numeracy in Health and Physical Education

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Context

My school is in Cowell, a small coastal town in South Australia about 100 km from the nearest regional centre. The Area School has 180 students from Reception to Year 12. Often in such schools there are composite classes for Years 6/7 and 8/9; however, at Cowell these year levels are in separate classes, some with quite small numbers of students. (Middle school is Years 7, 8, 9.) The school grounds are attractively maintained, with well kept gardens and shaded areas for the students to play or sit. An outdoor learning area beside the Year 8 classroom was built with the support of federal funding obtained by another teacher and myself. It comprises a large concrete slab the size of half a basketball court, together with a separate shelter shed that has a concrete floor and a whiteboard on one of the walls. I use these areas for outdoor learning activities; the students and I enjoy getting out of the classroom.

The classrooms are in timber buildings grouped in Primary, Middle, and Senior clusters. The rooms are brightly decorated with posters and student work samples. All of these buildings are due to be replaced with new, prefabricated buildings to be brought up from Adelaide. This is a major refurbishment project, federally funded, that has captured the interest of the whole school community. The school itself is a community hub and enjoys strong support from parents. Many of the staff are long-serving members of the school community and there is generally an air of commitment to and connection with the school and its community.

Background

I have taught at Cowell Area School for around 20 years. My class for the DECS Numeracy in the Learning Areas Project is Year 8 (11 students), and I teach them mathematics, Health and Physical Education (HPE) and English. I was on leave in Term 1 of 2009 and thus unable to attend the Professional

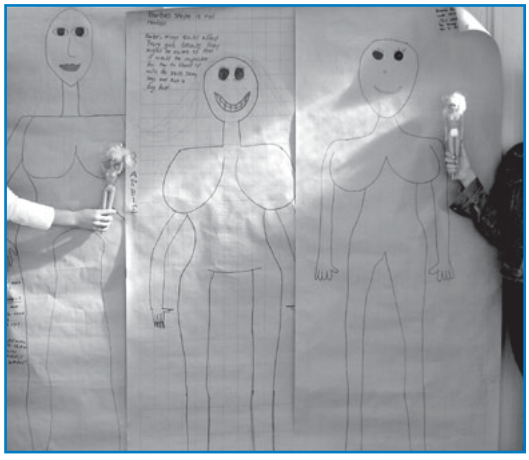
Development (PD) day at which the numeracy project was launched. Vicki, my teaching partner within the project attended and brought back information from the PD day for us to share.

School visit: Round 1

Planning and preparation

My initial thoughts were about planning a unit based on the novel *A Fortunate Life*, but I abandoned this idea because I thought a numeracy focus would take too much away from the story. Instead I developed a unit around Barbie and body image, triggered by an activity presented at the PD day. I incorporated this activity within the HPE learning area. I borrowed a Barbie doll from a colleague and noted that students' first reaction was to say that Barbie could not be real That s ridiculous; look how small her waist is! One of the activities I introduced to students involved them scaling up a Barbie to a version of the same height as an average 18 year-old Australian girl (164 cm). This information was obtained from the Australian Bureau of Statistics website and, in itself, was a point of interest with students who commented on how short this seemed.

Students spent a lesson drawing a grid (5 cm squares) on large sheets of Butchers paper in preparation for transferring an outline of a scaled-up Barbie to the grid. I was surprised how long it took students to draw these grids and mused that I could have used a grid on an OHT instead to save time. The Barbie activity was completed mostly in HPE but also referred to in Maths where students in a subsequent lesson on ratio commented that This is what we were doing with the Barbie thing! . The students worked in pairs and produced a poster/life-size drawing of Barbie together with annotations on: her proportions; whether her proportions were realistic; and what messages this conveyed about women. The models were displayed around the classroom and resulted in many interesting discussions.



My participation in the project, at that stage, increased my awareness of the numeracy demands of the various learning areas and how much time students need to deal with these demands. Previously, I tended to focus on the concepts of the learning area rather than its numeracy demands, and this meant I was not attending to students numeracy learning issues. Doing hands-on activities revealed some of the problems students had with numeracy. These included drawing a grid with 5 cm squares, which showed that some did not know how to measure using a meter rule, that is, they did not know which side to use, metric or inches or did not start measuring from the zero point (which could be at the very end of the ruler or a small distance from the end) or did not know how to mark units on the grid (putting the scale points in the middle of the side of the grid squares, instead of the ends). These

were all things that I expected students to be able to do, much like using a tape measure in HPE.

First lesson observation: Directed numbers

After meeting the project researchers for the first time (Merrilyn, Shelley and Vince), I launched into a traditional Maths lesson. The students were learning about Directed Numbers, something they often struggle with and a topic where I find it hard to explain using real life situations when using addition and subtraction.

I began the lesson by asking students to say anything they remembered about directed numbers. Students volunteered information such as moving to the right is positive and to the left is negative; the opposite of positive 1 is negative 1; temperatures can be above or below zero; East is positive and West is negative; and depositing money in the bank is positive while withdrawing is negative. A pretty good start! I then explained that the class would go to the outdoor area to work with a number line that they would draw on the floor slab with chalk. The aim was to work out how to add and subtract directed numbers. I demonstrated the method via a number line drawn on the blackboard, which was also illustrated on a handout I distributed to students. Students were to stand on the first number listed and face in the positive direction if the operation was to be addition or the negative direction if the operation was to be subtraction. They were then to walk the number of steps indicated by the second number, walking forward if this number was positive and backwards if it was negative. The number at which they arrived via this process was the answer to the problem. The handout provided a systematically developed list of problems involving adding and subtracting positive and negative numbers, including a long walk with seven operations in succession. Two questions then required students to describe any patterns they observed in their walks and to explain some of the rules they discovered while adding and subtracting.

After an initial ten minutes of teacher instruction, students moved outside to complete the activity. One drew a chalked number line and I gave instructions to another as this student walked a couple of problems. At this stage I felt like I had out instructed a sergeant major and I could see some of the students reeling from too much information!

After 30 minutes of outdoor activity the class moved inside and I asked students what they had been thinking and feeling during the activity. How did they know if they were on the right track? Students seemed willing to say they were confused, others simply said that the activity was fun. I explained to them that they had been using a model that would help them understand the thinking they would be doing in the next few lessons on adding and subtracting directed numbers. I drew their attention to the questions about patterns and rules, and asked them to try these for homework. I then modelled the number line representations of:

3 + +2 = 1
3 + 2 = 5
3 +2 = 5
3 2 = 1

and asked if anyone could tell me something about what they saw, reiterating that this was to be done for homework. I find that sometimes students are able to clarify their learning by moving (literally) through the steps. The problem was there may have been too many steps for some to follow.

The mathematical knowledge dealt with in this lesson was addition and subtraction of directed numbers. At the start of the lesson I elicited some of the real life contexts in which directed numbers appeared. I used a representational tooln umber lines drawn on the blackboard and on the groundt o help students create patterns and explain rules concerning these operations on directed numbers, although I did not have time to elicit and evaluate students ideas during the lesson. At one point I addressed students dispositions towards mathematics and the learning activity by asking them how they felt about the lesson. There was no scope in the lesson for developing a critical orientation to this subject matter, something I have tossed around in my head many times but found difficult to implement at this stage. Overall this seemed a bit like another pointless maths lesson, taught just in case and not just in time. I knew I had missed a vital point here.

School visit: Round 2

Planning and preparation

After much reflection I decided to do some things differently. The Year 8 class was unique in that it had a small number of students with few behavioural issues and it was an ideal time for me to change. One of the goals I set myself was to take a more exploratory and investigative approach, particularly in dealing with teaching aspects of numeracy across all learning areas. In the past I had taken an approach that left students with little freedom to explore a topic and to ask their own questions (too busy getting on with content). I had made the realisation that the nature of numeracy means that students needed to learn how to explore an issue or problem and then to make choices or decisions. Within any real world context these choices and decisions need to be justified. I always knew this but could never justify the time it took to teach. As part of this less direct approach, I intended to encourage students to support each other in their exploration of a problem or topical issue. I believe there is great value in fostering student interdependence that can be utilised in other aspects of everyday life.

Between research team visits I worked with the students on a project in HPE where we investigated media coverage of sports. We collected sports reports from an Adelaide newspaper each day for a week and then measured and calculated the area of the space devoted to both female and male sports. The students acknowledged that there was not an equal representation given to female and male sports in the media and we had an interesting discussion around this topic. At last I had begun to address numeracy in HPE and it seemed to create a deeper student understanding of the concepts and processes covered.

I also began work on a project in HPE where students were asked to investigate their physical activity during a typical week. This activity was measured through the use of a pedometer that the students were required to wear for one week. The collected data, that is, the number of paces walked or run, were entered into a shared Excel spreadsheet every day. It was my intention that students analysed their own data by using facilities available through Excel, for example, the graphing tool, and then for students to compare each others results. In the initial work on this activity I drew on the skills of students who were already competent in the use of Excel to assist other students with data entry and initial data analysis, for example, trying different types of graphs to represent their data. I was a bit apprehensive of this project as my experience with Excel was limited. I asked a colleague to give me some support and then relied heavily on students helping each other (and me!).

In an upcoming lesson, I planned for students to convert their total daily and total weekly paces into kilometres. The aim of this activity was to give students a sense of how far they typically walked in the course of a day or a week. The task was also designed to help students realize that the distance they walked was not determined by the number of paces alone as an individual s pace length was also a factor. When planning the work I was struck by the range of different mathematical concepts and skills that were embedded in the task, for example, the use of calculators, an understanding of decimal fractions and how to round results appropriately. I viewed the need to recall how to make use of these skills as a powerful way for students to reinforce previous learning and also to understand the integrated way in which mathematical skills are usually used in real world contexts.

Lesson observation: Measurement — Converting paces to kilometres

I began the lesson by outlining what students were expected to achieve. The introduction also included revisiting previous work on how to convert an individual s number of walking paces to kilometres, as well as directions for the activity that was to follow. When I asked the students to recall the conversion work they had completed in the previous lesson I did so via prompts and probing questions rather than direct instruction.

We then went outside to the footpath in front of the school where students were asked to estimate 100 metres from a common starting point and then walk to this position. After the students started walking to their estimated positions, the researchers and I followed the students while laying out a measuring tape. This approach had the effect of surprising students who had underestimated the distance as they could see we were catching up and then passing them. Students who overestimated the distance were also somewhat bemused to see us stop, well short of their positions, and just wait.

After calling all the students to the 100 metre mark, I asked them to estimate how many normal paces it would take for each of them to walk back to the starting point. Students were then asked to walk back to the start and to record their number of paces.

Once back in the classroom, I introduced a template designed to assist students to convert paces to kilometres. The template was displayed via the electronic whiteboard that was positioned at the front of the classroom. I began by filling in my own result: 119 paces. I then asked the students how to complete the conversion.

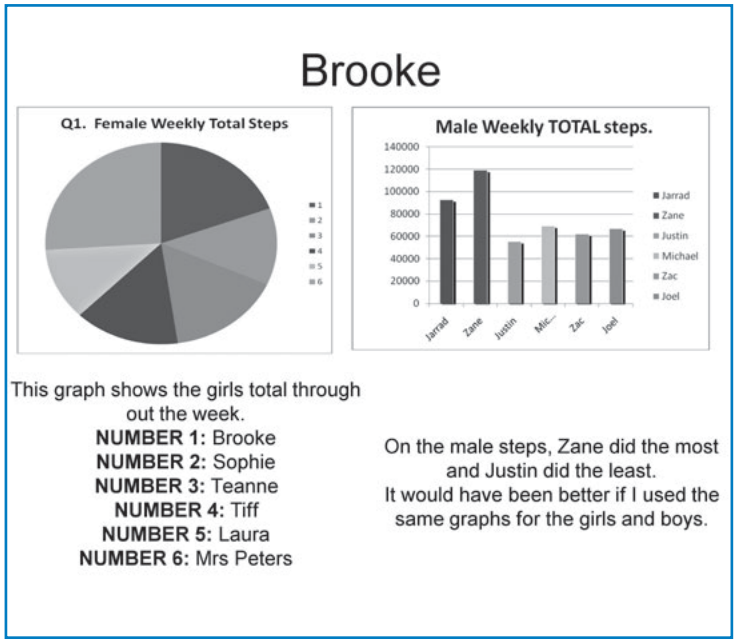
With a little support, via prompts and clarifications from me, the students developed an example which made use of a ratio approach.

119 paces = 100 metres
119 × 10 paces = 100 × 10 metres
1190 paces = 1000 metres
1190 paces = 1 kilometre

After this I displayed an Excel spreadsheet summary of students individual pedometer results that were recorded each day over a week. I asked students how they would convert their results to kilometres. Students found it difficult to begin this task so I again displayed the conversion template, entered my data and encouraged students to help me discover a method. After some discussion we produced the following result:

117 581 paces in a week.
From the previous calculation I take 1190 paces per kilometre.
So 117581 must be divided by 1190 to find the number of kilometres.

Students were amazed by the distance I had travelled in a week with one student exclaiming, Wow! That s nearly all the way to Whyalla!



After modelling the procedure, I asked students to complete conversions of their own pace totals to kilometres. Some students were able to proceed with this task independently while others required assistance. I supported students through questions and probes rather than simply telling them how to perform the procedure directly. I also suggested that students compare their kilometric distances with each other and to discuss why they were different and to check if their answers seemed realistic.

I finished the lesson by indicating the next session could include an investigation of the number of paces Usain Bolt takes during a 100 metre sprint.

Measurement (estimation and converting units), number (ratio) and chance and data (collection, organizing and representing data) constituted the mathematical knowledge used in this lesson. Students learning was situated in the real life context of an outdoor activity that required them to convert personal informationp aces walked in a weeki nto standard measures (kilometres), which in turn were used to compare each student s level of activity with that of others. I used a range of tools through the lesson, physical tools such as tape measures to make out 100 metres, representational tools like the template I designed in order to scaffold the conversion of paces into kilometres, and digital tools in the form of electronic calculators and the Excel spreadsheet used for recording students data. By embedding learning in an outdoor activity that made use of students personal information, I was attempting to encourage positive dispositions towards learning mathematics. In addition, by taking an approach where I supported students' learning via prompts and clarifications rather than directly responding to enquiries, I was attempting to foster

students' confidence in their own capacities to think flexibly and to make use of mathematical knowledge to solve problems in unfamiliar circumstances. This lesson also incorporated aspects of critical orientation as students made judgments about the reasonableness of results and were also asked to consider why the distances they had travelled differed from each other in relation to both pace length and to students different levels of activity over a week.

Final reflections

After the lesson I was asked what I had learned through the project. At a personal level I had learned about the need to address numeracy as the opportunity arose, which requires me to be more flexible and to avoid being driven by my teaching plan alone. In my role as a Coordinator I believe I am now better equipped to challenge colleagues to address numeracy within their own teaching areas because of my new understanding of what it means to become numerate and what experiences are necessary to develop students numeracy. Further, I want to emphasise with other teachers that numeracy is not just about number and that there is great potential to address other strands of mathematics within all learning areas.

I also described how I was attempting to take a more exploratory and investigative approach to teaching as I believe that this is vital in developing positive dispositions in students towards taking risks and becoming flexible thinkers and problem solvers. I believe that encouraging students to discuss problems and share possible solutions is an important part of an investigative approach to learning. In previous years I had completed a similar pedometer project by strictly controlling students procedures for data collection, analysis and representation of data as the focus was on the acquisition of skills with little consideration given to how and when students would make use of these skills in any context outside of the classroom. My feeling now, is that students are more positive about the use of mathematical knowledge and skills within a physical education lesson and that I was also learning a great deal more about my students through the use of different types of tasks and from conversations with students, which flowed naturally from an inquiry based approach to learning.

During this session I was asked to reflect on my changing understanding of numeracy in terms of the model presented at the start of the project. My desire to improve students dispositions marked my entry point to the model, and I attempted to do this by exploring the numeracy demands of different learning areas and real world contexts. This necessitated a change in teaching practice towards a less directive and more inquiry-oriented approach, a letting go" process that I found difficult but more effective for enriching students' mathematical knowledge and promoting a critical orientation to evaluating information and answers. Once I began to give students more responsibility for their learning I became more willing to experiment with unfamiliar tools, such as spreadsheets, for problem solving. While my entry point into enhancing students numeracy was through attempting to improve students dispositions through the course of the project, I addressed all aspects of the numeracy model and through this process changed my approach to teaching in a fundamental way.