Pre-service teachers' views of the Maths Talent Quest (MTQ)

Connecting mathematical concepts to everyday tasks and experiences


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Two pre-service primary teachers share some of their experiences as judges of the 2016 Maths Talent Quest. Some examples of different entries are provided as well as why this type of activity can be valuable for students.

Many of us have memories of a classmate having an aversion to mathematics, failing to see how it could be useful in future endeavours. Why was this the case? Was it due to fear of the teacher? Was it the style of teaching? Or could it be due to the lack of relevance? We have all thought, "When am I ever going to use this?"

> Students need to learn mathematics in ways that enable them to recognise when mathematics might help to interpret information or solve practical problems, apply their knowledge appropriately in contexts where they will have to use mathematical reasoning processes, choose mathematics that makes sense in the circumstances, make assumptions, resolve ambiguity and judge what is reasonable. (Commonwealth of Australia, 2008, p.12).

In other words, mathematics needs to take on a real-world quality, and students need to be able to identify and connect the value of what they are learning within the classroom to life outside the classroom.

Ware and Stein (2012) explored a method of motivating secondary students by exposing them to videos presenting the mathematics used by professionals within the context of their day-to-day work. Following this experience, students extended their understanding of how mathematics could be invaluable in their future careers, and their level of enthusiasm and commitment to mathematics appeared to improve. Creating a connection between the mathematics learned within a classroom and its value to life in the outside world is critical to effectively engage students and foster their love for learning mathematics. The Maths Talent Quest (MTQ) is a great opportunity for students to harness the skill of linking their learning in mathematics to real world investigations, and answering the question, "When am I ever going to use this?"

What is the Maths Talent Quest (MTQ)?

The Maths Talent Quest (MTQ) is an annual event conducted by the Mathematical Association of Victoria (MAV) in Australia. The MTQ provides primary and secondary students with the opportunity to explore and present mathematical investigations related to everyday life, by researching a topic of their choice. Since the introduction of the MTQ in 1982, the key focus of this program has been to encourage students to delve into their own mathematical investigations in areas they find intriguing, in order to foster their passion and interest for mathematics. The MTQ aligns with the still relevant work of O'Daffer (1972), in that it emphasises that teaching mathematics is about helping children learn mathematics through practical application, rather than using a teacher-centred approach. The MTQ provides students with an opportunity to discover practical applications of mathematics, while supporting independent and/or collaborative learning in a fun and creative way.

Attard (2011) presents many factors that influence mathematics learning culture: family, technology, peers, curriculum, social interaction, relevance, instructional processes, task design, inclusivity, and student-teacher relationships. Several of these factors are addressed within the MTQ. The MTQ assists students to develop numerous problem-solving strategies, while developing students' research and communication skills. *The Australian Curriculum: Mathematics* (Australian Curriculum, Assessment and Reporting Authority, ACARA, 2016) aims to empower students to become critical citizens by furthering mathematical ideas that will assist them in personal and work life. Thus, programs such as the MTQ help to promote students' interests and appreciation of mathematics.

The MTQ provides students with a rewarding opportunity to explore their mathematical ideas either individually, in small groups or as a class. The structure ensures students are provided with an opportunity to choose and explore a topic that interests them, while developing their mathematical skills, and making connections to the curriculum (ACARA, 2016). The boundaries and depth of mathematical investigation is entirely up to the participants (students). The teacher guides students' investigations as a facilitator and mentor. A study conducted by Gilpin (2010) suggested that students feel motivated to find a solution to a given mathematical problem when there is personal interest and a clear understanding of the relevance to their lives. Gilpin (2010) adds that students, whether adolescents or adults, tend to avoid mathematical situations where they feel failure may be likely. As the structure of the MTQ allows for students to embark on their own mathematical journey, they are less likely to feel any sense of failure and are free to guide their investigation in a direction in which they feel confident and interested. Even if no solutions are identified, the basis of the project is on working out estimations or possible answers as part of the experience and results. This is in keeping with the concepts of Freudenthal's Realistic Mathe-matics Education (RME) (2002) as outlined by Zulkardi (2013) which emphasises that mathematics is a human activity that allows for students to explore and discover appropriate mathematical processes themselves. Students are also encouraged to discuss their project with family members as well as class members and their teacher.

MTQ 2016 in focus

Last year the MTQ 2016 was held from 1–16 August 2016 at Latrobe University, Bundoora. The competition decided to include pre-service teachers as well as teachers as part of the judging panel and we were fortunate to be asked to be involved as pre-service teachers. The judging process consisted of spending about 20 minutes reading the students' projects on display, such as written reports about their investigations, including charts and models. As pre-service teachers, we found it straightforward to use the MAV MTQ rubric and allocate a score across three broad headings: investigation process, mathematics focus, and application.

Many students demonstrated their knowledge of various mathematical concepts and strategies as well as the four proficiency strands outlined in the *Australian Curriculum: Mathematics* (ACARA, 2016). There were a vast number of investigations ranging from day-to-day activities, such as studies investigating the most popular type of pencil case within a class (Figure 1), or an analysis of how much sugar could be found in favourite foods (Figure 4), to mathematical investigations exploring the cost of refurbishing a dream house, or the relation of the moon and space travel. Findings were presented and reported using a combination of visual aids, reports, mathematical workings, models and diagrams.

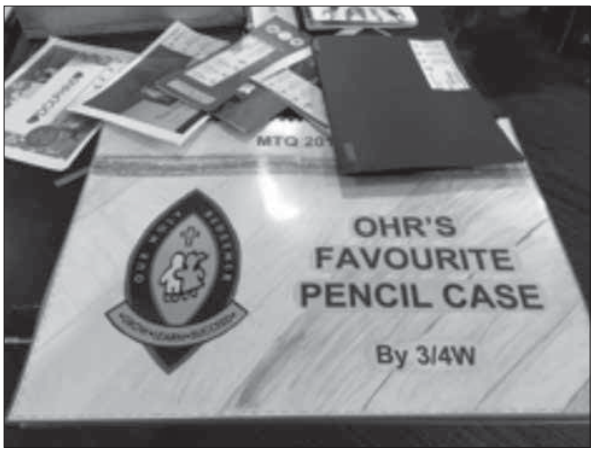

Figure 1. Investigation on favourite choice of pencil case (Year 3–4 students).

The detail in each entry suggested all students enjoyed the mathematical investigation. Students explored mathematical concepts and processes that many adults might not consider important or relevant. For example, one Year 3 student explored various ways mathematics could be utilised whilst playing netball (Figure 2). This entailed the student applying her knowledge on a variety of different mathematical concepts including angles, measurement of length, as well as data collection and analysis. One group of Year 3 students explored the different types of mathematics you might rely on when playing a game of tennis (Figure 3). Another student took on the task of trying to prove that global warming does in fact exist and looked extensively at temperatures of different regions whilst comparing them to levels of rainfall and changes across the seasons over time. Whilst these investigations may be a seemingly large endeavour for primary school students, it is the perfect opportunity for teachers and parents to help guide the student to facilitate their learning.

The majority of projects submitted showed evidence of mathematical calculations and strategies including reporting of results and findings.

Reys, Lindquist, Lambdin, Smith et. al., (2012) discuss the importance of writing in mathematics and suggest it helps students to gain insight into their thought processes and clarifies mathematical understanding

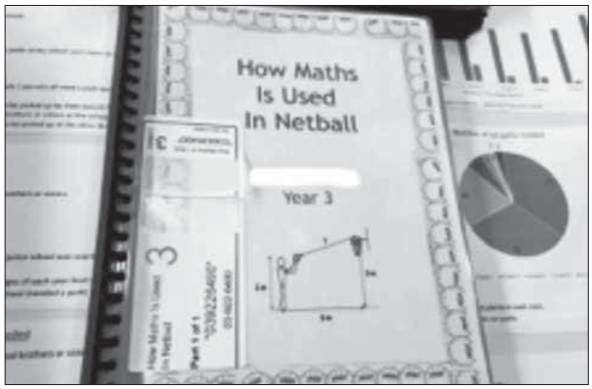

Figure 2. Investigation on how mathematics is used in netball (Year 3).

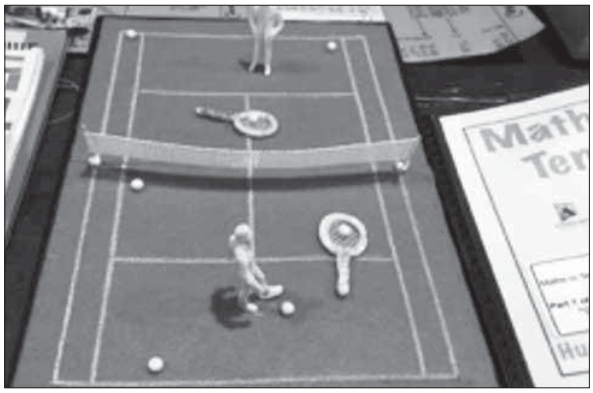

Figure 3. Model to accompany project on the use of mathematics in tennis (Year 3).

It also enables students to reflect on their mathematical journey and supports their thinking of alternative strategies. Being open to the possibility of alternative strategies and skills when approaching an investigation is an important skill when engaging in such a project.

The enjoyment of engaging in a real-life project that students could relate to and had interest in was clear from observing the work on display. This is in keeping with the findings of Attard (2011) who states, "The incorporation of tasks that mirrored life-like situations appear to have been a strong factor in engaging students in mathematics tasks…" (p. 372). This was obvious not only from the high-quality models and workbooks on display, but also from the depth of the investigations conducted.

Some of our favourite investigations

A Year 1 student produced a project entitled *Toy Car Science.* This investigation was presented as a poster with separate sections including results and graphs, and headings, "What did I do?" and "What did I learn?" The aim of the investigation was to see how far a toy car would travel depending on how far it was pulled back. The student pulled the car back at 3 cm intervals, repeating the test twice for each distance, then plotted the data into a table and column graph. There was no attempt to arrive at a prediction or hypothesis about the results. When comparing this investigation to that of a student in a higher year level, it seems that the concept of mathematical investigation is relative to what is important in a child's life. Whether it be how far the toy car travels, or the mathematics involved in playing netball, the main link was how students related the mathematics involved in their real-life activities. In the projects produced by higher year level students, there was more evidence of provocation and a hypothesis formed, as well as suggesting alternatives to further the investigation.

Another project we considered outstanding was an investigation undertaken by a group of Year 4 students on 'How much sugar is in your favourite food?' (Figure 4). The project focused on healthy eating and explored the amount of sugar found in day-to-day food items. In addition to their report, which included mathematical calculations, students had chosen to visually represent the amount of sugar found in each food item and present it as packs of sugar. The physical display of the sugar found in each food item enhanced their study and also provided students with the opportunity to develop their knowledge of measurement. The depth of the investigation displayed the students' level of interest while their results and discussion enabled them to reflect effectively on their initial aim and conclusion.

Reflection

One of the main understandings gathered from engaging with the investigations submitted to the MTQ as beginning teachers was the strong relationship between everyday activities and mathematical learning. As Reys et. al. (2012) suggest, involving students in the learning process develops greater mathematical understanding by making sense of what they are doing. This was clearly shown in the students' investigations, usually involving something from a familiar element of their lives. In a study by Attard (2011) into students' thoughts about mathematics, it was found that parents have significant influence over children's attitudes towards mathematics, especially in regard to valuing mathematics in future endeavours and employment opportunities. This is at least partially true in the MTQ, with most entrants acknowledging the help of their parents with their investigation.

From a pre-service teachers' perspective, the experience of being a judge at the MTQ was invaluable and quite thought-provoking. At the beginning of the judging process, we wanted to give full marks to all the young

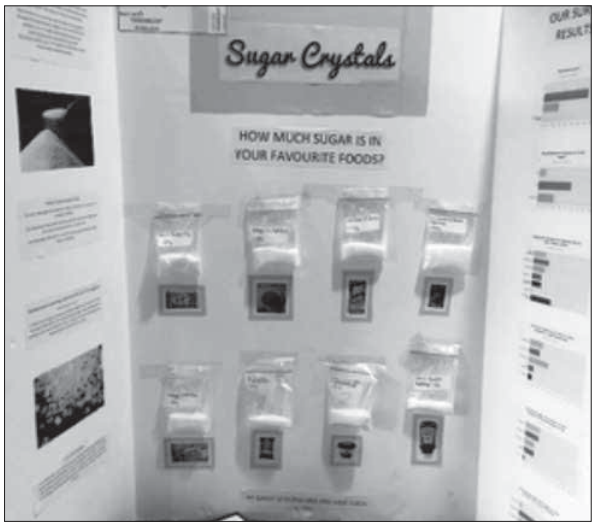

Figure 4. Visual aid to accompany investigation on how much sugar is in your favourite foods (Year 4).

learners for their effort and hard work in presenting their mathematical understandings. On reflection, however, some entrants had missed out on valuable steps during their investigative process, or not provided substantial reflections, and therefore needed to be marked accordingly to aid their future learning. Despite this, most entries showed evidence of all four proficiency strands: understanding, fluency, problem solving, and reasoning (ACARA, 2016). This suggests participants had the opportunity to cover the appropriate areas of the curriculum for their year level, and were improving their mathematical capabilities and skills.

Conclusion

The MTQ provided students with the opportunity to foster their love for mathematics by engaging in mathematical investigations of interest. Engagement in the MTQ also provides teachers with a valuable chance to encourage young learners to foster a positive attitude towards learning mathematical skills in a practical real-world manner, whilst working towards achieving the rationale and aims outlined by the *Australian Curriculum* (ACARA, 2016). The fact that projects needed to be planned, conducted and created by the students in a hands-on manner, whilst ensuring proper evidence was recorded and collated, ensured students not only gained data collecting skills but also a deeper understanding of mathematical concepts and its practical use. This is highlighted by an old Chinese proverb found in Rey et. al. (2012) which states: I hear and I forget; I see and I remember; I do and I understand.

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