Whither Ability Grouping: Changing the Object of Groupwork

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Grouping children by achievement levels is a thriving practice in New Zealand primary school mathematics classrooms. In this paper we look at the impact of a formative intervention project—*Developing Communities of Mathematics Inquiry*—that required a whole-school shift to mixed achievement grouping. Engeström's Cultural Historical Activity Theory framework is used to explore changes in the teachers' object/motives over the first year of the project. Teachers' learning about mixed-ability groupwork focused first on organisational and social structures, then participatory practices, and finally to students and their own mathematical sense-making. Such a shift is characteristic of expansive learning and transformative agency.

Grouping students according to teacher assessed mathematics achievement levels, commonly referred to by teachers as *ability* grouping, a practice that is thriving in New Zealand primary schools. Well supported by teachers (Golds, 2014), the reliance on ability grouping has been fuelled by the Numeracy Development Project (Ministry of Education, 2008) that recommended teachers group students according to numeracy strategy stages. A recent Education Review Office (2013) report—*Mathematics in years 4 to 8: Developing a responsive curriculum*—noted that despite the widespread use of ability grouping few schools "had evidence that such programmes, initiatives and interventions, or additional staffing, such as teacher aides, actually accelerated the progress of their priority learners" (p. 2). Faced with sustained and systemic levels of underachievement of students from socio-economic disadvantaged circumstances and policy calls for accelerated achievement gains, viable alternatives to ability grouping are gaining ground. One such project—*Developing Communities of Mathematics Inquiry* (DMIC; Hunter, 2016)—is the focus of this paper. Designed as a formative intervention program (Engeström, 2011), DMIC supports teachers to engage students in productive communication and mathematical practices.

In this paper we report on whole-school changes in grouping practices for three DMIC schools working as a cluster within a low socio-economic Pasifika-based community. We track teachers' apprehensions and aspirations about teaching and learning through mixed-achievement groupings. The puzzle that drives our analysis is not that grouping practices changed per se in all of the classes—as the use of mixed-ability grouping was a 'given' of the project. Rather, given that we know that ability grouping was a well-established practice, and one that was largely unquestioned, we wondered how the use of mixed-ability groups came to be so embedded in practice, to the extent that at the end of the first year of the project when asked about significant changes, challenges, and sustainability issues, ability grouping was noticeably absent in teachers' responses.

In this paper we use the notion of expansive learning from Engeström's (2011) third generation Cultural Historical Activity Theory to explore changes in the teachers' object of focus for groupwork activity. To situate the research we begin with a brief overview of the context of the DMIC project

2016. In White, B., Chinnappan, M. & Trenholm, S. (Eds.). Opening up mathematics education research (Proceedings of the 39th annual conference of the Mathematics Education Research Group of Australasia), pp. 117–125. Adelaide: MERGA.

Developing Mathematics Inquiry Communities Project

Designed as a formative intervention (Engeström, Sannino, & Virkkunen, 2014), the DMIC professional learning model engaged teachers "in identification of how effective their practices are in creating learning opportunities for students, seeing the relevance of the evidence-base to inform changes to their practice, and evaluating where these changes have the desired effect" (Timperley, 2011, p. 1). To counter the systemic effect of student underachievement and disengagement with mathematics professional learning centred on the development of culturally responsive pedagogies supported by a model of teaching that involved conceptualising mathematical thinking and learning as participation and communication (Alton-Lee et al., 2011; Hunter, 2008). Drawing on the work of complex teaching involving mixed ability groups (Cohen, 1994) and relational equity (Boaler, 2006) teachers were supported to integrate students' everyday cultural experiences and language within mathematically rich group tasks (Civil & Hunter, 2015).

The DMIC professional learning model is built on the premise that teacher learning involves a process of social participation within communities of practice. Key to participation is the development of relational agency: "a capacity to align one's thought and actions with those of others in order to interpret problems of practice and to respond to those interpretations" (Edwards, 2005, pp. 169-170). Collaborative consultation was facilitated by cluster group workshops and syndicate planning/teaching experiences. Furthermore, in-class practice-based mentoring (see Hunter, 2016) supported the teachers, mentors, and project leaders/researchers to become stakeholders in each other's practice. As the mentoring sessions become more established students also become 'players' in the intervention.

Expansive Learning within Formative Interventions

Acknowledging the complexity of the teachers' existing practice, formative interventions fit well with Engeström's model of third generation of Cultural Historical Activity Theory—henceforth referred to as Activity Theory (AT). Drawing on the well-known triangular model of human activity systems (Engeström, 1987), Engeström (2011) proposed a joint activity system, one that is expanded to include at least two interacting activity systems as the unit of analysis (see Figure 1). The contradictions within and between the activity systems are regarded as sources of change and innovation, termed by Engeström (2001) as expansive learning, learning activity that produces culturally new patterns or forms of work activity.

In this model, the object of an activity gives it a determined direction. In the expanded activity system network the key focus is the space of overlap or distance between the objects of the separate fields of practice—in this case the teachers' object to introduce mixed ability grouping and the student object to learn to participate in a collaborative mathematical community. Hence, in looking to identify and understand changes related to grouping practices (be it manifested in beliefs, knowledge, pedagogies, access, and participatory practices, for example) it is necessary to understand the changes in the object of the activity. In the initial stages of a professional learning programme, where the object is in a state of emergence, learners would be expected to "open the problem superficially" (Roth & Radford, 2011, p. 107). It is through the introduction of tools to support learning (e.g. Hunter, 2008; Communication and Participation Framework) that one might seek to create discrepancy between the learner's current knowledge and the learning object. Promoting the "possibility of new learning through developing increased abilities to

interpret situations—with the object becoming available to the learner's "consciousness in its entirety" (Roth & Radford 2011, p. 107)—is a goal of expansive learning activity.

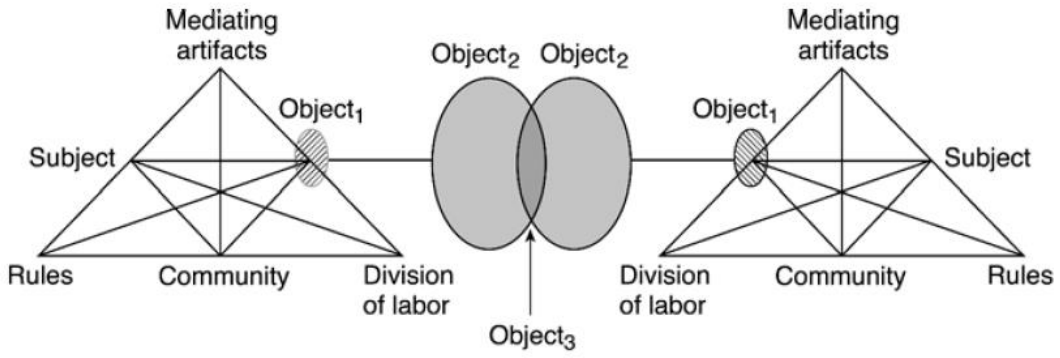

Figure 1: Two interacting activity systems as minimal model for third generation of Activity Theory (Engeström. 2001, p. 136)

In order to fully understand the tensions and contradictions inherent in each of the activity systems (including that of the professional development team), and the melding of objectives to create new objects related to mathematical inquiry communities consideration must be given to the intersecting activity systems. As a start, this paper attends to changes in the object from the teachers' perspectives.

A way into the data

The DMIC project contains multiple intersecting activity systems involving students, teachers, schools, communities, and professional learning personnel. For the purposes of this paper, we concern ourselves with the intersecting activity systems involving the teachers (20 interviewed at the end of year 1) and the students. Our question concerns how the object of grouping practices and associated enactment of group tasks shift during the course of the first year of the project.

In the wider project, data was gathered from student surveys about mathematics and mathematics learning and teacher interviews in April and November of 2015. Videos of mentoring lessons and teacher reflections were also collected in each of the four school terms. For this exploratory analysis presented in this paper we considered all reports in the first interview data set that referenced grouping practices, noting teachers' concerns and the focus of the perceived shift in practice as it related to the project aims. In the mid-year reflection data we looked for expressions of teachers' espoused beliefs concerning their students' mathematical ability. The end-of-year interviews were coded according to teachers' expressions of significant changes both completed and in progress that related to pedagogical practices and opportunities to learn. Of interest were those changes around grouping and enactment of group tasks that were expressed in terms of new and or future teacher learning.

Findings

In the beginning. Adhering to a historical analysis we begin by looking at what the teachers told us about grouping practices, in terms of their prior experience and their

experiences in the first few months of DMIC. Prior to the project every teacher reported using ability groupings. JS1's description sums up the general approach:

> I have always taught with streamed ability groups. And this is our learning time, and this is the strategy you learn, and this is now your maintenance time, and now there's sort of like an extra time to practice skills and things … I've always done my maths teaching with ability based groups and learning intentions focused on learning certain strategies, whatever I've decided to teach on the day.

When asked about what changes they thought were involved in the project, the removal of ability grouping was at the forefront, alongside the recommended two groups and one problem organisation:

> Probably the difference is the half class. So working with a half class. And doing one problem, although they're still in groups, and that the students are mostly working in mixed ability. That would probably be the biggest change. (AS1)

For many, initial concerns focused on deciding who would work well with others. We see how JS1 drew on the Maori concept of tuakana-teina [relationship between an older (tuakana) person and a younger (teina) person and is specific to teaching and learning in the Māori context] to justify grouping Year 2 and 3 students together, but then wondered if social grouping was a better way:

> Just because the whole idea is that tuakana-teina because I've got some Year 2s and Year 3s so there is a little bit of that. And I just think it does work better. But then if you've got the really quiet ones, sometimes they are better working together because they will quietly talk to each other.

Challenges associated with getting students within the groups to work well together included the need to balance "dominant, strong personalities". Several teachers reported group membership involved trial and error, with a mix of random and planned assignments. But overriding these concerns was the challenges of being able to cater for differences in ability within the groups. As LS1 noted:

> So that's my challenge; how do I cater for the lower ability kids working with the high ability kids, and then also extending the high ability kids without kind of losing the lower ability kids.

Their efforts to reorganise groups were tinged with moments of 'possibility' and 'wait and see'. For example, KS1 linked the changes in grouping practices with changes in learning opportunities around task design and participation practices:

> the problems are going to be pitched at a high level and they're going to be open, … and there's also going to be a whole range of ways of sharing your thinking. There's going to be some pretty high expectations around children sharing their thinking; children justifying their thinking; children responding to other's thinking, maybe affirming or challenging and also about saying if you're a bit lost or you don't understand something.

Thus while initially many teachers felt that the change in grouping practices was an organisational matter it was clear that quite early on most teachers' focus was starting to shift towards their own professional capability—expressed in terms of changes related to student participation. For example, KS1 noted that it was more than "just working with a bigger group of children than you normally work with". She felt that she was starting to see a shift in agency and authority within the classroom:

> … and they [students] are going to be taking control really, the locus of control when it comes to the sharing of ideas and responding to ideas and you [teacher] have quite a significant role as a drawer-outer of ideas.

In implementing new collaborative problem tasks the teachers reported experimenting and learning to use different instructional strategies As LS1 commented:

> With the juniors, I'm actually using three groups just because I feel that I just need to give them those Talk Moves. I need to be modelling them and scaffolding them and groups of sort of eight work better for me than sort of groups of ten.

For a few teachers, their focus shifted to include consideration of the mathematics involved in the problem tasks. We see in the following response AS1 beginning to think about the mathematics in terms of her learners' understandings and cultural space:

> I guess the biggest impact, and this comes down to my mathematical knowledge and ability, is that the planning. I guess it's like doing anything new, takes me hours and hours. And that's because I don't have the mathematical knowledge or ability to write the problems on my own; be able to work out all the strategies that the students might use when they're solving the problem and then know how to make the connection back to the big idea. And I find it really hard to adapt the problems into a cultural context because of my lack of knowledge and understanding.

In terms of AT it appears that the first phase of the project involved teachers seeing the change to mixed ability groups as organising groups in ways that enabled their children to feel comfortable working together. The focus on the group task was initially providing an activity that would be suitable for diverse students so as to keep all students gainfully occupied. However, for many of the teachers, we see evidence of disquiet about their role in orchestrating the task, in terms of starting to appreciate that they needed to know more about the mathematical potential of the task, students' misconceptions, and connection to the big mathematical idea.

In the middle. Survey responses concerning how teachers thought their own and their students' beliefs had changed regarding who can do mathematics revealed shifts from entity to incremental (Dweck, 2006) ability beliefs. For those teachers (the majority) who claimed that they had "always believed that all children are capable", many noted that they now thought it was more their responsibility, as the teacher, to make sure children were "free to do so". Other teachers who shifted from believing that only some children "were naturally good at it" towards believing that "everyone has a chance to get better" also qualified this in regards to the role of the teacher. They talked about needing to create learning environments that are "safe, open, with lots of talk, high expectations, and connections" where students are "taught to use their own thinking and reasoning". Most teachers reported that more students now believed that they "can do maths" and that "mathematical practices are more important than knowledge". Some suggested that the experiences of collaborative groupwork had changed the way their students positioned themselves, noting that there was no longer talk about "who is the brainiest" at maths and support for those "who took a risk". However, despite this shift, several of the teachers were concerned that not all students "were taking the responsibilities of collaboration seriously".

Mid-year we see that the shift in object is moving away from the individual learner, within the group, labelled by a perceived fixed ability or difference, towards seeing groupwork as collaborative learning experience. In the next section we see how the teachers build on this notion of groupwork to create a new object that drives their professional learning in a way that characterises expansive learning.

At the end of first year. As part of the end-of-year interviews teachers were invited to talk about: the effect of the project on mathematics teaching and learning in their classroom; the challenges and rewards, and their learning as a teacher and member of the community. A typical description of what we would see in their class was students working co-operatively to solve problems that related to their lives and communities. Frequently, teachers commented on the prevalence of mathematical talk: "there would be a

lot of discussion and arguing over maths ideas" (ES3). In the absence of explicit discussion about the shift to mixed ability grouping we looked more closely at the discourse around group learning and tasks.

Firstly, when teachers described the grouping arrangements they consistently referenced collaboration. As AS3 expressed it:

> I think I've always seen maths as an individual thing. I needed the children to be doing their own work and that I probably dissuaded them from working together at times and so that's been a huge turnaround.

Engagement in group tasks involved students in new ways of participation and coming to see themselves as learners. As MS2 noted:

> Now they're actually realising that they need to think for themselves. They have to talk to each other to actually come up with the solution and I think for the children they are then becoming the—they're embracing that whole 'I am the learner' and actually sort of seeing themselves as learners instead of 'We're just going sit there and just absorb but not the information that you're giving us'.

Likewise, AS1 claimed that expectation for her students to share their thinking and to challenge other students' thinking by saying "Oh well actually I don't agree with that" was significant in making mixed-ability groups work. It supported children to develop prosocial skills in order to be able to work together.

In extolling the virtues of groupwork the teachers were keen to discuss how discussion provided opportunities to hear the student voice—not just of one student but of many. As ES3 put it:

> I think it is that the kids are now having a voice and I can hear their voice. They're thinking when it comes to what particular maths operations to use when dealing with different maths problems.… With this now, I hear a whole lot of them, in their own groups, talking about mathematical ideas and arguing it out rather than just accepting what mathematical knowledge they have been taught and then working on that independently.

In discussing children's thinking several teachers expressed concern that they had previously never really listened to what their children were thinking. Put bluntly by LS3:

> the Numeracy Project was quite structured and so you didn't really have to think super-much, you just sort of—it was almost like you followed. If a child could do it, you'd take that and move to the next thing and there wasn't a huge amount of connecting. I mean, I didn't even know there were big ideas in Maths actually, I thought they were only in Science.

Now, in listening and responding to children's thinking, teachers talked freely about coming to appreciate the 'big ideas' in mathematics, the need to connect mathematical ideas to enhance understanding, and the role of misconceptions. CS1teacher noted that in the past she had made "vast assumptions about what children know about fractions" and LS3 reflected that she:

> Had never looked at kids' misconceptions before so that was really important recognising when you're hearing a misconception and working out, like getting out of the mindset of 'No that's wrong, this is how you do it' to unpacking that misconception.

As a consequence of the new grouping arrangement that supported collaboration and rich problem solving activities teachers talked about changes in their expectations and understandings of what children know and can do, revelling in the newly revealed richness of children's responses to problems:

> So I think the thing that I love is when they just explain so clearly what they've done and when we've had to do the [assessment] I wouldn't have got these answers, I'd probably would have had to just guess and you always take the lower strategy. We're now working in the knowledge of what the

children do know, so I think that's been huge and it's taken away some of the frustrations that I've had with teaching. [AS3]

However, at this point in the project most of the teachers appeared acutely aware that this new insight into children's thinking required changes in their planning, their interactions with the children, and ultimately their role as a teacher and learner. As ES3 expressed it:

> My journey has been exactly the same as the kids … because I've been taught in a similar way where maths reasoning and strategies have been given to me and without much thinking behind it. So with this program I've had to really think about what the numbers are, how I can apply it, and I now need to work out all the different ways that the kids can work out what the problem is before I can give it out as a problem. … I know a lot more maths now!

Applying the AT lens, we propose that in learning how to utilise collaborative groupings within their classroom the object of teachers' focus has shifted from the initial focus on social groupings, behaviour management, and task differentiation—all factors related to mixed ability groups. At the end of the year the focus of teachers' learning was more on how they could better plan and provide opportunities that would explicitly address the mathematical learning needs of the students within a trajectory of learning across a topic or big mathematical idea.

Discussion and Conclusion

In seeking to understand factors within the activity systems that contributed to changes in teachers' grouping practices we are reminded of Hattie's (2009) claim that "stratification and streaming practices, likely have minimal effect on learning outcomes and profound negative equity effects" (p. 90). Noting that the effects of ability grouping are part of a complex web of factors, Hattie goes on to argue that "it seems that the quality of teaching and nature of students' interactions are the key issues, rather than the compositional structure of the classes" (p. 91). However, we question whether the quality of teaching and nature of students' interactions that was evident at the end of the first year of DMIC could be possible without the change to mixed-ability grouping practices.

Using an AT framework we saw how historically accumulating systemic tensions associated with traditional ability grouping practices, signifying who could and could not participate in mathematics, manifested themselves as disturbances and conflicts that were "observable in the daily flow of actions" (Engeström, 2016, p. vii). These disturbances, initially prompted by changes in grouping practices, included changes in task format, mathematical practices associated with mathematical argumentation, student engagement, student identity, teacher expectations, and cultural responsiveness, and the teacher role.

Whilst the transformation was built on our own praxis, from initially intervening in the teachers' existing grouping practices, the development of teachers' relational agency was central. Working with others supported them to expand the 'object of activity'. That is, relational agency enabled these teachers to engage in professional learning as an "expansion of their control over life conditions and action possibilities" (Roth & Radford 2011, p. 106). Indeed DMIC appeared to create genuine teacher interest in learning that was expressed variously as a feeling of "coming home' or 'an awakening". As CS1 proclaimed:

> As long as you keep on learning you keep on changing. I don't consider that I've arrived and I probably never will arrive but it just took one lesson to see the difference it made to the children and their engagement, to go right this is the way to go.

Driven by the motive to support more equitable participation for their students within the new grouping structures, we conjected that the continuous changes in the teachers' object supported their expansive learning about the work of equitable and culturally responsive pedagogies.

References

Alton-Lee, A., Hunter, R., Sinnema, C., & Pulegatoa-Diggins, C. (2011). *BES Exemplar1: Developing communities of mathematical inquiry*: Retrieved from http://www.educationcounts.govt.nz/goto/BES.

Boaler, J. (2006). How a detracked mathematics approach promoted respect, responsibility, and high achievement. *Theory into Practice, 45*(1), 40-46.

Civil, M., & Hunter, R. (2015). Participation of non-dominant students in argumentation in the mathematics classroom. *Intercultural Education, 26*(4), 296-312. doi: 10.1080/14675986.2015.1071755

Cohen, E. (1994). *Designing groupwork: Strategies for the heterogeneous classroom*. New York: Teachers College.

Dweck, C. (2006). *Mindsets: The new psychology of success*.

Education Review Office (ERO). (2013). *Mathematics in year 4 to 8: Developing a responsive curriculum* Wellington: Education Review Office.

Edwards, A. (2005). Relational agency: Learning to be a resourceful practitioner. *International Journal of Educational Research, 43*, 168-182.

Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.

Engeström, Y. (2001). Expansive learning at work: Towards an activity theoretical reconceptualization. *Journal of Education and Work, 14*(1), 133-156.

Engeström, Y. (2011). From design experiments to formative interventions. *Theory & Psychology, 21*(5), 598-628.

Engeström, Y. (2016). Foreword. In D. S. Gedera & P. J. Williams (Eds.), *Activity Theory in Education: Research and Practice* (pp. vii-ix): Springer.

Engeström, Y., Sannino, A., & Virkkunen, J. (2014). On the methodological demands of formative interventions. *Mind, Culture, and Activity, 21*(2), 118-128.

Golds, R. (2014). *Cross-grouping in mathematics.* (Master Thesis), Auckland University of Technology, Auckland.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Hunter, R. (2008). Facilitating communities of mathematical inquiry. In M. Goos, R. Brown, & K. Makar (Eds.), *Navigating currents and charting directions* (Proceedings of the 31st annual Mathematics Education Research Group of Australasia conference, Brisbane, pp. 31-39). Brisbane: MERGA.

Hunter, R. (2016). Learning by leading: Mentoring actions to support culturally responsive and ambitious forms of mathematics pedagogy. Keynote presentation for *Opening up mathematics education research* (Proceedings of the 38th annual conference of the Mathematics Education Research Group of Australasia. Adelaide): Adelaide: MERGA.

Ministry of Education. (2008). *Numeracy Professional Development Projects 2008, Book 3: Getting started*. Wellington: Learning Media.

Roth, W., & Radford, L. (2011). *A cultural-historical perspective on mathematics teaching and learning*. Rotterdam: Sense Publishers.

Timperley, H. (2011). *Realizing the power of professional learning*. Maidenhead: Open University Press.