

# Taking Time Out

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Grandmother to 7-year-old: *I'll buy you a watch for your birthday if you learn to tell the time by then.*

Teacher to student: *The children should be able to tell the hours and half-hours, but they're not very good at the quarter-hours yet.*

Teacher to 8-year-old: *What is the time?*

*Twenty-five past ten.*

*Twenty-five what? What is it twenty-five of?*

*Twenty-five anything, I suppose.*

Why is it that 'time' is so difficult to teach? It is the one aspect of mathematics that is still conventionally taught by rote, and one that causes many children considerable problems. How often do we see teachers manipulating the hands of a cardboard or wooden 'clock', saying "What time is it now?"

"Half past two."

"Good. Now what time is it?" as she moves the hands.

"Quarter past ten."

"Right. Now you seem to understand."

Yet the clock on the wall of the classroom is suggesting that it is 11.30. Now we all like to think of teachers being in control of the situation, but to give the child the impression that his teacher can actually control the passage of time is surely going a bit far! Are we also making it difficult for a child to develop a concept of time, when we use these so-called 'clocks', and pages of clock faces stamped on a page, all recording different times simultaneously?

It is important to realise that 'telling the time' is nothing more than a dial-reading exercise, and is not necessarily related to the concept of time itself. It is possible to read a dial without having any understanding of what the dial is measuring. Interpreting a clock face bears the same relation to time as using a metre rule does to the concept of length, although the clock as a measuring device is considerable more complex than a rule. It is worth considering clocks in the context of other dial-reading activities. It is not assumed, for example, by gas and electricity boards that people in general are capable of reading their own meters. If one is out when the meter is to be read, a card is left behind, not asking one to read the dials, but to draw the position of the hands on a picture of the set of dials. It is rather like a child telling you that 'the big hand is on the seven and the small hand on the five'. In some cases, one is not asked

to draw a picture of the dials, but to record the digits on either side of the hands. Yet, although the electricity and gas meters have several dials, numbered in alternate directions, they are in many ways much easier to read than clock dials. Each dial has only one hand, and has a set of digits 0 - 9 only. Compare this with the two hands of a clock, moving at different rates over a single scale with digits 1 - 12, which have to be interpreted differently, depending on the size of the hand. So a hand pointing at a seven may call for the response 'seven', or 'twenty-five to' or 'thirty-five past'. A hand pointing to a nine is sometimes to be interpreted as 'quarter-to' in addition to 'nine', 'forty-five', 'fifteen'. To add to the confusion, some watches have no digits at all marked on them, and the child will see clocks with Roman numerals, twenty-four hour clocks and digital clocks. With all this, eight-year olds are expected to be able to tell the time, while adults are not expected to read meters. Indeed, if the reading of meters is taught in school at all, then it is often done in secondary schools, perhaps in the third or fourth year, or as part of a general sixth form course! A good argument could be made for removing 'telling the time' from the primary school curriculum, and treating clocks as one of a set of dials, including speedometers, fuel gauges and so on in the secondary school. But unfortunately this argument is not socially very acceptable, least of all to parents who like to be able to set time limits on childrens movements, and to give them times to be home by, for example.

There is however a great deal that can be done by small children that will help to develop their *concept* of time. Time is a difficult experience to describe. The notion of it being continuous, extending infinitely into past and future, is a disturbing one, and the dictionary definitions of time as 'a limited stretch of continued existence' or 'the interval between two events' do not really make the idea much easier. Edmund Leach, addressing the Second International Congress on Mathematical Education in Exeter, suggested that time experience appears in six quite separable forms:

- (1) time as alternation,
- (2) time as sequence,
- (3) time as distance,
- (4) time as delimitation,
- (5) time as repetition,
- (6) time as aging.

Some of these aspects can certainly provide practical activities that can be made use of in the classroom. Indeed the routine of a school day can lead to the idea of alternation—week followed by weekend followed by week, etc.—and of repetition, when the class has P.E. every Tuesday afternoon, for example. The passage of time as an aging process can be seen in its effect on growing things kept in the classroom, weekly records on a graph of a growing plant, perhaps, or termly ones of the height of the children themselves. Activities involving timing events give the idea of delimitation, with each event having a beginning and an end. So, using arbitrary units of time, such as the time taken by water to flow from a can with a hole in its bottom, or the time it takes the can to sink when it is placed in water or the time it takes the sand to flow from one end of an egg-timer, we can time any events we choose, the time it takes to walk upstairs or downstairs, run along the corridor, walk backwards along it, count up to one hundred, or whatever. Thus we can emphasise the passage of time and the beginning and end of the activity defining an interval of time. We could use clock-work devices, and find the time they take to run down, or combine ideas of time and distance in finding how long it takes for a model car or train to travel a fixed distance. The related procedure of finding how far something travels in a fixed time, together with that of finding how long it takes to travel a fixed distance, will prepare the way for an understanding of speed. A graph of the time taken by children to travel a fixed distance is also interesting in that the child who 'wins' the 'race' has the shortest time, and therefore the smallest column on the graph, a counterexample to the common feeling that 'more is best'. Music, with its different lengths of notes and repeated rhythms, also gives valuable time experiences. The sound when a chime bar is struck will fade with time, a plucked string can be seen to vibrate for a time; some music is played fast, some slowly, and we may move quickly or slowly in response to it.

A young child entering school often has a very sketchy idea of time. Words like 'yesterday', 'last week', 'tomorrow' (which is often used by teachers and parents as a delaying tactic, and is synonymous with 'never'!) are often not yet understood. Certainly the idea of 'last year' is likely to be very hazy. It is quite common to find a child asking half way through the morning if it is 'going-home time', or whether they have had dinner yet. It has to be explained that Saturdays and Sundays are not school days. Research suggests that it is reasonable to expect understanding of the child's own age, of morning and of afternoon by the age of six, and weeks, months and years by the age of eight, although we have all probably suffered from a grossly exaggerated view of our own age by a child, such as when we are asked if we can remember seeing Queen Elizabeth

the First! We are also told that only about two thirds of all eight-year-olds realise that it is the same day of the week in a nearby town. Yet in two or three years at school we expect children to be able to mark off the passage of time in hours, half-hours and quarter-hours. An hour, the first unit conventionally dealt with, is a difficult unit of time for a child, being too long for one span of attention, whereas the seconds that a stop-clock measures are much more realistic. A child can measure events in seconds and minutes much more easily; he can concentrate his attention for that period. Using hours first is a bit like expecting a child to measure in kilometres before any experience of metres or centimetres. Indeed, how well are we able to estimate a period of an hour? We all know of hours that seem to pass like minutes, and hours that seem to go on for days! This is very like the young child's view of 'five', as shown by Piaget, that spread out can seem to be more than five, and pushed together can seem less. Perhaps we are none of us at Piaget's stage of conservation as far as our concept of time is concerned.

The child's concept of time, then, is more likely to be developed by the 'timing' activities mentioned earlier, than by concentrating on 'telling the time', and likely to be harmed by wooden or cardboard 'clocks' and rows of clock faces stamped on exercise books. However, it is clearly important for a child to learn to tell the time in the conventional sense. Now, instead of measuring the passage of time, one is trying to pinpoint a particular moment of time. The clock, of course, since it has to measure something which stretches infinitely from the past to the future, is constructed so that when it arrives at the end of its scale, at twelve-o' clock, it goes back to the beginning and starts again. So it cannot distinguish between 5 o'clock today and 5 o'clock yesterday or the day before. And of course, by the time we have looked at the clock and decided that it is 5 o'clock, the seconds have ticked by, and our reading is no longer accurate. At least when a child measures a length, he can take his time over interpreting the ruler, and can check his measurement as many times as he likes. A child is more likely to learn to tell the time when he has a need to do so, and the first times to be important to him are the times of his favourite television programmes, the end of the school morning or afternoon, his bed-time, the time he gets up, and so on. These times may well seem to be more difficult, as they are more likely to be awkward times like 5.10, 6.40, 7.35, 12.30 and 3.45 than the hours that we tend to teach first, followed by half-hours then quarters. But children by no means always learn in the nice tidy ways that we as adults think might be best for them. We no longer teach all about the number 1 first, then move to the number 2 and so on, and we certainly do not expect them to learn to read all the two

letter words like 'at', 'as', 'on', 'of', 'to', 'by', 'an' before they learn to recognise three-and four-letter words. Children often learn in a random fashion, although we may prefer to present them with logical structures.

We fall back on encouraging learning by rote

when the ideas we are trying to teach are too difficult for the learner. If we are prepared to spend more time on developing the concept of time and less on 'telling' it, we may make things easier for ourselves and the children.

## Elizabeth and the Mystic Rose

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What follows is an account of some individual work undertaken at the A.T.M. conference/course at S. Martin's College last Easter, while I was in the group led by Mrs. M. Harris.

It was a salutary experience making a workcard for an unknown child and being able to work with one child, rather than a class of forty.

Elizabeth was presented with a work card.

### Patterns on Circles

Join every point to every other point on the circle with a straight line.

Beside each circle write

- 1) how many points there are;
- 2) how many lines you need.

Do the lines make a shape or a pattern?

Write about it.

Turn over.

When you have finished 4 circles look at the numbers you have for the numbers of points and number of lines. Is there a pattern in the numbers? Can you guess how many lines you will need for the next circle? And the next?

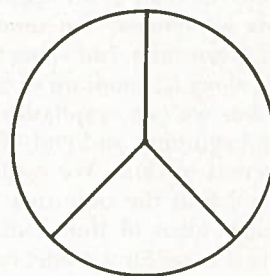
A prepared set of circles with evenly spaced points in a series 2, 3, 4, 5, 6, 7, 8, 9, 10 and a ruler were supplied. The top sheet of paper had 'Mod. 2' and 'Mod. 3' on it.

Elizabeth, looking at the workcard, reads "Patterns on shapes."

I say, "That says 'circles'. Would you like me to help you read the card?" If I don't help her we'll never get to the maths. I read the first side of the card and ask, "Do you know what to do?"

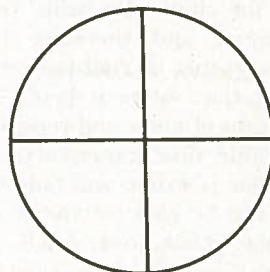
Elizabeth: "Yes. It's easy. There are two points so that's one line."

I leave her to proceed, and return to find that her second circle looks like this.



She assures me that every point is joined to every other point and so it is, but not in the way I'd hoped for!

I watch her continue with the four point circle, which she joins thus.



She writes beside it '4 points, 2 lines'.

I suggest that

- a) it will save time if she numbers her answers '1' and '2' and omits to write 'points' and 'lines' every time; and
  - b) she might have missed some lines.
- She considers b) and concludes that there could be four more lines.

