PEER TUTORING AS PART OF A RESEARCH DESIGN

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This reports describes part of a pilot study investigating language use in the mathematics classroom. It focuses on the language used in a peer tutoring situation. I shall describe the theoretical background tothe study and illustrate the outcomes with a description and discussion of one incident.

Background

During my career as a teacher of mathematics there has been an increasing interest in the part language plays in the teaching and learning of mathematics. Twenty years ago Stubbs observed:

> There is probably general agreement among educationalists that language is somehow a crucial factor in a child's education. But there is no general agreement on precisely how 'language' and 'education' are related.
>
> (Stubbs 1976, p.15)

Later the Cockcroft report recommended that:

> Mathematics teaching at all levels should include opportunities for ... discussion between teacher and pupils and between pupils themselves.
>
> (Cockcroft 1982, p. 71)

Acceptance of this position involved some adjustment to my teaching strategies which motivated me to investigate more closely the language used when pupils were involved in a mathematical activity. In particular, I wanted to observe pupils teaching their peers.To support this aim I recalled Vygotsky's definition of the Zone of Proximal Development (Z.P.D.) as:

> the distance between the actual developmental level as deteI1nined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.
>
> (Vygotsky 1978, p.86)

The final few words are important to the design of my research project. I placed upon them an interpretation which would enable me to create the situaions required.

The Pupils

I undertook a pilot study, focussing on one aspect of a planned larger project in which I was investigating communication within the mathematics classroom and its implications for me as a teacher, at the school where I teach - a small rural 11-18 comprehensive in Oxfordshire. The pupils were members of a year 7 class, aged eleven or twelve, containing a range of mathematical attainment.

The Research Method

I decided to set up a chain of four pupils, selected by themselves, and to teach the first pupil of the chain a new topic or technique associated with the mathematics being studied at the time. This strategy resulted from my interpretation of 'more capable' in a restricted way. The first pupil would then be in possession of a mathematical result and the method by which it was derived which the others had not yet acquired. It did not relate to any other measurements of the pupils' levels of

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attainment. Each pupil would then, in turn, become the tutor: the last pupil would then 'teach' me.l was particularly interested in observing the language used by successive pupils and how it related to the communication of ideas in such a context. I (audio)-recorded each interaction and kept any notes made during each session.

Teacher----> Pupil₁----> Pupil₂----> Pupil₃----> Pupil₄--->Teacher

Figure 1

One Incident

I would like to illustrate some outcomes from the pilot study with a description of one incident which raised a number of questions about language use which are factors in defining my further research. At the time of this small-scale study the class was studying a module of work relating to Shape and Space. The chain consisted of four girls who had already shown an aptitude for mathematics. All of them knew the angle sum of a triangle. I chose to extend this to the angle sum of a polygon and thence to the size of the interior angles of a regular polygon.

I chose to teach using a method based on the idea of 'scaffolding' which involves the extension of current skills to a higher level of competence. I made it clear to the first pupil that this was the method I would be using and that they might like to use a similar method.since my main focus is on language I decided, for pragmatic reasons, to take care with the number of technical words I used. Many authors (see later) have commented on the mathematical difficulties faced by pupils because of the mathematical vocabulary or linguistic structure of the problems posed.

The word which is at the centre of this particular incident is 'angle-sum.' I used it in such phrases as 'the angle-sum of a pentagon' during the first phase of the chain.

I taught the first pupil, in the style described above, using 'angle-sum' and the names of the polygons (pentagon, hexagon etc.) as the only less-than-familiar words. However I emphasised that remembering the names of the polygons was not important - I was more interested in the technique being employed. The method used was the common approach of dividing the n-sided polygon into (n-2) triangles and calculating (n-2)xl80.When I was confident that the first pupil had grasped the technique, drawing out the (n-2) result during the course of the session, I called a halt.

During the following lesson I set up the next link in the chain, pupil} teaching pupil2. Once the chain was underway it was my intention not to intervene except for 'emergencies.' However I did listen to the recording of each session immediately afterwards. These generated a great deal of information about understanding and language which I am still in the process of reviewing (interpreting may be overstating the case).

Of particular interest was an apparent substitution of one word for another without apparent loss of meaning to the mathematics being shared. For convenience let the pupils be A, B, C, D in that order. During the A->B session A began to use the word' Area' in place of 'Angle-sum'. For example she asked B "What is the area [of the polygon]?" Later she said" The area of that is 360 ." I checked back and found that A had used the correct term in her exchange with me. However it was clear from the tape and the notes made that the main elements had been taught During that interaction B picked up the word 'area' and began using it herself. During the next link, B->C, B used 'area' throughout.

Discussion

The links between language and understanding, between communications and shared meanings and between words and ideas are, by common consent, complex. Many authors have discussed the factors which affect pupils' understanding (see Aiken, Durkin & Shire, Ellerton & Clements). Some have concentrated on language problems within the learning of particular mathematical topics. (See Anghilieri, Kerslake).

However the incident described above raises, for me, a number of issues about communication and understanding.!t seems to suggest that, in some contexts, ideas can be communicated without necessarily using a mathematical vocabulary recognisable outside of that context. It appears, here, that the word 'area' has been used as a label for an idea and has not hindered its communication. other research methods, e.g. observing collaborative learning, provide similar examples of wordsubstitution. However, I suggest that the method described here can focus on such a phenomenon. The incident described above is an example of one type of outcome of this method. Consideration of other aspects of the taped exchanges between the pupils suggests that this method not only throws up a number of questions about language and understanding but also provides a different perspective on these elements.

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