Overcoming a Difficult 'Area'

A.P. Calleja

Clearing the Air

One of the problems of the young teacher in the primary school is to find the middle-of-the-road course between what mathematics his pupils need to know and that mathematics which is prescribed in the syllabus for the examination. In an ideal setting there should be no conflict really and this is chiefly for two reasons: (a) the primary school teacher should teach *mainly* mathematical concepts and later someone else will teach the necessary arithmetic rules and techniques; (b) a satisfactory treatment of primary mathematics is achieved if the teacher has clearly in his mind the correct balance and treatment of the separate topics to which the prescribed syllabus is an approximation.

In order to teach mathematical concepts successfully the primary school teacher should be equipped and guided. Equipped with preparations, plans, notes, aids, language, situations, activities, skill, expertise and knowledge in order to impart these concepts. And guided by syllabii, schemes and organisations that best suit the particular children in his class so that the learning is maximised.

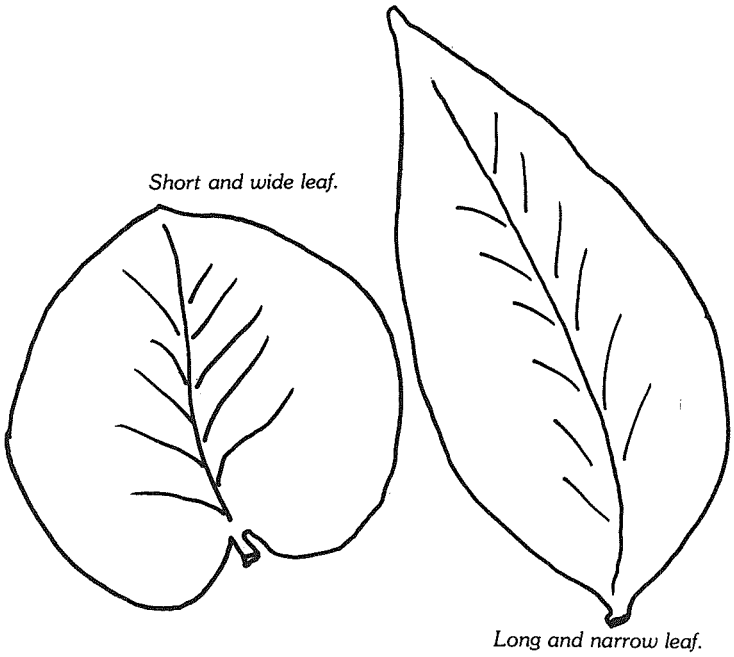


Fig. 1.

Identifying a Difficulty

Many student-teachers in primary schools have encountered difficulties when teaching certain topics like *area*. Also, older teachers readily confess that their pupils become confused when "finding area". What causes these difficulties? Firstly there are certain difficulties inherent in the topic itself. Secondly difficulties will certainly arise if the teacher rushes to do formulae-arithmetic on area too early.

During a teaching-practice visit I observed a student-teacher starting a lesson on area with pupils in Year III and I overheard the following introduction:

Teacher: Who can tell me what is area?

Class: Dumb silence.

It happened that there was a Year V pupil in this class whose regular teacher happened to be absent. And this boy answered:- 'It's length times width, Sir.'

Honestly, at first I thought that this was some sort of a conspiracy by the student-teacher who, I suspected, was in league with the pupils so as to compel me to deliver the lesson myself. However, I continued to listen and then I made my comments to the student at the end of *his* lesson. This article is therefore the result of my observations of what had taken place during that lesson. It is hoped that identifying the difficulty will help to clear the air a bit.

Lesson Material

How much time should the teacher spend on concept formation? How should he plan his lessons on area? Secondary school experience with its stress on formulae should not be brought to pupils in primary schools. Instead *activities* should be planned to give the pupils an intuitive understanding (based on messing about with scissors, pencil, objects, etc) of (i) the flatness of plane surfaces; (ii) the amount of plane surface enclosed by a boundary; (iii) conservation; (iv) two-dimensional property; (v) the understanding of the

practical language-words; (vi) scope for experimental work or workshop sessions; (vii) scope for discussion, communication with emphasis on the use of clear expression; (viii) for making accurate estimation; (ix) for reinforcing the knowledge of length (perimeter) and the multiplication tables and finally (x) for the beginning of computational work. As you can see, therefore, far more time should be devoted by the teacher to lessons on concept formation during these early years of learning.

Planning the Lesson

A careful teacher should have clearly in his mind both the assumptions and the objectives. Assumptions are those ideas, skills and concepts which the pupils need to have covered with the teacher before they are ready to receive their first lessons on area. Some of these assumptions are experience with numbers less than hundred, experience with counting and with measuring, knowledge of the practical language words such as short and wide, long and narrow, irregular shape, one-half, more than, less than, etc., and knowledge of the basic Euclidian shapes — the square, the rectangle and the triangle.

A natural choice of objectives would be some of the items listed above in the section under Lesson Material, for example (i) to understand the property of flatness of a plane surface; (ii) to give pupils the experience of measuring, in a practical way, the amount of plane surface enclosed by the boundary of an irregular shape.

Developing the Lesson by Steps

a) Teacher asks some of his pupils to bring with them to school the following objects: a poster, two post-cards of the same size, a few used stamps, mosaic pieces, some jigsaw puzzle pieces. Also each pupil is asked to find two leaves (from the garden) of unequal size. (Fig. 1)

b) These objects are then placed down flat on the surface of the table. "Let's feel them between the fingers." "What can we say about them?" They are thin and flat. Their surface is flat and thin. "Can you name some other flat objects?"

c) "Look at these two leaves. How can you describe them? Very good, thin and flat. One is short and wide, the other is long and narrow. Which is the bigger of the two? We shall soon find out.

d) This coloured paper (see Fig. 2) is covered with many similar shapes. Triangles, right. All are of the same size. Now will put the two leaves onto this paper and will trace out their boundary, their outline, their *perimeter*. Next, let's cut out their shapes using the scissors.

e) Which is the bigger of the two leaves? Which has the more triangles? The rule for counting the number of triangles is to count more than half of a triangle as one whole and ignoring less than half of a triangle. The more triangles that are enclosed by the boundary (or *perimeter*), the bigger is the surface of the leaf. Now we can easily tell which leaf is the larger. We have measured how much surface is enclosed.

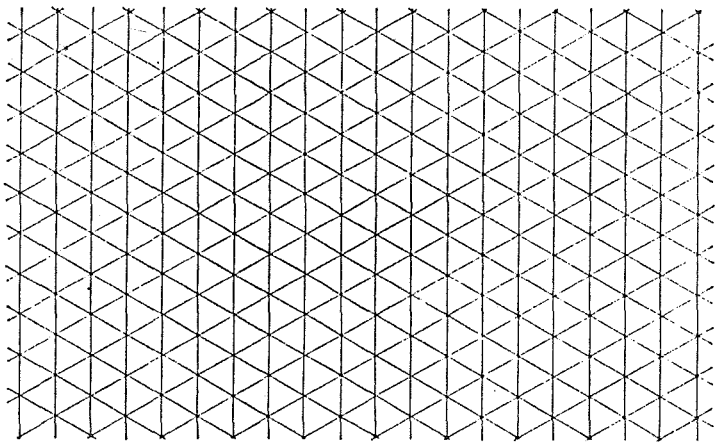
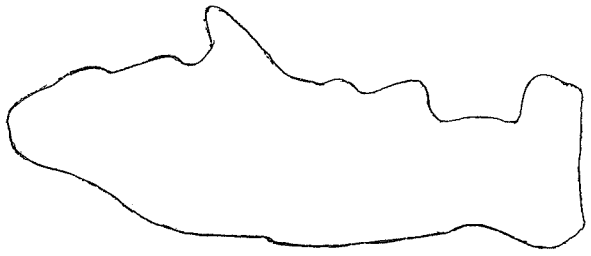
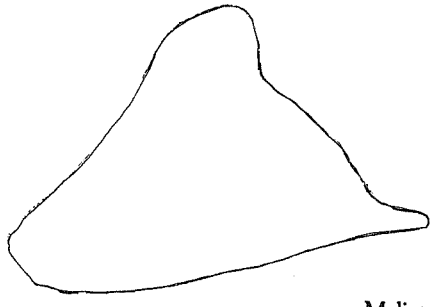


Fig. 2 Isometric Graph paper



Marfa



Mdina

Fig. 3

f) Take another sheet of these coloured papers with triangles. Measure the amount of surface covered by your foot (or shoe). Next, here we have the outlines, the boundaries or perimiters of two districts, Marfa and Mdina both are taken from a map of Malta. (Fig. 3). Let's find out which is the larger of the two districts Marfa or Mdina and by how much.

g) We have been finding *the amount of surface covered or enclosed* by a leaf, by a shoe, by a

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district on a map. For all the words in italics above we can use a single word *area*. So instead of saying *the surface* of the leaf we say *area* of the leaf, or *area* of the foot, or *area* of the district. Which other things on the teacher's table have area? The poster, the post-cards, the tiles. All these objects are thin and flat and so have their *area*. Area therefore is the amount of surface enclosed by a boundary. Let's write it down again

area=amount of surface enclosed by a boundry

The area of one leaf was 18 wholes or 18 units of area. The other leaf was 15 units. What was the area of your foot? Of Mdina?

Conclusion (for Teachers)

Area is fundamentally a measure of surface and the essential aim of these concept-formation lessons about area is to develop an appreciation of this idea. Rules for finding areas of certain shapes will come later, but under no circumstances should these rules or formulae come first. Children should first be confronted with finding the area of irregular shapes, and not, as was normal until recently, be given the deceptively easy rectangle to consider in the first instance. There is a distinct danger in using the formula for a rectangle too early. It is the concept of area that is required not the rules at this early stage.

References

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