

Equals

Realising
potential in mathematics
for all

for ages 3 to 18+

ISSN 1465-1254

Problem of how much food to give to fish of differing sizes

Vol.16 No.1

MATHEMATICAL ASSOCIATION



supporting mathematics in education

Tables are not the only way!

Alan Edmiston challenges the assumption that ratio is too difficult a concept for young children. Using a context of feeding fish, he explores how children can think about ratio when it is presented in a problem-solving context.

The following quote stood out from a book I was looking through as I decided whether or not it was time to assign it to that big box in the loft: *'Before children meet the arithmetic operations formally, it is crucial that they appreciate the nature of situations in which multiplication and division are inherent ...'*

I happened to have multiplication on my mind because of a conversation with Sandy's mum at the school gate. Now that our children are in Year 3 they are expected to make progress with their tables. The problem was that he was not and some three weeks into this work he was still stuck with his threes. Many of the others had moved on leaving this boy to fall behind his friends – I cannot imagine the impact this was having upon the mind of such a keen little learner.

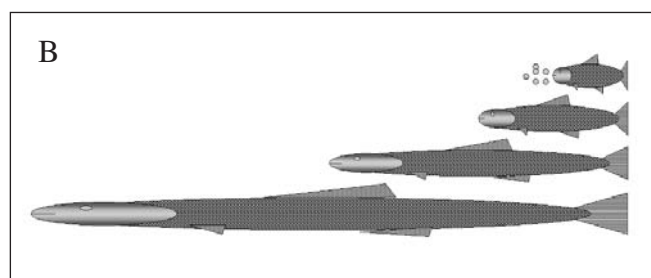
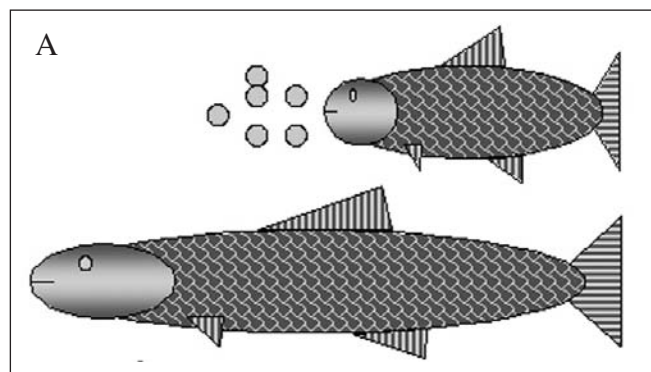
Many of the early Thinking Maths lessons tackle the idea of multiplicative thinking head on. The concepts are presented in a way that builds upon the work of Piaget who found that many 5-7 year olds are able to handle this concept i.e. the multiplicative links between numbers (3 sweets for every one party bag). The activities present the pupils with situations that require this type of reasoning and do so to lay down good thinking foundations for fractions, measurement and multiplication. All of these areas of mathematics are dependant upon multiplicative relations rather than simple additive ones. They seek to integrate the idea of ratio at an early age so that the pupils have a rich source of formative experiences to draw upon when they are required to grapple with proportions, ratios, fractions and decimals towards the end of their primary school experiences.

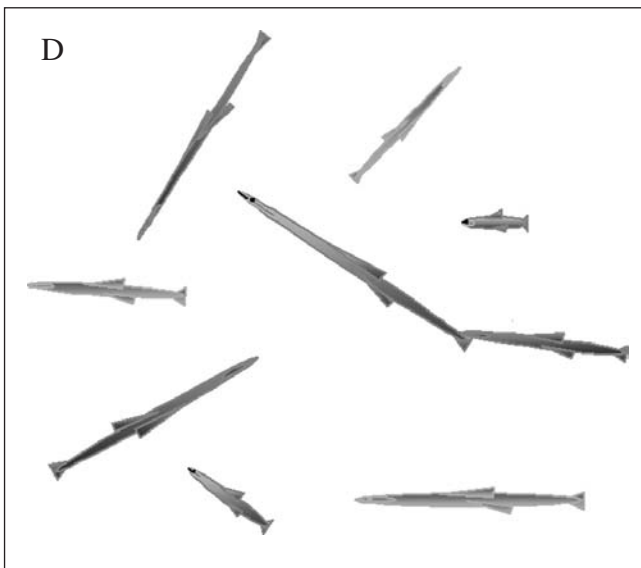
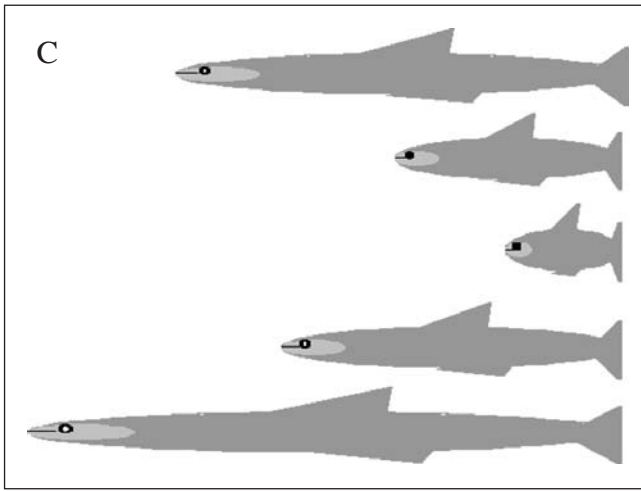
This is of particular interest to me as on courses in both Wales and Northern Ireland I have been told by Mathematics Consultants that ratio has been moved out of their primary curriculum because it is too

hard. I just wonder if by doing this, with the learners' best interests at heart, they are failing to build upon the very skills that young children bring with them to the classroom and as a consequence are storing up even more trouble ahead?

Feeding the fish

I will describe another new Thinking Maths activity developed during a CAME Extension Course at Ambler School, London. The aim of this particular lesson can be found in the words of T Nunes² who states that *'The need to discover a relation from the meaning of the situation (instead of being told what the relation is) can lead the children to expand their understanding of one-to-many correspondence'*. The situation that prompts the discovery in this activity is the problem of how much food to give to fish of differing sizes. The lesson is built around 3 thinking episodes that culminate in the use of explicit multiplicative relations to calculate the amount of food that should be given. The pictures show the four sets of fish in question:





Episode 1 – I have a problem.

This particular lesson was taught in October 2009 and at the start many of the pupils shared their experiences of looking after other people’s pets. This led to one boy relating his experiences of helping his aunt feed a particularly valuable group of tropical fish, and in his words ‘she just did not know how much to give them!’ A better start I could not have wished for!

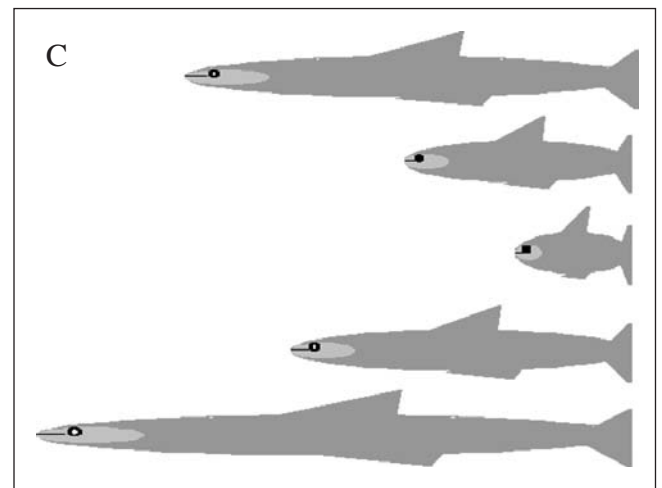
With the children sitting in tables of four, but working in pairs, two fish families are given out, A and B, one set per table. The idea was that after a few minutes they could swap families before reaching a consensus.

The discussion at this point is very animated; some are using unifix blocks, some rulers and others fingers to formulate the patterns that they can see before them. Episode 1 works because the pupils are

using their maths knowledge to verbalise the intuitive patterns that are present in the fish lengths. A quick survey would reveal that 95% of pupils have grasped the proportional nature of Family A. They give this family a range of names to describe this which are all based around the idea of ‘times tables’ i.e. up in 3’s, 4’s or 5’s. Family B on the other hand presents them with more of a challenge. That particular Tuesday the breakthrough came when the group who were using a ruler volunteered the fact that their numbers went ‘24, 12, 6 and 3 – that is halving’. This led to them being called the ‘Double family’.

Episode 2 – Fish family C

At this point the pupils realise the importance of quantifying the fish with rulers as a way of spotting the multiplicative relations between the fish in each family. The challenge in this part of the lesson requires the pupils to both round and order the fish lengths to see the x 4 link.



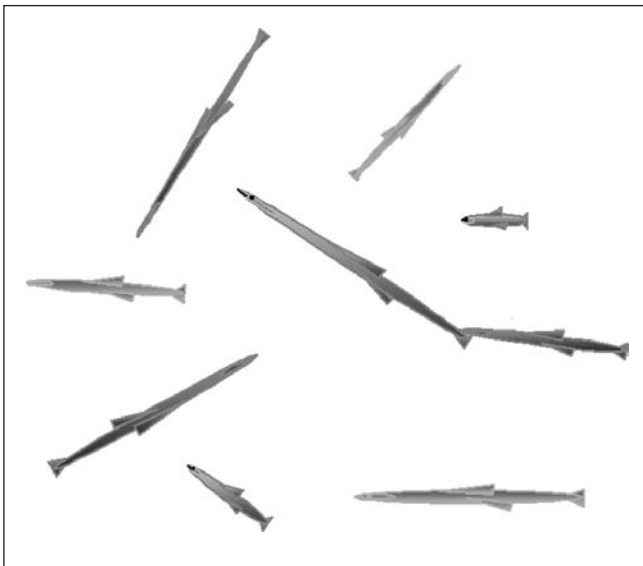
Even though they were easily able to measure the fish they found the ordering and rounding aspect much more difficult. Only 2 out of the 5 tables were able to see beyond the numbers (4, 7.5, 12, 15.5, 21.5) and grasp the pattern. To me this is a key aspect of the Thinking Maths approach for the numbers used are not presented in any tidy order – the pupils themselves need to decide what to do to best make sense of the situation.

The feedback was quite interesting as 2 of the tables quickly shifted position and agreed with the others, leaving one group who had a most interesting strategy!

They had been using unifix to measure each fish and then doubled the answer to give a value to each. What eventually caused them to agree was that one child was overheard talking in a most animated fashion as he changed his mind with the realisation that all he needed to do was to order the numbers rather than look for patterns between individual numbers (16, 8, 4, 12, 20)

Episode 3 – Feeding the fish from the pet shop

As an extension activity the pupils are presented with a more complex scenario. A school of fish of many different sizes need feeding but here the ratio is not fixed but dependant upon the relation of the smallest to each of the larger. In addition to this one of the ratios involves a $\times 1.5$ relation.



This activity requires the pupils to measure, order and tabulate the fish so that the ratios can be explored. Seeing the need for and then creating a table adds quite considerably to the task and with only ten minutes to go I felt it best to consolidate the gains that had been made by the class thus far. In discussion with the teacher she agreed with this, feeling that Episode 3 would need at least 30 minutes to tackle in a meaningful way.

What I remember most from this lesson is the joy that arose from the class as they realised that they could see the ‘times tables’ patterns in familiar objects and that a knowledge of this helped them to calculate the quantity of food required by each fish. On a more sober note it also makes me see just how important is the work of people such as T Nunes is

to children in school today. She notes that *‘Mathematics teaching has often overlooked young children’s understanding of multiplicative relations. It is possible that, if children were to explore their early understanding of multiplicative relations, the progress from understanding relations to solving quantification problems might be different.’*

I just hope it is not too late for Sandy but maybe I could help; I wonder if he would like to feed our fish next time we go away!

Cognitive Acceleration Associates

1. *Language in Mathematical Education*, Ed Durkin and Shire, 1991, p. 95
2. *Children doing maths*, Nunes and Bryant, p 168

On 6th August 1945 the USA dropped an atomic bomb on Hiroshima

The firestorm destroyed 13 square kilometres (5 square miles) of the city.
Over 60% of buildings in Hiroshima were completely destroyed and over 90% of structures were destroyed or damaged.
Up to 180,000 people were killed - out of a population of 350,000.

Three days later, on 9th August, a second atomic bomb was detonated over Nagasaki.

Nearly a quarter of Nagasaki’s buildings were consumed by flames.
Up to 100,000 people were killed out of a population of 240,000.

In total around 250,000 people died in the first few days.

Today we live in a world where there are around 30,000 nuclear weapons.
These weapons are capable of destroying all life on earth many times over.

CND leaflet, April 2008

Save the children

I can count further than I will probably live....
Kroo Bay, Sierra Leone, is the worst place in the world to be born.
In Kroo Bay 1 child in 4 won’t make it to five.

Save the children leaflet, November 2008
(020 7013 6400)