

Describing Teacher Actions After Student Learning from Rich Experiences

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This contribution to the Maths in the Kimberley project symposium focuses on teachers' actions around the review of student work. Recognising that teacher actions at each phase of a lesson are connected, it is argued that there are two different but complementary rationales for effective reviews of student work, and two phases at which such reviews occur. The following uses a vignette from a lesson observed as part of the project to elaborate some of these actions.

Introduction

The pedagogies associated with directed teaching are clear and obvious (see, for example, Good, Grouws, & Ebmeier, 1983). On the other hand, if the teacher aims to facilitate the learning that arises from engagement of children with rich mathematical experiences, the pedagogies are more complex. The *Maths in the Kimberley* (MITK) project is examining some of these complex pedagogies, one aspect of which relates to the actions teachers take after students have engaged with such activities.

The following presents some actions that contribute to effective lessons, outlines two rationales for effective reviews of students work, and elaborates two phases at which such reviews occur.

The Nature of the Teaching We Advocate

The complexity of the pedagogies associated with organising rich learning experiences have been well documented. Sullivan, Mousley, and Zevenbergen (2006), for example, when describing lessons that have potential to address diversity of student readiness, proposed the following as lesson elements:

The tasks and their sequence: Open-ended tasks create opportunities for personal constructive activity by students, and appropriate of sequencing of tasks contributes to their effectiveness.

Enabling prompts to support students experiencing difficulty: Teachers offer *enabling prompts* to allow those experiencing difficulty to engage in active experiences related to the initial goal task, rather than requiring them to listen to additional explanations or having them pursue substantially different goals.

Extending prompts for students who complete the initial task readily: Students who complete the planned tasks quickly are posed supplementary tasks that extend their thinking on that task.

Explicit pedagogies: Teachers make explicit the usual practices, organisational routines, and modes of communication that impact on approaches to learning, types of responses valued, views about legitimacy of knowledge produced, and responsibilities of individual learners.

Learning community: All students progress through learning experiences in ways that allow them to feel part of the class community and contribute to it, including being able to participate in reviews and class discussions about the work. (p. 497)

Similarly, the MITK project proposes that lessons should include: rich tasks and activities, drawing on a “working as a mathematician” approach; group work to prioritise social learning; use of home language for student-student communication; high interactivity between students within the group work and the reporting back stage; and use and recognition of multiple representations allowing accommodation of diversity of approaches among learners.

The focus in this contribution is on the reporting back phase of lessons. To clarify aspects of the following discussion, an example that was used as part of a within class study as part of the project is presented. When teaching a class in a community school in the Kimberleys having initial experiences in learning subtraction, a problem was posed as follows:

I am thinking of two numbers. The difference between the numbers is 2. What might be the numbers?

This was recorded symbolically as $_ - _ = 2$. The point was that pupils could explore different aspects of a difference of two, and even recognise the patterns of difference that appear. In this class pupils had opportunity to make active decisions on the numbers they used and the way they recorded their results. The teacher emphasised to the students that there is more than one possible answer, and asked the students to search for patterns in their answers. The pupils worked productively on the task, and most groups were willing and able to produce multiple solutions, some of which were systematically organised. Making choices seemed to be engaging. Students worked in groups and had particular roles which contributed to the success of the activity. So far, this lesson had all of the elements of a successful experience. To realise the potential of this initial learning, the key was how the students' work was reviewed by the teacher.

There are Two Aspects: Mathematical and Social

All students had participated in common activities that could form the basis of common discussions and shared experience, both social and mathematical. These two aspects are reflected in Wood's (2002) emphasis on the interplay between children's developing cognition and the “unfolding structure that underlies mathematics” (p. 61) and “rich social interactions with others substantially contribut(ing) to children's opportunities for learning” (p. 61).

For the mathematical aspects, it is argued that students can benefit from either giving or listening to explanations of strategies or results, and that this can best be done along with the rest of the class with the teacher participating, especially facilitating and emphasising mathematical communication and justification. A key in such tasks such as this example is students having the opportunity to see the variability in responses (Watson & Sullivan, 2008). Cheeseman (2003) similarly argued:

the critical issue is to think about drawing mathematics lessons to a close in the most effective and interesting manner. It is difficult to do so well and quite complicated because it involves much more than simply restating the mathematics. It encourages children to reflect on their learning and to explain or describe their strategic thinking. The end of the session give the opportunity for teaching after children have had some experience with mathematical concept. (p. 24)

The second aspect of reviews at the end of lessons is the contribution they make to social learning. The second aspect is related to a sense of belonging, but is also connected to building awareness of differences between students and acceptance of these differences. Such differences can be a product of the students' prior mathematical experiences, their familiarity with classroom processes (e.g., Delpit, 1988), social, cultural and linguistic

backgrounds (e.g., Zevenbergen, 2000), the nature of their motivation (e.g., Middleton, 1995), persistence and efficacy (e.g., Dweck, 2000), and a range of other factors.

In the case of the subtraction experience, the teacher invited, in turn, each of the groups to report on their exploration. Note that the openness of the task gave students something to report on. One of these feedback instances was videotaped, reviewed and studied. This particular group produced 17 separate responses to the difference 2 question, although these were presented on a small whiteboard somewhat haphazardly.

In this group there were four students, and there were two reporters. The teacher first affirmed one of the responses, and asked the students how they found the answer to $19 - 17$. One of the reporters said "thinks". To seek to draw out a more extended explanation, the teacher commented that she had noticed that the group did not use their fingers. In response, this reporter said that they did, indicating that one student had put up 10 fingers, and the other had put up 9, at which stage this student then fell over (perhaps not liking being pointed at). This meant that the teacher was not able to solicit the key piece of information, which is how the students knew that the other number was 17.

The two aspects of lesson reviews were evident in the lesson. There was clearly a mathematical aspect to this review, which was that there are various ways of finding a difference of two, and having a strategy for doing this is helpful for students. Note that the teacher had intended this when choosing to use this activity. There is also a social dimension, in that students had worked in groups, and the group sharing emphasised the ways that the groups had negotiated the activity, and the reporting on an activity in which they had all participated highlighted the community that was represented by the classroom.

There are Two Phases to Lesson Reviews

It is helpful for teachers to think about the lesson review as consisting of two phases. The first is where the teachers solicit explanations from the students. In general terms, a possible approach is for some students with simple strategies to be invited to demonstrate those responses to the class. Next, the teacher might choose a student who had produced an organised response to summarise their answers to the whole group. Students who have different responses can be invited to contribute their answers. Cheeseman (2003) described the purposes as: gathering evidence; summarising; reviewing the focus; sharing common discoveries, celebrating learning; learning from each other; encouraging students to reflect on what they had learned; extending thinking; and building positive attitudes. Some of these are illustrated in the above discussion of the subtraction example.

The second phase involves specific actions by the teacher to ensure that the key findings from the explorations reported are sufficiently emphasised. One appropriate action is for the teacher to summarise successful strategies and the collective responses. The teacher can also seek to draw out patterns, identify commonalities, and promote the forming of generalisations. Cheeseman (2003) listed some of the key actions for teachers as providing evaluative feedback to students, flagging possible future activities, and reiterating the purpose of learning.

In the case of the subtraction lesson, a number of the groups reported of significant insights that could assist with aspects of subtraction in the future. While it was possible to experienced observers to infer the key insights and to extrapolate from the brief descriptions given, it was unlikely that the other groups of students would have seen those insights, or even have been alerted to their existence through the group reports. In this case, the teacher spent some time seeking to develop the pattern $19 - 17$, $18 - 16$, $17 - 15$, ... that the group whose responses were recorded used. Of course, if all goes well with the first

phase of the review then the second phase may not be necessary, but the teacher still needs to be aware of the possibility of the need for the second phase.

Summary

The MITK project is working with teachers on various aspects of the mathematics teaching, and one of the key guiding frameworks is the pedagogical approach. It is recognised that the pedagogical elements are complimentary, and all are necessary. This contribution has focused on just one aspect of these pedagogies: that of lesson reviews.

It is argued that there are two purposes for lesson reviews: mathematical; and social. It is also argued that there are two phases of lesson reviews: students reporting; and teacher synthesising. Teachers will be better able to cope with the complexity of student centred pedagogies if they are aware of the nature of each of the elements.

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