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Blind activity?

> " ... the task in itself does not 'contain' mathematical concepts or structures. And 'blind' activity on a task does not ensure learning as intended." [Christiansen and Walther 1986: 250]

The research reported here arises out of concern that, very often, learning mathematics does not take place as teachers intend. Apart from the general recognition that mathematics is a difficult subject both to teach and to learn there is also substantive and convincing research evidence to the effect that teaching and learning mathematics is not the straight forward transaction that it might at first appear. We note the research reported by Denvir and Brown (1986) which attempted to develop a 'descriptive framework and diagnostic instrument' and then use this to inform the teaching programme of low attaining children; they write:

> " ... acquired skills (...) were not the ones that had been taught" [1986: 153] and "Children did not always learn precisely what they were taught" [1986: 163].

Further we note the teaching experiments reported by Bell and his associates (Bell 1983, Swan 1983, Underhill 1991) which demonstrated the marked difference in pupil's performance between those who had been taught using 'conflict' methods and those who had been taught using a 'positive only' approach.

In an attempt to explore further the nature of activity in mathematics classrooms I have been observing mathematics lessons in secondary schools and interviewing pupils as they are engaged in the tasks set by their teachers. My intention here is to share part of my analysis of extracts ofthe transcripts of these interviews and the theoretical model of classroom activity which I am using as an analytic tool.

The model.

Theories of cognition based upon social practice and constructivist arguments have explanatory power in the analysis of classroom activity. Although it is articulated elsewhere by Lerman that the joining of these two provides an incoherent account of learning I would argue that we will fail to provide an adequate explanation of learning activity unless we recognise the importance of both the social and the individual.

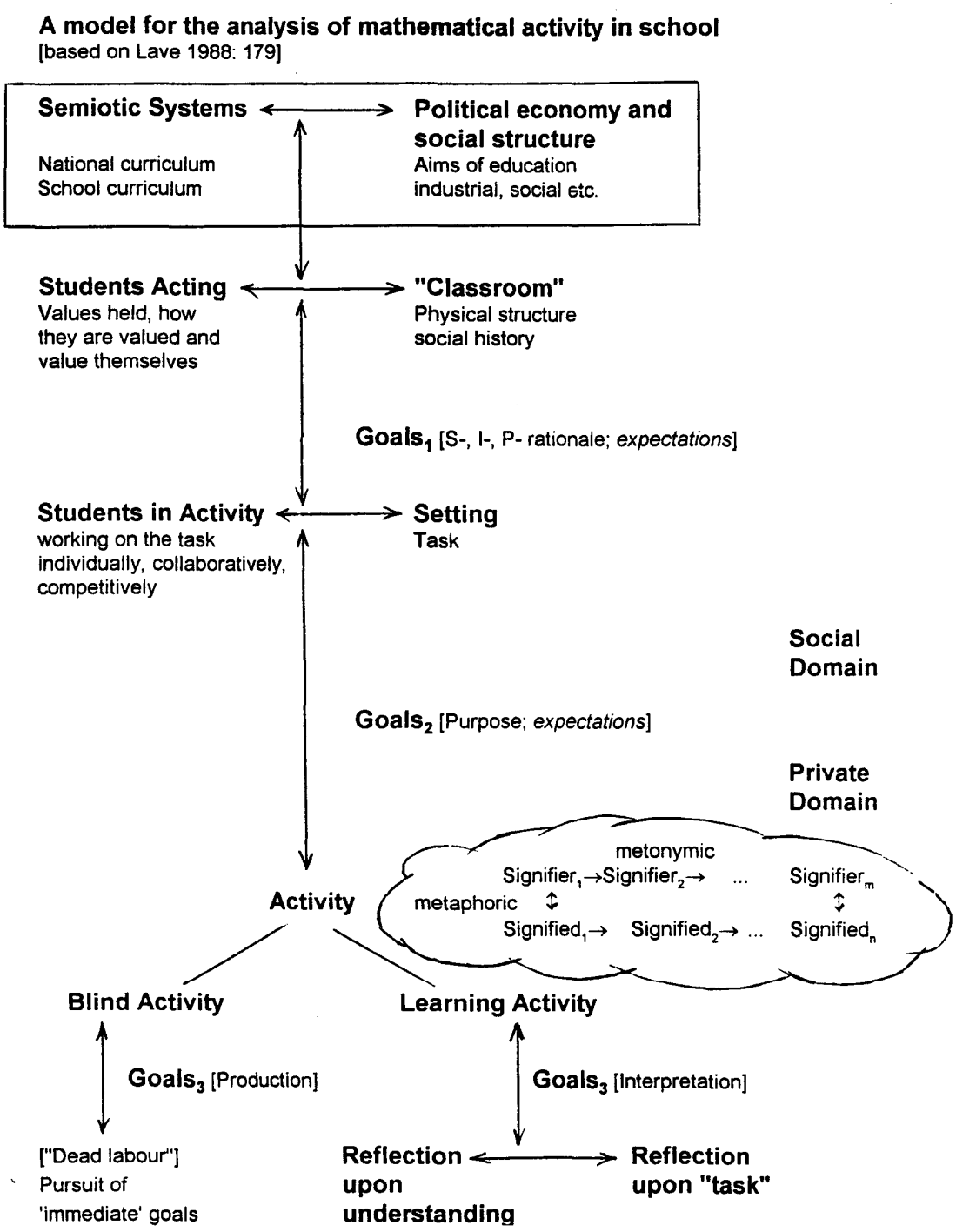
Lave (1988) describes cognition from the perspective of social practice in the following manner:

> " ... cognition is constituted in dialectical relations among people acting, the contexts of their activity, and the activity itself." [1988: 148]

The model that I propose is based very closely on that illustrated by Lave [1988: 179]. Lave bases her argument on the observations of people in their everyday activity; dieters preparing meals, shoppers visiting a supermarket and workers loading pallets in a warehouse. However the activity of a classroom has significantly different objectives from those of people engaged in their everyday lives; as EI'konin (1961) observes:

> "The basic unit (cell) of educational activity is the educational task .... An educational task differs fundamentally from other types of problems in that its goal and its result consist of a change in the acting subject himself, not in a change in the objects on which the subject acts."
>
> [Quoted by Davydov and Markova 1983: 60].

Whilst recognising 'the importance of the 'social' in the constitution of meaning the reflective activity of the cognizing individual is also seen to be central to an explanation of learning activity [Wheatley, 1992; Steffe and Wiegel 1992; Bauersfeld 1992]. Thus I present the following model upon which I base my analysis of classroom activity.



It must be stressed from the outset that the physical positions and juxtapositions of the objects and relationships of this model are due to the structure of the diagram and are not intended to presume any precedence or structure in the classroom. The arrows indicate dialectical relationships, thus students acting and the classroom are accepted as mutually constituted in dialectical relationship, similarly students in activity and the setting. To this point there is little to distinguish this model from that offered by Lave. I have labelled the vertical arrows 'goals' and indeed it is these goals towards which students work which are the focus of my present interest. Lave rejects the word 'goals' as she interprets this as a one-way relationship, she prefers to use 'expectations'. I have not followed Lave in this as I am specifically considering the rationale, purpose and interpretation/production of pupils and I am seeing these as one-way characteristics of pupils (although I accept that the consequence of the goals which pupils hold will be reflected in changes 'above').

The actual nature of mathematical activity I have indicated as metaphoric and metonymic processes, for this I must acknowledge, with gratitude the contribution of Paul Ernest. Again, it is emphasised that nothing should be read into the fact that this cloud of activity is shown to the right and apparently associated with learning activity, ideally I would superimpose it on the word activity.

Activity in the classroom could be 'blind' in that it does not result in any learning, the use of the word 'production' to describe the goals here will be explained below as I use the model to analyse transcripts. Interpretation is used to describe the goal of learning activity as this is seen as central to learning, [Goodchild 1992]. Learning activity is then seen as yet another 'level' of dialectic relationship, here between the learner's reflection on their own understanding and their reflection on the task. I fmd a useful sub-model for this is Neisser's perceptual cycle (in Christiansen and Walther 1986); in Neisser's model the schema directs the exploration which samples the object resulting in modifications to the schema and so the cycle continues.

Analysis of transcripts

1. In the first transcript examples of Goals2 are evident:

T. So why are you doing it?
Sl. Make us concentrate, I don't know.
T. Makes you concentrate?
S2. No, just make us do something.
T. Makes you do something? Do you agree with him?
Sl. No because then if Miss wanted us to do something she'd get us cleaning or something like that wouldn't she?
T. Yes, yeah, so why do you think?
S3. Concentration.
S 1. Yeah I think concentration and I don't know because maybe there's something about this that we'll go on and do later on that can help us with other things.

(Year 8 students, average attainment, working on an investigation with polyominoes. The teacher~<; objective wa<; for the pupils to develop an understanding of and facility with congruence and rotations).

The pupils in this transcript offer three possible goals at 'level' two which indicate their perception of the purpose of the activity: concentration, make us do something and help us with other things. It is possible that the notion of concentration is seen as a universal aim of mathematical activity arising from the frequency with which the pupils are exhorted to 'concentrate' by their teachers; this opens up the whole question about the origin of pupils' goals and our responsibility as teachers in 'transmitting' appropriate signals through the language we regularly use in class: 'I want you to do .. .' rather than 'I want you to learn .. .' .

That a pupil could suggest the activity was simply 'to make us do something' is possibly an indication of the sad fact that many pupils do not see any purpose in their activity outside of the requirement to do what the teacher tells them. On the other hand although the purpose of the activity was not clear one pupil was able to express sufficient confidence in her teacher to suggest that there may be a point in the activity because it would 'help us with other things' not yet apparent. There is here a hint of goals at levell, in that the pupils have a rationale for engaging in the activity because this is the accepted 'practice' of the mathematics classroom. I find it is useful to extend Me11in-Olsen's constructs of S- (socially significant) and I (instrumental) rationales [Mellin-Olsen 1987] to include a P- (practice) rationale.

2. This transcript provides an example of a 'level' three goal of blind activity.

T. Do you think it's important while you're going through them to think about why the rule works?
S. At the beginning so then you can understand it then.
T. But once you've understood it you just do it?
S. Yeah, why not?
T. Why not?
S. Because you know what you got, you haven't, it's going to take you ages to think each one while you're doing it, it's gonna take you four times as long. You'll only be able to do two sets of questions but otherwise you'll be able to do, say, four.

(Year 9 *pupil, average attainment working at an exercise on approximations).*

Although at the beginning of this extract the pupil acknowledges that understanding has a role it seems that he sees his goal as productivity and anything which gets in the way of this is to be avoided. It is interesting to note that my least successful interviews have been in lessons where the pupils have been engaged in routine, undemanding tasks and their clear desire is to do as much work as possible. Thus I label the pupil's goal when engaged in blind activity 'production' and this relates back to the words of EI'konin quoted earlier in which he draws attention to the difference between an educational task and other types of problems.

3. The extracts from a transcript below reveal the different responses to the repeated question 'why' and indicate goals at different 'levels'.

T. *(read~)* Round off each of these to three
S. Significant numbers, figures
T. Figures, right. And so partj (99993) what did you round that to? 10
S. Hundred thousand.
T. Hundred thousand? [So Yeah.] Why did you do that?
S. Because the next number, that's the three significant numbers and the next number's higher than five so you round it up to the next whole number. 15
T. So you rounded ninety nine thousand nine hundred and ninety three [So Yeah.] Up to a hundred thousand?
S. Oh ten thousand! *(reading her own answer incorrectly).*
T. That's all right, yes. [So Yes.] Why?
S. I don't know, because I have to, it's had to round it ~to three 20 significant figures ..
T. O.K. you've got ... that answer's correct [So Yeah], um and so you've obviously done it in the right way [So Yeah] but why does that way work?
S. Don't know.

(and much later in the interview)

T	Why do you think you're doing this?	15
.	Because Miss G. told us to.	2
S.		

(Year 9 pupil, average attainment working at an exercise on approximations, line numbers relate to complete transcript)

Why? asked in line 12 elicits a response of goal at 'level' three "the next number's higher than five so you round it up", the student's reveals a syntactic process. I argue that this does not necessarily compare with metonymic transformation practised by mathematicians as illustrated in the model since it is possible that the pupil acts without any consciousness of an underlying metaphor. When a mathematician works metonymically then she/he is in possession of a metaconcept which explains and justifies the actions even though there may be no concurrent metaphor in her/his mind. This student is following a rule without any notion of its meaning. When "why does that way work?" is asked (line 23) the pupil responds "Don't know", although later in the interview (not reproduced) the pupil reveals an understanding of all the necessary underlying concepts such as place value she is clearly not bringing these to the interpretation of the activity. It seems then that her 'level' three goal is one of production rather than interpretation and on the basis of this and other parts of the interview (not reproduced) Twould argue that her activity may be described as 'blind' rather than learning.

Why? asked again in line 19 elicits a goal at 'level' two. The purpose of her activity is to follow the instructions in the text, "because I have to, it's had to round it off to three significant figures." This seems to be characteristic of so much of pupil's activity in mathematics, the task is not really about anything in particular, it is about the manipulation of numbers empty of any meaning and there appears to be little purpose in engaging in the task other than "because I have to."

In line 152 why is asked yet again and a level one goal is provided. The pupil's rationale for working is because she has been told to do this by her teacher and the accepted social practice in this classroom is that pupils will engage with the tasks set by their teacher, no other reason is necessary or sought.

Discussion

The validity of the interpretations of the transcripts is not at all evident from the brief extracts discussed above but this is not the prime issue here, they are offered rather by way of illustrating the model provided and help to define further the notion of 'blind' activity. A number of points are in need of clarification.

A syntactic interpretation is not in itself evidence of 'blind' activity. Skemp has described relational and instrumental understanding and indeed it is reasonable to see the possibility of relationalleaming and instrumental learning. Learning a syntax based rule may rest on instrumental understanding but it is still learning. 'Blind' activity is used to describe a pupil's activity which is motivated by and for the production of answers without any interpretation of the activity or reflection upon the answers, it is work for the sake of work alone and is no more a learning activity than "cleaning or something like that" (I accept that is some circumstances even cleaning may result in learning, so perhaps the example is not so good!).

An approach which incorporates the practice of routine skills may be justified as a proper task for the mathematics classroom in that it raises pupils' level of proficiency and may help retention, this too some may argue is not 'blind' activity. Twould want to explore the pupils' goals before coming to any judgement on this issue. It is very easy to dismiss rule bound activity, and syntactic interpretation as 'blind' but there is a value for these in mathematics in that pupils may learn what to do or how to represent and meaning comes later, as Pimm [1986]

has suggested in relation to a young child's learning of number words. Pupils want to know 'how to do' I have been asking pupils what makes a good maths lesson for them and a frequent response is "one where I know what I'm doing" which lays emphasis on the production goal of their activity rather than interpretation.

A question arises as to whether it is possible to prompt particular types of answers which may be interpreted as indicating different goals, and whether I have attempted to lead pupils through using 'effective' questions. As far as the transcripts discussed above are concerned the answer is clearly 'no' since the interviews preceded the development of the model and the attention to pupils' goals by some months. In my future work the need for extreme caution is recognised so as not to fall into the trap of leading pupils to particular responses because they will fit and confirm the model I hope to use to analyse their activity.

In the third transcript examined above it appears that their may be a coherence between the goals:

$Goal_1$ (P-rationale) → $Goal_2$ (purpose → 'it's what I have to do, it's the rule) → $Goal_3$ (instrumental interpretation or production)

Again, there is insufficient evidence here for such a conclusion. I hope to be able to present a more convincing account of this on the basis of my continuing programme of interviewing pupils in the course of their activity in mathematics classrooms.

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