INQUIRY BASED LEARNING, INTERVENTION METHODOLOGY & THE QUEST FOR THE AUTONOMOUS LEARNER

Abstract

Learners learn, teachers teach but the cognitive overlap varies from learner to learner. Teachers intervene with learners’ learning in an attempt to help them converge to a set of National Outcomes which students pass or fail. What if teachers worked to promote student initiated interventions? Can students learn to regulate, personalise and become more flexible in how they learn? What methodology supports this endeavour? How do we actively change the roles traditionally held by students and teachers?

Since 2007, the Mathematics and Abstract Thinking (MAT) team at the Australian Science & Mathematics School (ASMS) have engaged in an action research process focused on the development of student metacognition within a mathematics learning environment. Although the program has cycled through multiple iterations of refinement, the following principle elements have remained at the core of its design.

1. Reflection through journaling: Writing about learning helps students to identify their strengths and challenges. Students write a journal to investigate and explain the progress of their mathematical and metacognitive learning. The journaling process requires them to respond at each level of thinking suggested by the revised Bloom’s Taxonomy: Remembering; Understanding; Applying; Analysing; Evaluating; and Creating.

2. Inquiry: Framed within a Community of Thinking (Harpaz 2005), student research/inquiry culminates in their response to a fertile question, called a concluding performance. A fertile question is open, undermining, rich, connected, charged and practical.

3. Collaboration: The learning environment promotes student learning with and from each other.

4. Integral Learning: Atkin (2000) suggests the integration of multiple ways of knowing in her Integral Learning Model. In mathematics this means that student experience should extend well past the drill, practise and predictable problem solving found in traditional text books. The ability to think intuitively, holistically and creatively is practised along with emotional and interpersonal thinking.

5. Flavell (1979) suggested three types of metacognitive knowledge: Person variables; task variables; and strategy variables. The Integral Learning Model is used to facilitate the construction of metacognitive knowledge. Students complete their individual thinking preferences profile and are then supported to consider the kinds of strategies that might help them be more successful at tasks that require thinking styles that fall outside of these preferences. Care is taken to reinforce a model of personal growth in contrast to ‘labelling’ and ‘pigeon-holing’ student potential.

Rather than the teacher directing the class from the same point in the textbook, students are presented with a CML. The CML is a set of differentiated Core Mathematical Leanings that relate to a particular fertile question and identifies the factual and procedural knowledge that the students need to learn to answer the question. The students identify which items they know well, which ones they need more practice in and which ones are new to them. They use available resources (see below) to build a portfolio of their understanding. This allows students to personalise their learning by starting from what they know already, to build their understanding, and to choose the resources and the learning style.

As well as demonstrating that they have learnt in identified Core Mathematical Leanings, students reflect on their learning through the Journal. The journaling process requires them to respond at each level of thinking suggested by the revised Bloom’s Taxonomy: Remembering; Understanding; Applying; Analysing; Evaluating; and Creating. In this way, the students’ conceptual knowledge is developed through reflecting on their learning thus building both the mathematical and metacognitive knowledge needed for exploring unfamiliar mathematical problems. Over time, students are expected to develop their abilities to research, understand and compile these journals autonomously. Reliance on teacher direction is strongly discouraged. Students can use reference books, the internet, interactive software, design their own investigations and consult a variety of people, including their peers, their teacher and any other sources of knowledge to assist them.

Inquiry and collaboration are fundamental to students’ core mathematical learning. Group inquiry projects are designed using the Integral Learning Model. Each group can select a different topic based around a theme. Their inquiries need to integrate the multiple ways of knowing to produce a product. The members of each group must collaborate and are expected formulate agendas and keep meeting minutes. A culture that promotes group learning and decision making is favoured over delegation and the isolated completion of identified sub-tasks. Groups are also encouraged to fully exploit the specialised talents of their group’s members. For example, while the whole group might design and critique the content of a flash animation product, the bulk of the
construction might fall on a particular member with those particular skills, while other members work on aspects of the project that reflect their talents. This model also allows peer leadership and cadetship with, for example, the flash animator taking on an interested apprentice.

In this context, autonomy is seen as the ability to make decisions about their learning and that the better developed their metacognition, the more options and better decisions they will be able to make. They will require less teacher intervention because they have more ability to direct their own learning. They will be able to personalise their learning by negotiating and co-constructing their learning environment to meet their individual needs. As an example, a student might use their metacognitive knowledge to solicit an activity for a particular learning outcome that supports them as a more visual learner, or suggest an altered treatment of an outcome in their journal that is more in line with kinaesthetic knowledge of a concept. Moreover, recognising their preference for a particular learning approach, they may request support, or otherwise elect to attempt to learn through an alternative approach in order to increase their flexibility.

As the fourth year of our Action Research draws to a close, we are still reflecting on this inquiry based learning environment that we have constructed and making recommendations for 2011 and beyond.

Of most obvious concern are the students who either oppose or find difficult in the freedom and responsibility of the learning environment. Some do not value metacognition focussing primarily on performance on tests and readiness for the external examinations in year twelve. Others are overwhelmed by the repositioning of the bar for success in mathematics. With some ten years of learning about what school mathematics is and is not, the MAT program can appear to be ‘not’. Successful students are not necessarily those who listen to the teacher, complete the text book activities, study a practise test or other revision activity and then perform on a closed set of mathematical skills in a test or other directed activity. Previously, highly successful students have been "accelerated", given the next year level’s text book to work through independently, rather than challenged to think more deeply about the purpose, worth, flexibility and connectedness of the knowledge they are constructing.

Learning is not necessarily sequential, orderly and predictable. It is not efficient, often requiring drafting and redrafting, containing mistakes that are not as easily detected as a discrepancy with the back of the book. A student could be far down the wrong track before realising a misconception. It might be messy. The teacher is more likely to tell you about your options than what to think or do, or better still, write down. This can be interpreted by students as teachers being unwilling to teach. This situation can be further comprised if a teacher overestimates how far the bar can be positioned away from the student and still allow them to engage productivity with the task. Furthermore, when a student does not have the skills and disposition necessary to negotiate the learning environment they may give up altogether.

These issues were highlighted with high staff turnover that occurred recently, resulting in the need for more careful management of this learning environment. In order to more easily explain the learning context and inform student and teacher activity, the following model has been developed.
In an inquiry based learning environment, students work to strengthen their relationship with the discipline. As discussed previously, at the ASMS this is through the interrogation of a fertile question. Interventions are activities or actions that support learning, both of discipline based outcomes and outcomes focused on the learner and their learning.

“I would prefer a view of teaching which emphasises that the role of the teacher is to intervene vigorously and systematically;” (Wilson 2003)

Interventions can be considered directed, scaffolded or responsive. Directed interventions are usually mandatory for at least a proportion, if not all of the cohort. These are planned interactions that lay the foundations on which the learning is built, whether it is about the learning of the discipline or the learning about the learning. Scaffolded interventions support students to learn in groups or on their own. They might require the development of particular product types or the communication of particular thoughts or ideas. Alternatively scaffolded interventions may be designed to promote understanding of a specific outcome. Responsive interventions are those that are more spontaneous in nature. A teacher might observe a particular misconception and design a learning interaction or a student might seek particular guidance or clarification and request a particular interaction to occur. Responsive interventions could arise from directed or scaffolded interventions or elsewhere.

Learning about learning, or metacognition, is used to promote growth in student initiated intervention and decrease the reliance on teacher initiated intervention, thus increasing student autonomy in the learning process.

Explicit tuition about learning technologies helps students select, collect, discover more efficient and productive strategies. The strategy seeks to help them self-regulate their interaction with the disciplines, personalise their learning experiences, and extend their thinking type repertoire to become a more strategic and flexible learner. Self assessment is vital to this process and appropriate interventions need to be instigated to build capacity in this area.

Metacognition

Overtime is would be desirable for the teacher initiated to decrease in favour of student initiated interventions and the discipline specific interventions to decrease in favour of metacognitive interventions to support students growing autonomy. Responsive interventions could become more targeted, with students having more input into how intervention might occur.

“The one really competitive skill is the skill of being able to learn. [...] We need to produce people who know how to act when they're faced with situations for which they were not specifically prepared.” (Papert 1998)

In an environment that values student autonomy, in general, student initiated interventions are favoured over teacher initiated interventions and metacognitive interventions are favoured over those relating to specific discipline outcomes.
Conclusion

Traditionally it is the educator who largely coordinates and constructs a learning environment and experience, however it is the learner who determines what is learned. It makes sense then, that to develop students’ ability to successfully co-construct the learning environment and experience, has the potential to improve learning outcomes for individuals. For this co-construction to facilitate individual curriculum personalisation, students will need to develop autonomy as a learner. This new paradigm seeks a new methodology that is responsive to the needs of individuals and extends learner capacity for metacognition and autonomous learning. Intervention methodology offers a framework for research into how teachers intervene and how to encourage student initiated intervention.

References


