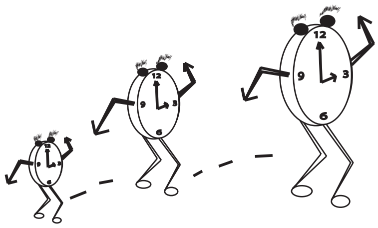
Time after Time



new VOICES

What is so tricky about time?

Lauren McGuire

addresses the issues surrounding the concept of time faced by many primary students

As a teacher's aide I am often asked to help children who have difficulty with mathematics. Recently I was asked to help children from three different grades with their understanding of time. Although each grade had a different activity to undertake, all the children struggled to grasp time-concepts that adults often take for granted. What is it that makes attributes of time measurement so difficult for children? What can teachers do to support children's understanding of time throughout their development?

The Queensland Studies Authority (2005, p. 185) point out, time does not easily link with the other topics of measurement due to its abstract nature. Unlike length or angles in which these attributes can be explored, tested and measured through tangible manipulations, time must be taught through hypothetical activities and problem solving (McInerney & McInerney, 2002, p. 36). As this is one of the core mathematics concepts across all the stages (Board of Studies New South Wales, 2002), it is important to get it right from the start.

My desire to change students' perceptions of learning time sparked a hunt for what are the contributing factors that inhibit learning concepts of time? Beginning with a historical account of time, and then a development of estimation strategies that draw on everyday experience and the use of formal and informal units, some of these notorious difficulties are addressed.

A step back in time

Referring to history can often be an effective teaching tool to engage older children, yet it can provide a context from which mathematical concepts have emerged. I found myself looking to the history books for an explanation for children's common difficulty in understanding time. It was here that I uncovered a glaring contradiction that may be the cause of confusion.

According to history, it was the ancient Babylonians who are responsible for our current system of time. Unlike the common number system which operates on a base-10, and which is used for other aspects of measurement such as weight, this ancient culture used a sexagesimal system that worked on a base of 60 (see Figure 1). This number system has continued to live on in some aspects of modern life: the degrees of angles and of course in the number of seconds in a minute and minutes in an hour. It is thought that the Babylonians elected to use base 60 "because of its multitude of convenient divisors" (Smith, 2006,) as 60 can be evenly divided by 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30 and 60 unlike a decimal system which will only achieve even division by 2 and 5. Other theories suggest the

Babylonians based their number system on the division of the circle into 360 units, or from the 60 degree angle of the equilateral triangle.

Although these ideas would be too complex for most primary-aged children to discuss, it revealed a possible reason for children's confusion with time. As shown by Aldridge and White (2002, p. 7) young children find it difficult to stop at 59 and return back to 1. I have seen this also with Stage 3 children who struggle to see the forward transition in 24-hour time from 23:59 to 0:00.

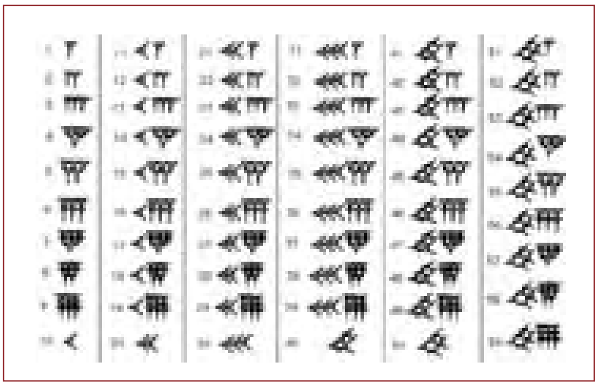


Figure 1: Babylonian numeral system

Time to tell the time!

Reading a clock face can be tricky for young children. Van de Walle (2001, p. 301) believes the curriculum and digital clocks are at fault here. Children are initially taught to read time on the hour, then half, quarter, and finally at five and one minute intervals confidently. This leaves many children puzzling over the time at 2:57 as it does not give an exact reading. Similarly, the digital clock allows children to give a correct reading, however this does not develop the concept of 'close to' times unless they have the knowledge that there are 60 minutes in an hour and two minutes short of an hour is not a long period.

In addition we tend do ignore the different functions of the hands, and instead we need to highlight the position of the hour hand and the distance the minute hand has travelled.

In the following adapted learning sequence, Van de Walle sets up an effective technique for learning to read the analogue clock.

1. Begin with a clock which has only the hour hand and use approximate language: "It's about 4 o'clock, " It's just past 11 o'clock", "It's half way between... etc.
2. Discuss what happens to the minute hand as the hour hand moves around. E.g., On the hour = hour hand exactly on a number, half way around = ?, a little past the hour = ?.
3. Introduce another complete clock but cover it up. During the day, discuss the one-handed clock in approximate language and have students predict where the minute hand might be. Reveal the other clock to check.
4. Teach time after the hour at 5-minute intervals by counting by five around the clock. Rather that predict the minute hand being on the 4 like in step 3, have children say 20 minutes past. Highlight the importance to look at the hour hand first to see an approximate time then the minute hand.

Mind your language

Another confusing aspect of time that teachers should be conscious of is the way language describes time. We will often say 'back in a second' or 'wait a minute' in everyday conversation, which can confuse younger children. The 2002 NSW syllabus (p. 113) reminds teachers that we should also be referring to the 'hour hand' and 'minute hand' instead of the 'big or little hand', so as to link their function to the name.

Have an (informed) guess!

Many educators of mathematics (Bobis et al, 2004; Muir, 2005; Van Walle, 2001) advocate the teaching of estimation in building children's understandings of measurement. This holds true for the teaching of time, as it can highlight a more purposeful and enjoyable aspect of mathematics.

Informed estimation helps children make sense of measurement by asking them to form "personal referents and mind pictures" (Queensland Studies Authority, 2005, p. 185) to help them make everyday applications. The process of estimation intrinsically motivates students to understand concepts and test their ideas (Van Walle, 2001, p.280).

Steps to understanding

Teachers should provide daily experiences of the attribute, in either standard or non-standard units. Thom (2002, p. 27) suggests asking students to estimate how long a lesson may take to set up in either minutes, or in hand claps or number of songs they can sing. It is through the important process of estimation that outcomes linked to Working Mathematically (BOS NSW, 2002) can be made as children are required to apply strategies and give reasons for their judgments. This practice can extend into using the formal units of seconds, minutes and hours to provide a sense of the duration of these units. As a part of the daily classroom routine highlight the duration of events, or have students record the time taken to perform daily tasks at home like eating breakfast or getting dressed.

It is beyond the scope of this article to address every facet of the measurement of time, yet the personal benefit of this research has guided me toward a better understanding of the challenges children face in a concept I take for granted.

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