

The Trouble with Mathematics in Primary Schools

It is true to say that most pupils do not like mathematics and that is because they find it difficult. Some pupils cannot cope with the subject at all. So what goes wrong?

There is too much blaming of the teachers when pupils cannot pass examination. We now know that the textbooks have contributed to the problems.

However, with mathematics the fundamental problem is with the syllabus.

From years of experience in primary schools, and from analysing examination papers for Standard IV and VII, a paper from Village Education Project Kilimanjaro (VEPK) sets out the cause of the problems. VEPK is an education NGO which has been working to improve the quality of education in the government primary education sector since 1994. It has extensive experience working with teachers in the classrooms.

There is a lack of appreciation of how children learn and develop. Children learn by touching and seeing real things (bottle tops for counting, sticks in bundles of ten for 'place value' of *makumi*), and slowly move away from using 'concrete' items to being able to work with 'abstract' alone (knowing that '4' is the abstract representation of four bottle tops etc, and that '12' means one bundle of ten, and two units/single items).

Primary education is a delicate mixture of developing skills within pupils and giving those pupils knowledge. In primary education the skills which should be developed consciously in the teaching of mathematics are: Counting skills; skills in working with numbers - adding, subtracting, dividing and multiplying; place value skills; thinking and problem solving skills; application skills (applying knowledge gained); skills of measuring, sorting and classifying; skills in estimating; visual/spacial awareness skills; skills in logical progression; skills of logical deduction.

Those skills very much relate to mathematics being part of everyday life. For instance, whilst shopping we are adding and subtracting with payment and change; we might be working out percentages with discounts on offer; we might be using multiplication if we buy several of one item etc. The most relevant and interesting way to teach mathematics is to use real-life situations. This will use 'narrative' questions – so that pupils are given a scenario and then have to work something out.

The real detail shows that pupils are failing to gain a sufficient understanding of the following topics:

- Processes: addition, subtraction, multiplication and division- particularly with decimals and negative numbers
- Extended number facts,
e.g. times tables, $4 \times 5 = 20$, $40 \times 5 = 200$. Multiplying and dividing by 10, 100 & 1,000
- Place value: particularly with decimals
- Problem solving: word/narrative problems
- Measurement: length, area, perimeter, time, mass
- Graphing
- Algebra
- Perimeter of a circle, irregular shapes

The syllabus is the source of nearly all of the trouble with mathematics. A short analysis of its deficiencies and also the omission of important stages of learning for just the first two Standards is set out below. The detail becomes greater in the analysis of the higher Standards. The full report can be found in English on-line at <http://www.kiliproject.org/maths-teaching>.

However, those at Village Education Project Kilimanjaro are not critical or down-hearted. They say that the problems are easy to rectify and that the teaching of mathematics could be transformed in a short time if the syllabus was changed and appreciation given to how children learn.

The information below is just a small example from the syllabus of the problems facing the pupils and teachers of Mathematics.

Standard I

- The syllabus jumps from working with numbers 1 to 9 to working with numbers 1 to 99. There is no development of number facts nor of place value for units and tens; as this underpins place value knowledge in other Standards it is a huge problem.
- Adding with carry numbers: pupils are still developing the facts of numbers and basic processes; they have not been introduced to place value and they are required to add with carrying. This is too advanced.
- Adding and subtracting horizontally with carrying: This is using the 'abstract' too early, and is too advanced at this stage. Place value must be introduced first, with lots of 'concrete' work.
- Number facts and processes must be introduced moving from 'concrete' to 'abstract'. At this level pupils are still very much at the basic 'concrete' level of learning and understanding.

Missing from the syllabus:

- Developing the knowledge of simple ordinal numbers
- Place value is not mentioned
- Developing 1 to 1 correspondence when counting (eg 4 represents four bottles/sticks/buttons etc)
- Developing concepts or ideas in measurement such as longer/shorter
- Developing ideas or concepts in geometry such as sorting objects according to shape
- Developing the concept of time such as 'today', 'yesterday', 'tomorrow' and 'days of the week'
- Ordering numbers between 1 and 20
- Drawing diagrams to show + and - e.g. drawing of four cats and two dogs = 6 animals

Standard II

- Reading & writing numbers to 1,000. This is a big jump from Standard I. Matching number cards with object to 1,000. Who is going to count single objects to 1,000? Where is the teacher to get the objects?
- Adding and subtracting numbers to 1,000 with carrying and borrowing which is a huge jump from Standard I.
- Multiplication is introduced, "Multiply numbers to get a product not exceeding 72." Pupils have not been introduced to the process of multiplication and yet in the syllabus they are to the 'x' sign and multiplication charts before they know or understand what the process is or what it achieves
- The term 'quadrilateral' is used and yet it is too difficult before the idea or concept has been developed. This should be developed by 'concrete' items.

Missing from the syllabus:

- Developing counting skills- skip counting by 2, 5 and 10 (e.g. 2,4,6, 5,10, 15 10,20 30 etc.)
- Place value not mentioned yet the pupils are working with numbers up to 1,000
- Sharing and repeated subtraction (as a valuable introduction to division)
- Counting-on skills (e.g. starting with 6, and counting-on three more)
- Introduction of multiplication using arrays (these are easy diagrams and easy with 'concrete' items)
- Development and use of a 'fact family' linking $25 + 5 = 30$ to $5 + 25 = 30$, $30 - 5 = 25$ and $30 - 25 = 5$
- Working with shapes to create pattern using flips, slides and turns
- Developing thinking strategies
- Further development of the concept of time- days, weeks, months, years

In summary the trouble with mathematics in primary schools is a trouble that can be rectified, and mathematics is a subject that could be enjoyed by all pupils and in which most pupils could succeed. The authors of the paper, Barbara Kerr and Katy Allen of Village Education Project Kilimanjaro, are available for consultation. Initial contact can be made via katy.allen@kiliproject.org