

# numeracy

## in society and environment

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## Context

I teach in an eastern suburbs primary school located approximately 8km from the Adelaide city centre. The school is regarded as an old school, having been established in 1846. The school caters for students in Years 3-7. There are approximately 500 students enrolled at the school. Fifty percent of students are from non-English speaking backgrounds with 46 cultural backgrounds represented in the student cohort. The school's vision is to provide an educational environment that is supportive and success-oriented that prepares students for changing futures. The school follows an International Baccalaureate (IB) program that is integrated within the Year 6/7 curriculum. The school has a reputation for excellence in education, with literacy and numeracy scores above or significantly above the state average. In mathematics, the school advocates an investigative approach and the use of concrete materials.

## Background

I would be considered a very experienced classroom teacher having a career in education spanning 30 years. I currently work 4 days a week in a Year 7 class. I have taken on other roles in education over my teaching career (Literacy and Numeracy Coordinator, other student support roles, etc).

## School visit: Round 1

### Planning and preparation

When starting work in the DECS Numeracy in the Learning Areas Project my first numeracy unit was in the Society and Environment learning area. Prior to

developing this unit, the students completed a questionnaire on their attitudes to mathematics. Not surprisingly to me, the students rated mathematics as one of their least favourite subjects. For this project, the goal for my numeracy teaching was for students to come to consider mathematics as being all around them (like the character in the book by Jon Scieszka, *Maths Curse* who sees mathematics in every situation and mathematise every situation, for example, by calculating how many minutes one has to spare to catch a bus which leads to considering how many minutes in an hour, and so on). For the Society and Environment unit, I organised an excursion to the local War Memorial to coincide with an Anzac theme and developed a booklet of activities to supplement the excursion. I considered the Society and Environment numeracy statement in the South Australian Curriculum Standards and Accountability (SACSA) Framework that outlines the types of numeracy activities required for this learning area and felt that my students required further map reading skills, and so this was focus of one of the tasks in the booklet. I was also keen to include activities that would assist in promoting students use of tools and was also aware that many of my students indicated that they were not confident in their mathematics (as per the skills audit survey). I felt that the excursion would be a good way to enhance students positive disposition towards mathematics.

I emphasised working like a mathematician and working like an historian in the booklet. In preparation for the excursion, I engaged the class in discussions about what it means to be an historian and a mathematician, and what it means to work like these people; how they would approach various situations; what sorts of things would interest them. Also, prior to the excursion, students were reminded that they would continue to work as a learning team as they did during usual classroom lessons. In the classroom as part of the established classroom practices, students are allocated to groups of 4 and are individually assigned a role to ensure that their group works cohesively as a team. I have found this to be a successful classroom strategy which enables students to work together well in their teams.

Planned activities on excursion day included making drawings of various statues and monuments in cross-section; sectional diagrams; scale; volume; drawing 3D shapes in 2D form. The students were also required to make calculations of the number of soldiers who died in the war (by viewing the Honour rolls) and finding angles in a large floor design. In various parts of the War Memorial, students were directed to complete a range of activities. They took with them a range of tools, including metriloys (mini trundle wheels), rulers, tape measures, and protractors.

On the day of the excursion, it was raining. The students had to huddle under awnings of buildings on the other side of the road; huddle in the shelters; also, when I was giving instructions, background noise from traffic around the war memorial made it difficult for students to hear what I was pointing out at various places. Despite the persistent rain, the excursion went ahead as best it could. The students were observed using quite surprising and inefficient approaches to particular tasks. For example, rather than using an estimating or chunking strategy to determine the number of names on the Honour rolls, the majority of students were seen to count by ones. Also, when calculating angles of patterns on the floor tiles, students were trying to use their small plastic protractors and I realised that they were not really thinking about size of angles and reasonable answers.

In terms of mathematical knowledge, the excursion activities enabled me to see major gaps in students' knowledge in relation to specific tasks and activities particularly in relation to scale, drawing of shapes, measuring, strategies

for counting large collections, and particularly estimating. Reflecting upon the Society and Environment focus of the excursion, however, I realised that content related to this learning area was not highlighted. The students were still interested in war, in knowing about Australians place in the war, about where we came from and local identity. Drawing upon these ideas, I wanted to continue to develop this unit of work and considered a timeline activity, and a mapping of back to where students would be required to detail their anticipated daily progress in a planned journey between two capital cities similar to the trip planner activity shown on the professional development day.

## Post unit planning

I was concerned that the excursion had not focused specifically on relating to target outcomes of the Society and Environment learning area: Time, Continuity and Change. I felt that there had been opportunities for developing Mathematics at the War Memorial, but that these were not specifically about numeracy. Upon reflection on the unit to this point, I realised that it was more of an integrated unit organised around a theme rather than a Society and Environment unit that required specific aspects of numeracy.

I wanted some direction on developing a research question for my unit. It was suggested that I focus specifically on exploring how a Society and Environment unit could develop required numeracy. Suggested data sources for examining students numeracy development included (1) a timeline, (2) a reflective piece of writing that demonstrated students' understanding of large numbers, developed through considering the number of people who died in the war (data collected from the War Memorial excursion), and (3) a trip planner that contained details of how to go back to either a war site or place of origin (or similar).

Our school is fortunate to have a small War Memorial plaque next to the school grounds. A highly successful task required students to choose a soldier from the memorial and research his military record. Students then planned a pilgrimage back to the place where their particular soldier had died in northern France. This task enabled students to develop a wide range of mathematical skills including scale, mapping, calculating distances, reading timetables, understanding time zones and managing budgets. On this occasion, the numeracy components of the task supported and in fact, enhanced the Literacy and Society and Environment components.

At a school assembly, my students wanted to communicate both the massive loss of life and huge number of injuries suffered during World War 1 in a visual way. The students asked various classes to stand up to represent the soldiers who died or were injured. This required them to not only become more confident in working with large numbers but also develop a greater understanding of fractions and proportional reasoning. It was an extremely powerful way to help students of all ages to connect to the horrors of war.

## School visit: Round 2

The focus of the second unit I planned was Growth and Development. My experience teaching Year 7 students told me that this unit is usually an uncomfortable part of the curriculum for them. Rather than students wanting to know about sexual reproduction and physical body changes, I had noticed that students were particularly interested in how tall they will grow, and for boys, how their muscles will develop. Within this unit, I included DVDs from

the Human Body television series and showed students *The Raging Teens* and *The Miracle of Life* DVDs. However, the focus question of my unit was: How tall will you be? To start this unit, I provided students with an article that I had found on the internet: A short history of height. Before this, students were asked what factors they thought influenced how tall they would be, and I introduced information about hormones and growth spurts. From the internet article, the students created a timeline from the information given, and I noted that some students still had difficulty creating this representation. I found that the activity was an effective way to revisit scale.

One of the features of the article read by students was that it provided details of average height of the population by country and included data from Canada and the Netherlands. However, Australian data were not presented. I challenged the students to think of why this was the case and to develop a critical eye in terms of reading. I also provided students with growth charts and introduced the term *percentile*. Through this task they were interpreting graphs and scales.

In another activity, I provided students with information on *The Gray Height Prediction Method* (another resource I found on the internet) which provided a formula for students to use to predict their adult height. For students this was a fascinating activity, because they found that they had already exceeded the height predicted by the formula from the information they substituted into it. Students tried to analyse the formula in an ad hoc way as they suggested reasons for why it did not work. In future, I would make this a more focused analysis and direct students to research the formula, the year it was developed and the data upon which it was based.

The next part of the unit introduced the *Vitruvian Man*, with me providing background information on its development by Leonardo Da Vinci. Students investigated the proportions of Da Vinci's drawing of the *Vitruvian Man* and made comparisons to their own bodies. One student exclaimed: *Leonardo da Vinci says I'm not perfect!* Far from making students feel inferior, however, this activity drew them into an investigation that made them happy as none of them were of the same proportions as the *Vitruvian Man*. The activity involved body measurements and required proportional reasoning. I liked this activity because it held students' attention for the entire lesson and they were keen to compare their body measurements, naturally requiring and using mathematical knowledge of fractions and ratios. I thought that the unit was successful in terms of meeting the requirements of the Growth and Development topic. The focus on predicting one's adult height maintained student interest and proved to be an engaging way to approach the issue of human growth and adolescent development. The activities in the unit provided authentic contexts for the application of mathematical knowledge and skills and the use of tools.

With my pre-service teacher, we developed a Health unit that focused on healthy eating. The pre-service teacher asked students to analyse the nutritional content of popular breakfast cereals. Students quickly realised that some measures were given in grams, and some were given in milligrams, which provided opportunities for unit conversions. They used Excel graphs to display their data and were required to explain their choice of graph. Through this activity, students' confidence with graphing improved, as did their critical skills, not only in terms of the choice of graph but also in relation to judgments about the nutritional value of breakfast cereals. For example, many students were amazed at the amount of sugar in particular cereals. The pre-service teacher and I were satisfied with the richness of the activities undertaken by the students and the ways in which the activities made visible the inherent numeracy demands of this learning area.

## Final reflections

In reflecting upon my journey through the project, my pathway to being a numeracy teacher was not straightforward. I didn't really get it at the beginning. When I was first presented with the numeracy model, it was like looking at something with blurred glasses so that everything was out of focus. But by the end of the project I felt that everything had come into focus and it all makes sense now. The model has enabled me to see connections between the elements that comprise numeracy, and I can see how to embed numeracy in my teaching practice in a meaningful way.

In my first unit for this project, I realise that I took a contrived and decontextualised approach to numeracy. I developed a series of mathematical activities for students to complete on the War Memorial excursion. None of these activities had a real purpose. I understood that I should have focused on the (Society and Environment) learning area outcomes and look for opportunities to bring in mathematics within this context. For example, timelines would have been a natural inclusion in this first unit.

As a result of participating in this project, I have come to realise that numeracy involves more than mathematical knowledge and skills. I now appreciate the role of contexts in providing opportunities for students to develop and use mathematics skills and knowledge for a purpose.

I came to this project as an experienced and successful classroom teacher who incorporated literacy development in my teaching at every opportunity. I knew that numeracy should also be promoted across all learning areas, but believed that numeracy stemmed from proficiency in mathematics knowledge and skills and this had been the predominant emphasis of my mathematics program. Indeed, at the beginning of the project I looked at the elements of the numeracy model and saw them as a blur, in that I knew they were all important but felt that the model had little clarity to guide my planning for numeracy. My journey started by using a context to extract mathematical knowledge, with the result being an artificial imposing of mathematics in unnatural and irrelevant contexts (e.g., what pattern makes up the floor of the War Memorial when the focus of the unit was on history, heroism and the horror of war). Through critical self-reflection, I saw how the learning area provided the context, not the topic, and through the learning activities the numeracy elements of mathematical knowledge and tools could be developed. The context also enabled students to develop a critical orientation as they explored particular topics in depth (e.g., how many young men died serving the war? What percent of the population was this?). By developing mathematics knowledge through such meaningful contexts, I noted the growth in my students' positive dispositions towards mathematics and confidence in their desire and ability to apply mathematics as required. I now see the importance of all elements of the numeracy model that were presented at the start of the project, and am confident in developing units of work that integrate this vision of numeracy into my natural teaching style.