Enhancing student students self regulation in middle years mathematics classes

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Abstract

One type of intervention to enhance student self regulation is related to learning in specific content domains. This paper describes interventions that relate on one hand, to the type of task that teachers use as the basis of mathematics teaching, and on the other hand, ways of increasing student choice and control within mathematics classes. This intervention has consisted of a group of project mathematics teachers planning units of work together, and the monitoring of the implementation of the unit via student assessments, student work products, teacher interviews and classroom observations. We found that opening up tasks creates a different sort of classroom dynamic, and allows greater attention by the teacher to student choice, student creativity, thinking and communication.

Introduction

One type of intervention to enhance student self regulation is related to learning in specific content domains. This paper describes interventions that relate on one hand, to the type of task that teachers use as the basics of mathematics teaching, and on the other hand, ways of increasing student choice and control within mathematics classes.

The following is a report of an aspect of the collaboration between two teachers who are part of a broader project involving teachers in three schools, and researchers from Monash University, La Trobe University and Australian Catholic University. We are seeking to understand better factors that influence Year 8 students' orientation to learning mathematics.

The type of tasks is important

The overall project is examining learning in English, mathematics and science, and developing interventions that enhance students' capacity for self-regulation. An underlying assumption of the project is that students' approach to learning directly influences their achievement, both in the short and long term. Dweck (2000) described two distinct learning approaches: those characterized by mastery goals; and those associated with performance goals, and our intention is to encourage the development of mastery goals. Students with mastery goals:

- tend to have a hardy response to failure;
- remain focused on learning skills and knowledge even when experiencing challenge;
- do not blame others for threats, and do not see failure as an indictment on themselves; and
- believe that effort leads to success and take pride in successful effort.

The mathematics aspect of the project is focusing on the types of classrooms tasks and perspectives on curriculum. The overall approach is based on the work of Ames (1992) who argued that teachers can influence students' approach to learning through careful task design. Ames suggested that tasks should include meaningful reasons for students to engage, perhaps through being personally relevant, that it is desirable that students feel a sense of control, and that students should experience a variety of task types, including those that foster social awareness. This complements suggestions from Gee (2004) that tasks be able to be customised to match the readiness of the learner both for those who experience difficulty and for those for whom the core task is not challenging.

The fundamental assumption, as argued by Ames (1992), is that teachers can influence students' approach to learning through careful task design. Ames suggested that tasks should include meaningful reasons for students to engage, perhaps through being personally relevant, that it is desirable that students feel a sense of control, and that students experience a variety of task types, including those that foster social awareness. This complements suggestions from Gee (2004) that tasks be able to be customised to match the readiness of the learner both for those who experience

difficulty and for those for whom the core task is not challenging. As part of the interventions, we have worked with teachers on the design of tasks that increase student choice and control, are varied, and are personally relevant.

The process for the intervention

The mathematics teachers involved in the project are working collaboratively to explore alternate approaches to teaching mathematics that involve greater student choice in determining both solution type and strategy. The intention is to encourage student decision making in the focus and approach to learning, and to communicate an impression that the choices of the students matter, which has the potential to promote engagement. Teachers are also encouraged to make their goals more explicit, especially when the goals involve problem-solving, trial and error strategies, and using activities in which the mathematics is embedded. We suggest that it is more likely that students will engage metacognitively with a task, and appreciate the role of effort, if the task cannot be solved by recourse to a previously taught method, and which requires some sustained effort to complete.

So far, among other things, we have worked together on developing four units of work, that are basically a collection of the types of tasks that might foster student engagement, carefully sequenced. After the teachers had chosen the topic, some suggestions were made by the researchers, generally drawing on some possible open-ended questions. Based on the suggestions, the teachers developed a coherent unit of work that incorporated a range of types of tasks, including open-ended approaches, and some that used technology in creative ways.

Choosing tasks to enhance self-regulation

For tasks to foster student self-regulation and other attributes like persistence, the tasks need to:

- be unfamiliar, to reduce the chance that students will rely on a known strategy, and therefore will have to work out how to do it for themselves;

- be challenging, so that students have to struggle toward a solution, and experience the joy of success;

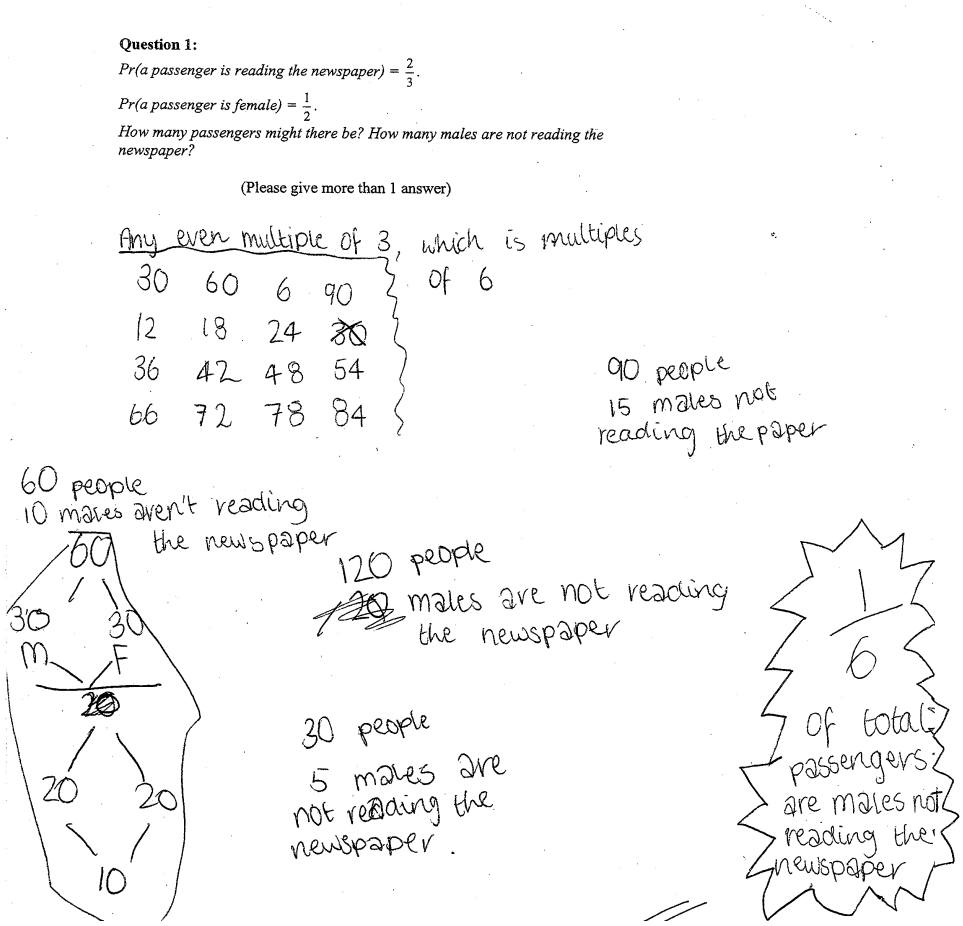
- allow choice, not only to foster engagement (since choice is motivating), but also to provide students with something interesting to talk about once they are reviewing their solutions.

We have found that open-ended tasks can do this, if matched by the appropriate pedagogies.

To illustrate the ways that open-ended investigations create powerful opportunities for learning, the following is an example of one of the tasks that was used as part of the unit. The task was posed as follows:

> *On the train to Melbourne, the probability that a passenger is reading a newspaper is 2/3, and the probability that a passenger is female is 1/2. How many passengers might be on the train? How many males are not reading the newspaper?*

In responding to the task, the students gave diverse possibilities for the passengers on the train, but all students gave the balanced response. The following is an example of the work of one group of students



In this case, the students have seen the possibility of a range of possible responses, a range of forms of representation, and have started to generalize the proportions of males not reading the newspaper.

In problems such as this, the responses of the students give the teacher opportunities to introduce a range of important ideas about representations. For example, the balanced response would look like (assuming 60 people on the train) the following, using two way tables as the form of representation.

	Read newspaper	Not read newspaper
female	20	10
not female	20	10

The challenge was to encourage students to investigate whether, for this number of passengers, there are other possible answers for this as well. For example it is possible that the distribution could be:

	Read newspaper	Not read newspaper
female	30	0
not female	10	20

The power of such investigations is in the examination of the scope of variability of the responses (see Watson & Sullivan, 2008).

Conclusion

The purpose of the collaboration was to work together on planning significant units of work, addressing the topics that form the basis of the curriculum in Year 8. There were three aspects of the units. First, that posing open-ended tasks allowed students to made choices, which is intended to be engaging. Second, the activities, especially in the second unit, had a "real" dimension to them, which also has the potential to be engaging. Third, the problems are challenging. Our belief is that students cannot learn to persist and try hard, if the problems they are asked to do are too easy. While it is not clear whether the units have had an impact on the learning of the students, the students do seem to have been more engaged in their learning and more willing to make suggestions about mathematical possibilities.

Another key outcome is that the development of units of work contributes to the building of a mathematical community among teachers. The teachers involved report that the planning and review of the units provides an ideal way of stimulating discussion with other teachers.

References

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