From their point of view – Middle Year students' perceptions of school mathematics[1]

By Dianne Siemon and Jo Virgona
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"maths…not easy, not hard, I want to learn, just need to get taught" (Brendan, Year 9)

As part of the *Middle Years Numeracy Research Project: Years 5-9* conducted in Victoria between 1999 and 2001, a number of interviews were conducted to ascertain students views about their experiences in relation to numeracy, what motivated their learning and what prompted them to disengage with the teaching and learning of school mathematics. The particular sample was selected to shed light on the specific teaching and learning implications for students 'who fall behind' (Siemon, Virgona and Corneille, 2001).

Trial Schools involved in the Project were invited to nominate 2 to 4 students (depending on the size of the school) from Years 5 to 9 as appropriate to be interviewed by the Project Team. Nominated students were expected to satisfy the following criteria. That is, they were regarded as

- fairly typical of "lower performing" students generally;
- performing at one or two CSF Levels below where they might be expected to be;
- prepared to talk to project team members about their mathematics/numeracy-related experience;
- 'under-achieving' in relation to mathematics.

Schools were advised that the Project Team was not looking for the very weakest students or students with severe learning problems as we were trying to understand what it was that hindered 'mainstream' student numeracy performance. The students who were nominated for interviews were largely representative of the larger school population in terms of social and language background.

42 students from Years 5 to 9 were interviewed. 23 were males, 19 were females.
The breakdown by Year Level is given in the table below. At least 2 students from each Trial School were interviewed in July and August of 2000.

	Year 5	Year 6	Year 7	Year 8	Year 9
Male	6	4	4	3	6
Female	6	4	4	1	4

The interview comprised a brief introduction aimed at putting the student at ease and exploring his/her beliefs about mathematics. A short Likert survey was used to document student's beliefs about themselves in relation to school mathematics. The second part of the interview involved asking students to reflect on their experience of doing the assessment tasks for the project. In some instances, this meant showing the

[1] Selected excerpts from Siemon, D., Virgona, J. & Corneille, K. (2001) *Report on the Middle Years Numeracy Research Project: 5-9*. Melbourne: DEET

student the relevant Student Numeracy Performance Tasks. Students were asked to nominate those items that they found relatively easy and those they found 'hard' or 'harder'. They were then asked to choose one or two tasks to solve. The interviewer asked further questions to elicit students reasoning and understanding depending on the student's response. Where students showed some reluctance to proceed, the interviewer reverted to a set list of questions designed to elicit students understanding of key areas identified by the Phase 1 data.

Interviews were generally arranged during class time but not necessarily when mathematics was scheduled. They were conducted in an Interview Room or a small room away from the classroom and varied in length from 40 minutes to an hour. A selection of the interviews were videotaped, all other interviews were audio-taped. Student work samples were collected where generated.

The analysis of the transcripts, yielded a rich description of the experience of those students referred as 'typically weak' or 'at risk' students. For instance, the vast majority expect school mathematics to equip them for the future. They believe that mathematics is important and that teachers of mathematics are primarily responsible for ensuring that they have access to opportunities to learn mathematics. For students who 'fall behind', the quality of teacher explanations is seen to be one of the most important factors affecting their learning of mathematics. However, the quality of explanations depends as much on the listener as the speaker. To participate in the conversation, to appreciate what is being said, students need to be able to access relevant prior knowledge and be disposed to engage in the conversation.

Engagement is a consequence, not a cause, of understanding. It is also closely related to past success. That is, students are willing to engage in the task of learning and applying mathematics to the extent that they believe they understand what is required of them and they experience some success. This suggests that inviting engagement is more about meeting students 'where they are at', than providing 'more of the same'. To be able to do this teachers need accurate and reliable knowledge of students, what they know and how they know it, and a deep understanding of the pedagogical tools needed to involve students in the enterprise of learning mathematics.

The distinction observed by Marr (2001) in relation to talk in adult numeracy classrooms, that is, the *opportunity to speak* and the *means to speak* appears to be relevant to the issue of student engagement. While schools and teachers need to ensure students are given the *opportunity to engage* through the selection of appropriate content and the use of a variety of teaching approaches, this on its own is insufficient. Students also need access to the *means to engage*. That is, how to read, write and speak mathematically, how to participate in the conversation and text of mathematics. While this requires some focussed attention on the key underpinning ideas such as place-value and part-whole relationships, teachers also need to deal directly and overtly with the ways in which mathematics is represented and communicated, the models and symbols used to explicate mathematics. From the students' point of view the most important contribution teachers can make is to communicate mathematical ideas and texts effectively *to them*, on a one-to-one basis where needed, to help them build shared meaning. This message is overwhelming and cannot be ignored.

Because disengagement tends to be associated with poor learning outcomes, it is often assumed that engagement will lead to improved outcomes and that engagement in mathematics learning is about making maths fun, relevant and "not boring". While adopting an expanded range of non-text based teaching approaches is clearly favoured by these students and more likely to engage them as learners, this on its own is insufficient if it does not address, support and enhance student understanding.

Disengagement is a consequence of not understanding the task and lack of confidence derived from the experience of repeated failure. This suggests that mathematics teaching and learning needs to focus more on *opportunity to engage* through negotiating the *means to understand* the texts of mathematics, and by knowing where students are at and how to scaffold and extend their understanding. The focus should not be on 'relevance' or 'fun' for its own sake. Rather, the focus should be on ensuring students understand and they experience some success.

The following propositions were derived from the student interview data with respect to students 'who fall behind'. They have been loosely grouped into statements about students, teachers and teaching.

- Students believe that mathematics is important and relevant.
- Students generally want to learn and be able to apply mathematics.
- Mathematics is not perceived to be as 'boring' or irrelevant as is often assumed.
- Students are prepared to accept some of the responsibility for learning
- The most critical element in their learning from the students' perspective is the quality of teacher explanations, in particular, the capacity of teachers to connect with their level of understanding and communicate effectively.
- The teaching focus needs to be on identifying and scaffolding student's learning needs.
- Accurate and reliable assessment is essential to identify where to start teaching.
- Extensive professional development is needed to equip teachers of mathematics with knowledge and skills to probe students understanding, support conversations about the ways in which mathematics is represented and used and to scaffold students' mathematical thinking.
- 'Traditional' text-only based approaches are seen as a major impediment to engagement and successful learning.
- Student engagement is related to capacity to read, write, speak and listen to mathematical texts (communicative competence). That is, capacity to understand and access the forms of communication used in mathematics
- Success is crucial to engagement.
- Students would prefer more one-on-one assistance.
- Students prefer mathematics classes to be activity-based (that is, games, manipulatives, investigations), deliver success, involve problem solving, and be conducted in a constructive and positive manner.
- Relevance is about connectedness, it is not necessarily about immediately applicable, 'real-world' tasks, although this is important. It is, at least in part, about being able to access what is seen to translate to further opportunities to study mathematics, 'real' maths, and access to 'good' jobs.
- Given the areas students find 'hard' are loosely connected to the same 'big ideas', specifically, place-value and multiplicative thinking, a logical starting point would

> appear to be to build on students' ideas about addition and whole number using applications in measurement to justify and extend students' thinking.

The observations reported here are supported by a recent large-scale study on student engagement conducted with a sample of schools in the United States. The study by Marks (2000) found that class subject matter was a significant factor in the engagement of elementary and high school students and that mathematics classes increased student engagement markedly for both these levels of schooling. However, mathematics was "no more likely than social studies to engage middle school students" (p.172). This suggests that the issue of engagement is considerably more complex for students in the middle years of schooling than it is for students in Years Prep to 4 or Years 10-12.

While personal background accounted for little of the variance in engagement among students, Marks reported that at all year levels,

> "positive orientation towards school, as reflected in school success, solidly predicts engagement; negative orientation, as reflected in alienation, just as solidly predicts disengagement" (p.173)

This confirms the importance of the experience of success in student engagement reported above. For 'students who fall behind' success can only come with recognition of where these students 'are at', the setting of appropriate standards and targets, and interactive teaching aimed at scaffolding their understanding to higher levels of performance.

Authentic instructional work was another factor that was found to contribute strongly to the engagement of all students. Authentic work as described by Marks

> "involves students intellectually in a process of disciplined inquiry to solve meaningful problems, problems with relevance in the world beyond the classroom and of interest to them personally " (Marks, p. 158).

This supports students' views about effective mathematics teaching and learning. That is, activities which they understand sufficiently enough to participate in and contribute to, which involve them in 'real' work and which they perceive to be relevant by being of interest *to them*. Where 'of interest to them' might be as much about accessing mainstream maths as it is about solving somebody else's 'real-world' problem.

The third factor found to be a strong predictor of student engagement was systems of social support.

> "A positive school environment is favourable to learning by being normed for respect, fairness, safety, and positive communications. Such an environment enhances the engagement of students at all grade levels. Similarly, supportive classroom environments, in which students experience high levels of expectations and receive help from teachers and peers, promote the engagement of all students" (Marks, 2000, p. 174)

This supports a range of students' views about the importance of access to more knowledgeable, approachable others, quality explanations and supportive classroom cultures where it is possible to work without fear of retribution or being made to feel a fool.

References:

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