approach forwarded by CHAT provided principled means by which we were able to weigh in on practical, theoretical and psychological knowledge. More generally actions taken by practitioners need not be random, but based on informed deliberation. Being able to deal

with and not sidestep contradictions and bring about change is thus not a mysterious process, but one that can utilise practitioner reflexivity. In such a pursuit Gutierrez's (2013) guidelines are useful – exercising transparency in the taking and reporting of actions and making explicit the taken-for-granted rules in any practice. In response to Niss' (2007) concerns relating to the difficulty of studying mathematical instruction and Schoenfeld's (2013) concerns of addressing major problems of practice, I thus argue for the deployment of a composite theory/practice and close-to-practice approach in any classroom. In addition, such an approach does not contradict but aids professional development of teachers as they collaborate with external experts, a suggestion made by Åman (2011) in wider Swedish debate. However, a closer look at Timperley's (2005) writings, whom Åman draws upon, shows her conceiving such collaboration in terms of distributed leadership and relations between leaders and followers. While I agree with the perceived wisdom of teachers partnering with external expertise, I find my collaboration with Lotta to have differed in two significant ways. First, we were able to deal with contradictions found in Lotta's ongoing instructional practice in both practical and theoretical terms. Second, as a teacher Lotta was able to engage with the scientific exercise of theory building, often times regarded as the exclusive domain of university researchers. It was thus possible to once again keep alive the dialectical relationship between theory-which-informs and theory-being-built, besides existing-practice and steered-practice (Gade, 2012b). As suggested by Stetsenko (2010), such conduct differed also in deploying analytical categories that did not lie outside instructional practice, but were intrinsic to design and conduct of our interventions. It is noteworthy, that these interventions were also carried out upon grasping the subjectivity of participants, like Lotta and her students Jan and Nelly, whose agency, voice and meaning making were both negotiated with and understood. Such an approach made it possible for us to realise an educative rather than instrumental model of relating theory and practice (Fay, 1977). Our ability to promote our own self-understanding besides those of Lotta's students was here subtle yet deliberate. While the action cycle enabled Lotta's students to rectify faulty use of the equal sign via *their* actions, Lotta and I realised professional autonomy in terms of *our* own practical, theoretical and instructional knowledge.

The trajectory of actions I recount in my study provides a fillip to the potential self-studies have in reflecting upon and understanding the lived space of practitioners as they attempt to bridge practice and theory during ongoing instruction (Feldman, 2005). Vital evidence of ontological and epistemological issues that relate to such efforts are also

well served in their very ability to create a dialogical and third space (Pinnegar & Hamilton, 2011), that can inform knowledge bases of teaching and teacher education research (Zeichner, 2010). There is concrete grounds upon which to question modernist assumptions of abstract theory and re-conceive the role of theory in terms of its ability to bring about transformation and change. Taken together these arguments leads one to the explicitly political nature of conducting interventions while deploying a dialectical theory/practice approach. In Lather's (1986a) terms and possibly beyond, it may in fact be inevitable that such manner of empirical research achieve a more just world and social order. The equal sign I allude to in this paper, serves only as an example of the many aspects in mathematics instruction and its pedagogical conduct that need practitioner attention in everyday classrooms. The nature of activism that was required of me and Lotta in conducting the four part action cycle made us engage with local data, our own assumptions in relation to theory, and practice, in exercising our reflexivity. This last leads me to two final points. First is the need for methodological innovation while conducting research as praxis, in terms of, say, practitioner self-study. Adopting such a humanistic approach has potential to speak with personal and forceful authority gained from conducting interventions with stakeholders in *their* concrete practices. Second, as my present study showcases, it is possible to not merely recognise but also redress the many contradictions that lie embedded in *ongoing* instruction. In such conduct one's research need neither be ideologically neutral nor blind to expectations that can be had from transformation seeking, publicly funded, democratic research.

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## Sharada Gade

Sharada Gade works at the intersection of three domains – cultural-historical activity theory or CHAT perspectives, practitioner inquiry and mathematics education. After more than a decade of teaching at middle school grades in India and doctoral work at the University of Agder, Norway; Sharada has held postdoctoral fellowships at Homi Bhabha Centre for Science Education, Mumbai; Umeå Mathematics Education Research Centre, Sweden; The Graduate Centre, City University of New York and the Department of Education, University of Oxford.

sharada.gade@gmail.com

