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Teacher-researcher collaboration as Formative Intervention and Expansive learning activity

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Extended teacher-researcher collaboration is reported in this paper, by drawing upon cultural historical activity theory (CHAT) perspectives. Teaching is herein conceived as dialectical practice in which teachers are both shaped by and shape instructional practices. Three instructional interventions conducted at a Grade four mathematics classroom in Sweden constitute and exemplify the construct of Formative Intervention. Teacher-researcher collaboration which paralleled such conduct next exemplifies the construct of Expansive learning activity. Such transformation and change sheds light on how mid-level taken for granted phenomena in schools can be worked with and around, besides contributing to the motivational sphere of students and teachers.

Keywords: CHAT perspectives, collective unit of analysis, transformative agency, Formative intervention, Expansive learning activity.

TEACHER-RESEARCHER COLLABORATION

In this paper, I draw upon cultural historical activity theory (CHAT) perspectives and exemplify the constructs of *Formative intervention* (Engeström, 2011) and *Expansive learning activity* (Engeström, 2001). In doing so I draw on my extended collaboration as university researcher with a school teacher Lotta, as Charlotta is known, at her Grade four mathematics classroom. Such collaboration relates to project funding obtained by Lotta from the Swedish school authorities (Skolverket Dnr 2009:406) towards promoting students' communication in mathematics and includes three specific interventions. First, action research in relation to students' use of the mathematical = sign (Gade, 2012), second a problem posing practice in relation to students' use of textbook vocabulary (Gade & Blomqvist, 2015) and third, Lotta's plenary conduct of exploratory talk in relation to everyday measures (Gade, 2014). The very nature of teacher-researcher

collaboration changed during such conduct from my being participant observer in Lotta's classroom, to her becoming theoriser and co-author of scientific reporting of our collaborative research. I argue that while the conduct of classroom interventions exemplifies Formative intervention, my extended collaboration with Lotta exemplifies Expansive learning activity.

Prior arguments in three research domains steer arguments in this paper. In the first, mathematics education research which seeks linkage between theory and practice in a comprehensive manner (Arbaugh, Herbel-Eisenmann, Ramirez, Knuth, Kranendonk, & Quander, 2010). Highlighting for reflective rationality instead of instrumental rationality, it is also sought that researchers become stakeholders in teachers' instructional practices just as teachers become stakeholders in classroom research (Krainer, 2011). Second, arguments in action research recognise the theory-practice relation to be a practical issue, wherein personal knowledge teachers have and their instructional realities are often found denied and/or generalised in idealised theory formulated by researchers from outside (Elliott, 1991). Finally, it is recognised that most research at K-12 levels of schooling is not conducted by K-12 teachers, leaving out and silencing the voice of teachers and their world of teaching (Cochran-Smith & Donnell, 2006). In three interventions alluded to in this paper, Lotta and me respond to many an issue here outlined. Lotta's own role is conducting these included working to stride the theory-practice divide, become stakeholder in research and contribute to K-12 research as a Grade four mathematics teacher. In doing so Lotta took on two significant roles. First and as teacher she elevated the problem of students' faulty use of the = sign in everyday instruction to one worthy of resolution via action research. She also steered instruction to have students make explicit use of textbook vocabulary and conducted a plenary of talk for students to explore

understanding of everyday measures. In each of these Lotta was willing partner in deploying CHAT constructs which I brought to bear as researcher. Second and in this process Lotta went on to become co-author and theoriser of research, lending voice to its conduct and reporting. In such manner of reflective rationality, Lotta and myself became stakeholders in each others' professional practices (Krainer, 2011). More recently I unpacked our extended collaboration with different theoretical lenses (Gade, 2015). Lotta, her class teacher and me also report our problem posing practice in a teacher's journal (Persson, Blomqvist, & Gade, submitted). It is against this backdrop that I ask, What manner of change can teacher-researcher collaboration, identified by constructs of Formative intervention and Expansive learning activity, bring about?

CHAT BASED UNDERPINNINGS

Cultural historical activity theory (CHAT) grounds discussion in this paper with two arguments. First that the capacity to teach and benefit from teaching is a fundamental attribute of human beings. Second that educational processes are conceived as being active at three level – the student, the teacher and the environment between them. In fact CHAT perspectives view teaching as a practice wherein a teacher and his or her environment are in a dialectic whole, in which teachers not only shape but are shaped by instructional practices (van Huizen, van Oers, & Wubbels, 2005). With dialectical exploration of public and personal meanings, CHAT disavows a transmission model of teaching and conceives teacher subject knowledge to develop within instructional practices (Ellis, 2007). Such a conception is at odds with objectified, individualistic and dualistic conceptions of teaching, and proposes an alternative wherein teachers could take actions based on negotiated outcomes of collaboration and participation in a community of learners (Shulman & Shulman, 2004). This latter contests the idea that teachers are heroic individuals given societal status in lieu of their ability to work autonomously facing all odds in everyday practice (Edwards, 2010).

Bronfenbrenner's (1977) *Transforming experiments*, wherein environments can be restructured to bring unrealised potentials of participants to life is useful in realising viable practitioner collaborations. Engeström, Sannino and Virkkunen (2014) term Transforming experiments as *Formative interven-*

tions, elucidating three assumptions that underpin their conduct. First the principle of double stimulation, which highlights how human beings use not one but two stimuli to overcome the problem situation they find themselves in. With the first stimuli being the problem situation itself, the second stimuli is used to make a meaningless situation meaningful resulting in individuals regulating their own behaviour, for example, the ticking of a clock in a waiting area is used to kill time, besides leading to volition. Second the principle of ascending from the abstract to the concrete, whereby any phenomenon is studied holistically from as many perspectives as possible (Luria, 1979). In the CHAT tradition the term abstract means underdeveloped, lacking in connections and thin in content as against concrete phenomena which are mature, well connected and rich in content (Blunden, 2010). Third Engeström and colleagues' (2014) principle of transformative agency,

Transformative agency differs from conventional notions of agency in that it stems from encounters with and examinations of disturbances, conflicts, and contradictions in the collective activity. Transformative agency develops the participants' joint activity by explicating and envisioning new possibilities. Transformative agency goes beyond the individual as it seeks possibilities for collective change efforts. (p 124)

The three assumptions outlined above which underpin Formative interventions, allow for non-linear, agentic conduct of classroom interventions. Engeström (2011) further outlines four distinguishing features of these. First the starting point of Formative interventions are not pre determined but found embedded in the life activity being studied. Second, in resolving any problematic the individuals involved gain agency in its conduct. Third, that any pedagogical idea utilised in a Formative intervention has potential of being utilised later on as well. Finally and in such conduct the role of the researcher is to conceptualise and support the growth of interventions, as these evolve over time. I highlight these very aspects in Lotta's conduct of the three instructional interventions, which taken together constituted a Formative intervention.

The nature of teacher-researcher collaboration as realised by me and Lotta not only paralleled our interventions but expanded qualitatively over time, from my initially being participant observer in her class-

room to her becoming co-author and theoriser of research reported. It is such manner of transformation that Engeström (2001) terms *Expansive learning activity*. Arguing against reactive forms of learning based on dualistic conceptions of the mind, Engeström (1987) argues for learning as an expanding and historically evolving activity. In line with Engeström, Lotta and me overcame many a contradiction we faced in her classroom practice, resulting in our collaboration becoming a case of Expansive learning activity. By this is meant that it was possible to view the learning that transpired during our collaboration in three distinct ways (Engeström, 1999). First and instead of benign mastery of what was already learnt hitherto by us as practitioners, our learning involved partial destruction of the old in our intentionally intervening and conducting an action cycle to restore say her students' faulty use of the = sign. The realisation of such conscious reflection was also possible in the problem posing practice, as well as Lotta's plenary conduct of exploratory talk with respect to everyday measures. Second and instead of conceiving transformation and change in individualistic terms, in our interventions we conceived students' development in collective terms involving all students in Lotta's classroom. Finally and instead of vertical movement along hierarchical levels, it was possible to conceive students' learning and development as a horizontal movement across subject specific borders. In addition, Lotta and me participated in each other's professional practice as stakeholders. Our object was not to become the other but realise new activities at the margins of our existing practices. Our realisation of co-authorship and theorising with Lotta is illustrative of such horizontal, as against hierarchical aspects. Detailed in Gade (2015) and geared towards Lotta's project goals, our collaboration evolved into newer forms of activity which grounded in her classroom realities were also not envisaged beforehand. As articulated by Engeström (2001),

The object of expansive learning activity is the entire activity system in which the learners are engaged. Expansive learning activity produces culturally new patterns of activity. Expansive learning at work produces new forms of work activity. (p. 139)

I now turn to outline the instructional interventions which together constituted our Formative intervention, outlining the development of teacher-researcher

collaboration as Expansive learning activity in the section that follows.

FORMATIVE INTERVENTION

Before detailing Lotta's instructional interventions at her Grade four classroom, I mention our collaboration to benefit from my conduct of a pilot study with her prior batch of Grade six students (Gade, 2010). It was during summer vacation in between that Lotta took the initiative of applying for funding of a project she conceptualised in terms of communication and mathematics. Yet since such a topic is broad in spirit and scope, it was only in some topics of the curriculum that we designed and conducted instructional interventions. In line with Engeström (2011) the very starting point of the overarching Formative intervention I discuss in this paper, was not determined ahead of time but found embedded in Lotta's everyday instruction. This happened when Lotta came upon her students' faulty use of the mathematical = sign. In Lotta reporting this to me, we designed and conducted an action research cycle based on CHAT perspectives of self-directed activity (Bodrova & Leong, 2007) and explicit mediation (Wertsch, 2007). While we detail the background, rationale and conduct of action research in our reports (Gade, 2012; Blomqvist & Gade, 2013) it is reasonable to assume the incidence of faulty use to transpire in other mathematics classrooms as well. Yet Lotta's actions of highlighting the problem to me, in our collaboration, held with it an expectation that we address the problem by means of research. It was then that I drew upon CHAT constructs to conceive a relevant and implementable semiotic practice. Continued participation by Lotta's students' in four stages of this practice led not only to restoring students' appropriate use, but also to Lotta achieving satisfaction of such use as teacher. We realised two significant aspects in these actions. In the first we implemented a practice that was active at three levels – Lotta's students, Lotta as teacher and the environment between them. In the second, we enabled Lotta to utilise her teaching in a dialectic manner, wherein she not only shaped her students' learning and development but was herself shaped by the instructional intervention she led (van Huizen et al., 2005). In line with Engeström (2011) Lotta's agency was realised in her conduct of the action cycle, with that of her students as they worked in dyads and offered mathematical statements of equality. In this intervention we handed out numbers and signs on slips

| | | |
|---|------------------|-------------------|
| $200 = 150 + 100$ | $6 \cdot 5 = 30$ | $40 + 10 = 50$ |
| $200 = 50 + 50 + 100$ | $36 - 6 = 30$ | $1 \cdot 50 = 50$ |
| $200 = 150 + 50$ | $20 + 10 = 30$ | $60 - 10 = 50$ |
| $200 = 1 \cdot 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 190$ | $5 \cdot 5 = 25$ | $1 \cdot 64 = 64$ |
| $200 = 190 + 10$ | $20 + 5 = 25$ | $60 + 4 = 64$ |
| $200 = 8 + 192$ | $26 - 1 = 25$ | $65 - 1 = 64$ |

Table 1: Example of students' statements of equality in *lappar* based activity

of paper (*lappar* in Swedish) asking students to pick these at random and offer mathematically accurate statements. Two excerpts from such work detailed in Gade (2012) are given in Table 1.

We used *lappers* to hand out textbook vocabulary in the problem posing intervention as well (Gade & Blomqvist, 2015). As example while conducting this intervention Lotta herself partnered with a student Noel whose problem was as follows,

1000 people voted for president Noel but 600 voted for President Blomqvist. How many more voted for President Noel than President Blomqvist.

In the same session Ulla and Sara, two students who sat in desks behind Noel, posed the following problem almost in retort.

There is a presidential election in the United States for the President. Noel was dismissed. President Ulla received 320 votes, President Sara 165 votes. How many people voted?

We next utilised *lappers* in Lotta's plenary, handing out improbable questions on everyday measures to provoke talk, for example: Can Eva and Anton measure the length of Sweden on foot?; Can Lars and Iris measure their age in decimetres? (Gade, 2014). An excerpt from Lotta's plenary conduct of the first question is given below:

- Lotta: Once more
 Eva: Can Eva and Anton measure Sweden's length with/on foot
 Many: Nooo ... @@
 Lotta: No, no, not now, Eva and Anton will attempt this question ... only them first
 [?]: It works (*Det går* in Swedish)
 ...
 Liam: You have to go straight ahead
 Ulla: What if you go into a building

- [?]: Then you go over the house
 Lea: Noel! Do you have anything good to say
 Noel: And you can go through the house ... and you can go inside the house and jump off the balcony ...
 Leon: And what if it is a high building
 Nils: If you have a map, you can take that, you can look how much a foot is and use the scale of the map ...

In realising students' agency in the three interventions we conducted, my own role as researcher saw me drawing upon relevant CHAT constructs, sharing these with Lotta and supporting her instructional practice. Where for the = sign intervention we drew on action research literature (Ladkin, 2004), in the problem posing intervention we drew upon van Oers' (2009) guidelines for Developmental education and for plenary conduct of Exploratory talk we drew on pioneering work of Barnes (2008). It was also the case that in each of the three interventions we conceived Lotta's teaching as a dialectical practice, in which Lotta shaped students' learning and development as well as reflect (Krainer, 2011) and be shaped by pedagogical actions she herself took (van Huizen et al., 2005). In was in this manner that Lotta was able to factor her practical knowledge (Elliott, 1991) besides develop rich nuanced understanding of pedagogical actions within her teaching (Ellis, 2007). Lotta went on to acknowledge our extended collaboration to be equivalent to her doing a professional development course in her classroom, which was rich preparation for her to foster a community of classroom learners in the future as well (Shulman & Shulman, 2004).

I finally discuss the four CHAT assumptions which Engeström and colleagues (2014) outline as underpinning any Formative intervention. First is the notion of double stimulation, in terms of which human beings resolve problem situations they find themselves in through a second stimulus, so as to gain volition. I argue that in each of the three interventions Lotta con-

ducted, her students gained both agency and volition. I also argue such agency to be aided by their participation in instructional practices we had set up, in which the second stimulus was provided by the many *lappar* we utilised in a pedagogical sense and the CHAT constructs we utilised in a theoretical sense. The use of these together served the purpose of double stimulation. The understanding that Lotta and myself reached, was a result of observing and reflecting on each stage of the cyclical manner in which we deployed either intervention. Such an approach enabled us to view each of the three interventions from as many angles as possible and understand how various aspects were interrelated (Luria, 1979) besides how each intervention appeared as a pedagogical whole in concrete practice (Blunden, 2010). Finally and importantly it was in our conduct of interventions as classroom practice, that Lotta's students were able to jointly participate as well as contribute to collective transformational agency (Engeström et al. 2014). As example Lotta went far beyond treating the faulty use of the = sign by one of her students as a stand alone case and welcomed successive whole class interventions. Having shed light on the manner in which Lotta's instructional interventions exemplified the construct of Formative intervention (Engeström, 2011), I now turn to examine the manner in which teacher-researcher collaboration evolved correspondingly over time.

EXPANSIVE LEARNING ACTIVITY

As mentioned earlier on, my pilot study with Lotta's Grade six students prepared ground for teacher-researcher collaboration (Gade, 2010). It was during this study that either of us had opportunity to gauge each other as working professionals and take the many small steps which went on to eventually realise what Engeström (2001) terms as Expansive learning activity. In line with CHAT perspectives such a process was dialectical in spirit in that we both related and understood each other's actions. I was able to observe Lotta's teaching as participant observer and Lotta too was able to gauge how I interacted with her students, sharing a trick on one occasion and stoking their interest in mathematics on another. This led to her suggesting that I work with a few students who either needed special attention she did not have time for, or to those who were able to comply with her instructions before all others. From gauging each other and in terms of these actions, Lotta accepted me as a professional whom she could trust her students with. I argue that it was

this trust that she took for granted when applying for project funding, whose aims were realised over time in the interventions which constituted our Formative intervention. In these it was possible to do away with older relations that students had with mathematical signs, textbook vocabulary or even talk and build relationships which we considered productive and mathematically rich. Our reporting of these aspects allowed for co-authorship and theorising by Lotta as K-12 teacher (Cochran-Smith & Donnell, 2006). Not only did we come up with and carry out new forms of shared activity (Gade, 2015) we also changed the very object of our collaboration from our jointly facing contradictions to conceiving alternatives and conducting interventions. As argued by Edwards (2010) and in the cumulative history of collaborative efforts, we brought our expertise as teacher and researcher to bear in our joint actions. In place of individual autonomy we lay emphasis on thoughtful practice and inclusive reflexivity. Our professional expertise was thus a negotiated one, which was not only born of practitioner struggle but also altered many times over. In line with Engeström and colleagues (2014) our agency was a transformative and collective one which realised systemic change. Such manner of change is captured once again by Engeström (2010, p 88) in 'Expansive learning is a process of material transformation of vital relations.'

CONCLUSION

I conclude by highlighting an outcome of significance about my collaboration with Lotta, which is that in our combined efforts we did not fail. Our actions, judgements, trust as well as relationships nurtured with one another, students and mathematics all contributed to the manner of outcomes I report in this paper. In line with a CHAT driven agenda, we worked towards as well as achieved transformation and change. Three observations follow. First and as recognised by Elliott (1991) there is reason to view the theory-practice relation as a practical issue for teachers. We saw the kind of efforts that Lotta and me took upon ourselves to bring CHAT based theoretical constructs to bear within everyday classroom instruction. Second and in line with Engeström (2001) such efforts necessitated expansive forms of learning, which were neither reactive nor predetermined but realised in our reflective actions which were grounded in Lotta's classroom. Such actions have potential besides of seeding as yet unforeseeable expansive learning in our trajectory

ahead. Finally, such meta-level analysis sheds light on two historical trajectories, that of successive interventions conducted and teacher-researcher collaboration realised in parallel. Such insight in turn reveals how mid-level taken for granted phenomena in school, lying between rules and budgets on one hand and curricula and textbooks on the other can be worked with and around. Such actions and knowledge have potential besides to contribute to the motivational sphere of students and teachers within teaching-learning in everyday mathematics classrooms (Engeström, 2008).

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ENDNOTE

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