Report from the Critical Mathematics Education Working Group meeting

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> This BSRLM working group met for the second time with the aim of discussing ways of promoting research that brings about positive social change through mathematics education. The meeting began with a presentation and discussion around student teachers' apparent reluctance to share their pedagogical rationale with learners and the implications of adopting open-ended approaches to learning mathematics for the achievement of working-class students. This was followed by a discussion of the aims of the working group, its structure and organisation, and the focus for future meetings and activities.
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> **Keywords: critical mathematics education; empowerment; equity; social justice.**

Making pedagogical rationale explicit to mathematics learners

A presentation and discussion led by Pete Wright:

Pete highlighted his recent experiences observing PGCE mathematics student teachers. He noted that, despite generally being able to articulate a clear and highly developed pedagogical rationale for their teaching approaches during post-lesson reflective discussions, they often demonstrated an apparent reluctance to share this pedagogical rationale with learners. Bernstein's notion of strong and weak 'framing' suggests that working-class children may be further disadvantaged by open-ended approaches to learning mathematics. The question then arises as to whether such pedagogical approaches should be avoided altogether, or whether teacher educators should continue to explore ways for student teachers to engage with these approaches whilst making their rationale more explicit to learners.

Boaler, Altendorf and Kent (2011) highlight a persistent and strong association between mathematics attainment and family income, whilst Jorgensen, Gates and Roper (2014) describe how Bourdieu's notion of 'cultural capital' explains how mathematics education contributes towards the reproduction of inequities in society. Alternative pedagogical approaches have been advocated by those with a concern for addressing issues of equity and social justice, including: collaborative problem-solving and discussion (Boaler, 2009); building on learners' real-life experiences (D'Ambrosio, 2006); conducting inquiries that enable students to develop understanding of their social, cultural, political and economic situations (Gutstein, 2006); and encouraging students to make decisions about the direction of their learning (Skovsmose, 2011).

Bernstein (2000) argues that school mathematics has strong 'classification', i.e. it is considered as separate from other subjects and has specialised rules for communication and behaviour. It also typically involves strong 'framing', whereby teachers are viewed as transmitters of knowledge and maintaining substantial control over the discursive and social order. Success in mathematics depends on students

being able to decipher the 'rules of the game' of the mathematics classroom, including the 'recognition rules', which require learners to identify relevant meaning from tasks set, and 'realisation rules', which involve formulating appropriate responses and legitimate actions. Framing is weaker, and hence the 'rules of the game' are less explicit, when learners are provided with more open-ended tasks. This suggests students from working-class backgrounds may be further disadvantaged by such tasks as they less readily create their own framing in order to make effective use of realisation rules.

Lerman and Zevenbergen (2004) outline a case of working-class students in the US who were disadvantaged by a model of inquiry-based teaching that used relevant and meaningful contexts. Such instances pose a dilemma for those advocating investigative approaches to teaching maths, in which learners are given less direction and greater autonomy, and who wish to achieve equitable outcomes. Lerman and Zevenbergen argue that "Some work needs to be done, both theoretically and practically, to mitigate the effects of invisible pedagogies - such as through modifying the strength of framing" (2004, p. 37). Teachers need to reflect carefully on their own expectations of students from different social backgrounds and become more aware of how these influence their responses to classroom tasks. This will help teachers to avoid interpreting misrecognition of implicit classroom norms as non-compliant misbehaviour.

Pete presented the following extract from his notes from a recent lesson observation and suggestions for making the pedagogical rationale more explicit that arose from the post-lesson discussion with the student teacher. This highlights an instance in which learners did not recognise the teacher's pedagogical objective (in this case generating cognitive conflict) and hence the teacher's aim of enabling students to appreciate the limitations of their current thinking for themselves was not realised.

Notes from lesson observation:	Discussion of how to make the pedagogical rationale more explicit:
Discussion moves on to area of a triangle and Student 3 offers an incorrect answer where the final step of dividing by 2 is omitted. *Teacher then draws a triangle and rectangle, one above the other, which both have base 10cm and height 5cm (sketch with base and height shown - drawn roughly to scale).* *Teacher: So you're saying these two shapes have the same area?* *Student 4: We have to halve it.* *Teacher: Excellent, so Area = ½ x base x height [writes on board]. Copy it. I want you to remember it because we're going to use it later. When you've finished copying it, have a go at question 3 [trapezium].*	*What's the purpose of the teacher drawing these two shapes one above the other and roughly to scale? Presumably it's to make it easy to see that they can't possibly have the same area (intuitively rectangle is bigger than triangle).* *Make it clear that current thinking (which leads to both shapes having equal area) leads to incorrect answer before focusing on correcting.* *How does cognitive conflict promote learning?*

Table 1: Extract from notes from recent lesson observation.

Pete then posed the following questions to the working group for discussion:

> What would happen if we encouraged teachers to make their pedagogical rationale more explicit to learners? To what extent might this address issues of inequity?

What is the potential for conducting collaborative research into these questions?

Who might be involved in conducting such research? Teacher educators? Experienced teachers? Early career teachers? Student teachers?

What might such research look like? Methodology?

What teaching approaches and classroom management strategies might be explored?

How might we assess the impact of the research on teachers and learners?

What might be the outcomes of the research? CPD module?

Members of the group were given some time to discuss the questions in small groups. The responses from the group included:

Teachers might keep their pedagogic rationale to themselves since they have an investment in holding on to power. Revealing their rationale may open it up to challenge and hence may result in a power shift.

Are students already aware of the pedagogic rationale and, if so, which ones? In mathematics, students may find it more difficult than in other subject areas to articulate the reasons why they are being asked to carry out tasks.

Is there any evidence that making the pedagogic rationale more explicit can address inequities? It might also be a question of making parents more aware of the pedagogic rationale and exploring how this might be achieved.

Using the word 'reluctance' implies teachers are making an active choice to hide their pedagogic rationale. This may not necessarily be the case, even if teachers are able to articulate their rationale in a conversation. There needs to be a greater understanding of classroom interactions before such a conclusion can be drawn.

At what point should teachers share the 'rules of the game'? Is there a danger that doing so will disrupt the teaching of the mathematical content?

Sharing the 'rules of the game' implies we are all playing the same game, which may not be the case. There may be different games going on that people are involved in. Therefore, in sharing these rules, we might need to make this multiplicity clear. This complexity suggests that sharing the rules of the game might not be easy.

There are ethical issues around labelling children as 'working-class'.

The evidence that inquiry-based learning further disadvantages working-class students should be questioned. There are some forms of 'inquiry-based learning' that are not 'genuine' inquiry. The 'script' that teachers are following needs to be interrogated. To what extent does guiding teachers with a 'script' promote equity and anti-racist teaching?

A lot of the pedagogic rationale might go into the planning of the lesson and there are many other complex processes, which mediate the delivery of the lesson and might explain the way it is 'performed', that need to be unpacked.

Pete responded with the following points:

The discussion encouraged him to think there was potential in pursuing the ideas and helped him to formulate further questions.

He was not aware of any evidence to show that making the pedagogic rationale more explicit would address inequity, hence the interest in researching this issue. He requested that people should let him know if they did come across any such evidence.

He accepted 'reluctance' might well be the wrong word. It might be more a lack of awareness of what the benefits of sharing the pedagogic rationale might be. The outcomes of a research project might help to make these benefits clearer.

The question of when to share the rationale is one worth exploring. A good example is when a teacher might pause from conducting group work in order to discuss with students what 'good' group work looks like.

Labelling children as 'working class' is problematic but so is ignoring 'class' altogether. The association between mathematics attainment and 'class' is stronger than that for other groups of students.

He highlighted that Bernstein's theories give a clue as to how working-class students might be disadvantaged by more open teaching approaches. These suggest it might be an issue with the way in which teachers went about implementing the pedagogies rather than the pedagogies themselves.

Aims, structure, organisation and focus for future meetings and activities of the working group

A discussion chaired by Heather Mendick:

In the second half of the meeting, members of the group were asked to consider the following questions relating to the future of the CME working group:

What should be its focus and possible future activities?

Should the group be for the 'self-betterment' of its members or more outward-looking?

How should the group be structured and organised?

How can we build momentum for the group?

Who might it aim to influence and how would it do this

The following definition of CME from the session abstract (based on discussions at the previous working group meeting) was read out in order to frame the discussion:

CME aims to identify and challenge ways in which mathematics is commonly used to maintain the status quo and reproduce inequities in society. It proposes an alternative and empowering conceptualisation of mathematics, which enables people to better understand their social, political and economic situations, and to advocate and bring about changes leading to a more just and equitable society.

The responses from the group included:

The distinction was made between promoting specific pedagogies and task design (such as that advocated by Malcolm Swan) and the intentions of CME.

CME should involve critique, i.e. a challenge to the ways that things are currently done, and change, since 'critical' implies an element of emancipation and action. We therefore need to be clear about our aims and the audience we are targeting.

Some of those present highlighted how they used to belong to a different CME group that met monthly in Sheffield, but has not existed for a while. The focus had been on members developing their own understanding of CME and sharing ideas.

We might think about this group as doing something similar, or we might think about it being more directed towards external audiences. It might be better to start with a modest goal, such as ensuring CME appears regularly on the agenda of BSRLM conferences, and allow it to grow organically into something more ambitious once the group is established. Being too ambitious to begin with may be setting the group up to fail and may result in losing momentum.

It should be remembered that those attending may take action around CME, or other critical issues, outside the meetings but action does not necessarily need to be a focus for the working group.

We might use the opportunities of the WG meetings at BSRLM conferences to pool ideas and generate collaborations, and then take ideas back to external audiences. It would be good to have opportunities to collaborate beyond the WG meetings.

The question was raised about continuity of the membership of the WG if it continues to meet only at BSRLM conferences. In order to sustain the WG, it would be beneficial to have an online forum where those who are not able to make the conferences could still engage with the discussions and ideas.

The group might wish to organise other meetings between BSRLM conferences, such as a CME conference, which would allow people to focus on CME in much greater detail.

Pete and Suman Ghosh (UCL Institute of Education) are happy to coordinate the group and would welcome help from anyone else who in interested.

There was consensus on the following:

The CME working group should be open to all and aim to draw in new people at BSRLM conferences.

We should start with modest goals of sharing ideas and facilitating research collaborations amongst those attending.

In order to encourage continuity and sustainability, we should establish some sort of on-line space (such as Facebook, GooglePlus, etc.) where those interested in the working group could continue discussions and activity between meetings.

The WG meetings should be structured initially in a similar way to this meeting, with a focused discussion around one aspect of CME, followed by more general consideration of what actions might be taken in order to drive the work of the group forward.

Conclusion

Pete asked those attending to let him know if they are interested in following up on the ideas presented in the first part of the meeting or if they are interested in leading a discussion on a particular aspect of CME at the next BSRLM Conference on 11th November at Liverpool Hope University.

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