When the numbers don’t add up

There has been much debate and discussion in recent times on the falling standards in mathematics. Evidence from the Department of Education and Skills reports and from International comparisons (PISA, 2009) has caused concern about children’s mathematical performances. As a result, raising the level of mathematical achievement is now firmly on the national and political agenda. The debate has largely focused on the teaching of mathematics at Second Level and the decline in students taking Higher Level papers. However, in my opinion, it is in the Primary sector where we should look for the cause of this general decline in standards and hence the solution. Focusing on a number of areas in the teaching of mathematics in the Primary school might go some way in raising the level of achievement and improving the teaching and learning of maths in our schools.

Language
The language that is associated with maths is often specific and very precise. It can be viewed as a language in itself with its own vocabulary and grammar. Pupils’ mathematical vocabulary is constantly increasing and for children to build upon their mathematical knowledge, this vocabulary must be taught and used naturally in learning contexts. It is the task of the Primary teacher to enable the child to use this mathematical language effectively and accurately. One of the causes of failure in mathematics is poor comprehension of the words and phrases used. Some of the language used will be encountered only in the maths lesson and children will need many opportunities to use it before it becomes part of their vocabulary. In other case, everyday words will be used in maths but will take on new meanings, which may be confusing for the learner. This confusion was brought home to me by an amusing answer to the question asked of a child: “What is the difference between 1 and 3?” to which his response was “One is straight and the other is curly”. The English National Numeracy Strategy booklet ‘Mathematical Vocabulary’ (2004:1) best sums it up when it says that: “Mathematical language is crucial to the children’s development of thinking. If children don’t have the vocabulary to talk about division, or perimeters, or numerical difference, they cannot make progress in understanding these areas of knowledge.”

Concept
A concept is the idea behind a name. To learn the name is just to learn a fact. Most children for example in senior classes would have heard the word ‘fraction. To learn what it means, however, and how it is defined it to learn the concept. We only understand new things in terms of what we already know. So we make sense of new knowledge in terms of our existing knowledge. If our understanding of a concept is sketchy or weak further advancement becomes problematic and uncertain. Maths, by its very nature, is much more abstract and hierarchic than a lot of other subjects which children learn. To overcome this abstraction, a good foundation of understanding and concept formation are essential. A new concept must begin with an analysis of the contributing concepts. If those all-important foundation concepts are formed then the new work becomes a more intelligible activity and progress can be achieved. Skemp (1989) puts it thus: “To enable children to learn with understanding, we must, wherever possible ensure that the new concepts embodied in the learning materials we provide are such as can be assimilated to their existing schemas.”

Resources
I think it goes without saying that children learn better, consolidate a concept more easily and enhance their development of mathematical understanding when visual representations of mathematical concepts and the manipulation of practical apparatus are employed. Nickson (2000) believes that this arises from “the importance placed on the Piagetian stages in the development of children’s thinking”, while Delaney (2001:125) bluntly states that “it is hard to see how some mathematics could be taught without visual or manipulative aids of some kind”. The use of
practical resources reinforces the notion that maths applies to everyday living and helps to add interest and variety to the subject and hence a better learning experience. However, despite research to the contrary, may teachers – particularly those in the senior classes – largely rely exclusively on abstract and symbolic work without recourse to mathematical activities of a more practical nature. Having said all that, it is not sufficient to produce resources and hope that everything will become clear. The teacher needs to select the resources carefully to suit the particular topic, use them in a fitting and meaningful way, incorporate the appropriate language and recognise their limitations. Whilst it is widely accepted that the use of concrete materials in the teaching of mathematical concepts is extremely beneficial, children also need to progress to using mental approaches and more abstract images. These mental images play an important part in forming children’s conceptual structures. Rote Learning has a place in the teaching of maths, particularly where the learning of tables is concerned. The problem with relying solely on rote learning is that when tasks become more difficult the amount to be memorized becomes too great and the lack of understanding of the concept becomes evident. Failure is the inevitable consequence. Ideally, a combination of rote learning and intelligent learning is the way to progress.

Relevance
Mathematical learning takes place best when children find that the maths they undertake holds some meaning for them. Maths should not be separated from the every day context but should be linked to real life and make “human sense”. (Atkinson, 1995) Young children in the Netherlands perform well in international mathematics tests e.g. TIMSS, (1995) partly because of their approach to the teaching of maths. Dutch children learn much of their mathematics through real-life problem solving. Lange (2003) concurs with this approach when he proclaims that: “Mathematics has to be seen as a human activity”. Another acceptable way to add relevance to maths is through the use of the environment. This helps children to relate the things around them and their everyday experiences to the maths they do in school. This link between maths and the environment facilitates different learning styles and is particularly beneficial to those pupils who learn best through visual stimuli. Kinaesthetic learners also benefit as they can touch and feel and actively explore the environment, thus enhancing their learning ability. Also, by highlighting the link between maths and the environment, a cross-curricular aspect emerges and “it is through using mathematics in the context of other subjects that pupils develop their ability to apply mathematics”. (Coles and Copeland 2002:7) This link with other subjects helps to give children a better understanding of and more meaning to their mathematical work. In conclusion, it is important to provide pupils with learning environments that are stimulating and interesting as this will only serve to provide relevance and meaning to the subject.

It would appear we have reached a critical point in the teaching of maths in this country. Overall standards seem to be falling and we need to plot the best way forward. I believe it is time for schools and teachers to develop their subject knowledge and examine their strategies and approaches to the teaching of mathematics. This is neither a short-term nor the only solution but we need to start somewhere… and soon.

References
PISA, 2009