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LANGUAGE ASPECTS OF MATHEMATICS

Most mathematics teachers are aware that many people, adults and children alike, have developed negative or even hostile feelings towards mathematics. The recently published Cockcroft Report (HMSO, 1982) revealed that a lot of people are afraid of mathematics or ashamed of their inadequacies. In fact, half those invited to take part in interviews refused to have anything to do with the questions they were asked, while apparently simple and straightforward pieces of mathematics induced feelings of anxiety, helplessness, fear and even guilt. What is there about mathematics that causes people to regard it with distaste and even fear? No doubt there are several possible answers to this question, but I should like to suggest that the root cause is one of understanding, or rather the lack of it and that a major factor related to the understanding of mathematics is the language of mathematics.

Some of the problems associated with the acquisition of mathematical language are similar to those of learning a second (natural) language; in particular, a vocabulary is needed before a person can understand. Another difficulty is that the language of mathematics contains

words which often have a meaning in everyday English as
well as a more precise and, in some cases, a different
meaning in mathematics (eg 'set', 'field'). It has also
been suggested that difficulties arise because, although
people learn their own language in a natural way from
native speakers of the language, '...they are taught mathe-
matics by people who were taught by people...who were
taught by mathematicians' (Griffiths and Howson, 1974,
p 21).

It is important to distinguish between, on the one hand,
mathematics as a language and, on the other, mathematics
and language. When mathematicians discuss mathematics
with one another, it is likely to be through the medium
of such natural languages as English, French, German or
Russian. Furthermore, when we turn our attention to the
process of communicating mathematical ideas to children,
we soon realise that it is not possible to provide the
'official' mathematical descriptions used by adult mathe-
maticians because of the lack of appropriate language and
of necessity we must explain in the language of the child.
For this reason it has been suggested (Griffiths and
Howson, 1974) that there are three distinct levels of
language employed : That which is used between mathe-
matician and mathematician, that between mathematician
and teacher, and that between teacher and child. Thus,
the translation of a piece of mathematics from one person's

conceptual framework to that of another may be fraught with
language difficulties, especially when the conceptual frame-
work of one is less complex and less mathematically
sophisticated than that of the other.

Mathematics, just like any other subject, uses many special-
ised or technical terms to refer to important abstract
ideas. Such abstract ideas, or concepts, are mental ob-
jects which require the use of either spoken words or
written symbols to facilitate communication between
individuals. Words like 'parallel', 'factor', or 'square
root' are used as linguistic labels for mathematical
concepts, while a collection of such specialised terms
may be described as a mathematical vocabulary. Research
related to the effects of language factors involved in
the learning of mathematics suggests that linguistic
abilities have a direct influence on performance in
mathematics and that knowledge of mathematical vocabulary
is important in solving mathematical problems (Aiken,1972).

A simple but effective way of diagnosing linguistic
difficulties due to problems arising from weak mathematical
vocabulary is to construct a test in which each test item
consists of a simple question or problem involving a
mathematical word or term, pupils being required to respond
with a written answer. Since a child may understand a
particular word but be unable to explain its meaning, the

3

intention of such questions is to test whether or not the
child understands the mathematical word involved, rather
than to test the child's mathematical ability. For example
such questions as:

> What is the remainder when 17 is divided
> by 5?

> Give one example of a factor of 21

can be used to give the mathematical word in a specific
context. Calculating the percentage of correct responses
to each question provides the teacher with a clear
indication of how well each word is understood and reveals
instances where serious difficulty is experienced with
particular words.

Research carried out in England (Otterburn and Nicholson,
1976) showed, for example, that the words 'product' and
'multiple' produced confused reponses in 75 per cent and
85,6 per cent of cases respectively, while in Zimbabwe
(Glencross, 1979) there was great confusion about the
words 'multiple', 'integer', and 'rhombus'.

As teachers we should remember that while the 'specialist'
language of mathematics may itself be a barrier to
children's understanding and concept development, this
barrier becomes even greater when the specialist language
is used in complicated sentence structures (such as occurs

in many mathematics text-books), or in language patterns
with which many pupils may be unfamiliar. Thus, if learners
are confused by the use of mathematical words that are not
immediately meaningful to them, their confusion may be
aggravated when complex sentence structures and unfamiliar
language patterns are also used and, in this way, the
development of children's mathematical concepts is likely to
be inhibited rather than aided by mathematical language.

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EXAMPLES OF MISUNDERSTANDINGS AND MISINTERPRETATIONS
THAT HAVE OCCURRED IN THE CLASSROOM

1) Teacher: What are you left with when you keep
   taking away 7 from 86?
   Most children: 2
   One child: I keep getting 79.

2) (From a Std 6 test)
   Question: Write down the following product without
   brackets: $\frac{1}{2}p(4p - 8q + 2)$.
   Answer: $\frac{1}{2}p \times 4p - 8q + 2$

3) $3x + 2 = 5$ "You cannot, because 30 something plus
                  2 will not give you 5."

4) $7 - x = 9$ " It is stupid. How can you take
                 something from 7 and get an answer
                 bigger than what you started with?"

5) $y = x$ Teacher: What can you tell me about that?
             (Expecting something about a straight line)
             Pupil: It is silly. They are different
             letters, not the same, so how can they
             be equal? You would not be pleased
             if I spelt 'yacht' as 'xacht'.

6) $n + 2 = p$ "...because it is two more letters along."

7) "If   is a right angle, is   a left angle?"

COLLECTED BY M J GLENCROSS

6