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LEARNING OBJECTIVES: IN A SOCIOCULTURAL ACTIVITY SYSTEM ARE THEY TOOLS OR RULES?

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Learning objectives have become a feature of secondary mathematics lessons in England. In this paper we focus on two lessons taught by beginning teachers to explore the potential of a particular framework for analysis. The language of a sociocultural activity system is used to consider the place of learning objectives in student and teacher learning. This is offered not as a research paper, but as a philosophical review to begin to offer a language to explain some obstacles to teacher learning.

INTRODUCTION

In earlier papers we have described a model to classify the different elements that might come together to transform a student teacher's (ST) learning about teaching – professional traditions (curriculum, textbooks research etc.), practical wisdom (the activities chosen for lessons) and learner-knowledge (the knowledge needed to answer the questions). We argue that it is the interaction of these that lead to classroom events but it is only the sustained reflection on these elements that leads to the teacher-knowledge of mathematics (Prestage and Perks, 2001).

In this paper we review aspects of this learning in relation to a sociocultural framework (Cole and Engeström,1993, and Engeström, 1999). The framework offers ways to consider the connections between elements that influence the action of learning about teaching in the activity systems of schools and teacher education partnerships.

In particular we use the role of a professional tradition, current in English schools, that of 'learning objectives'. The 'Framework for Teaching Mathematics' states that the main part of the lesson will be more effective if you "make clear to the class what they will learn" (DfEE, 2001, p 1/28) and that "better standards of mathematics will occur when … lessons have clear objectives." (p 1/6). One consequence of the Key Stage 3 Strategy has been that learning objectives/outcomes have become a major feature of mathematics lessons in secondary schools.

Askew (2004) in his analysis of the relationship between the objectives and examples in two primary lessons argues: "teachers' subject matter knowledge for teaching will be central in mediating between these." Subject matter knowledge for teaching is, however, an ambiguous phrase. We believe that it is important to unpick the many meanings ascribed to subject knowledge and Shulman's (1986) pedagogic content knowledge, (Prestage and Perks, 2001). Askew (2004) appears to use the lack of

subject matter knowledge to mean, using the language in our model, the lack of learner-knowledge by suggesting that some mathematical connections were not available to the teachers. Our analysis is that the unsuccessful use of learning objectives may not be a function of inadequate learner-knowledge.

Our practice involves many classroom observations; the two lessons offered here exemplify our thinking. The data comes from observation notes, school documents and lesson plans. The data are described in terms from our original model with links to socio-cultural activity theory to counter the perspective offered by Askew.

WAYS OF THINKING ABOUT LEARNING

For Vygotsky, spontaneous concepts are developed through experience, by getting on and doing. Scientific concepts are developed through the context of instruction, through a deliberate pedagogic act

> The development of spontaneous concepts goes from the phenomena upward toward generalisations. In the case of scientific thinking, the primary role is played by the initial verbal definition, which being applied systematically comes down to concrete phenomena Vygotsky 1986, p. 148

Though fundamentally different in nature, the development of scientific and spontaneous concepts represent two sides of the same concept formation:

> Though scientific and spontaneous concepts develop in reverse directions, the two processes are closely connected. … In working its slow way upward, an everyday concept clears a path for the scientific concept and its downward development. It creates a series of structures necessary for the evolution of a concept's more primitive, elementary aspects, which gives it body and vitality. Scientific concepts, in turn, supply structures for the upward development of … spontaneous concepts toward consciousness and deliberate use. Scientific concepts grow downwards through spontaneous concepts; spontaneous concepts grow upwards through scientific concepts. Vygotsky 1986, p.194

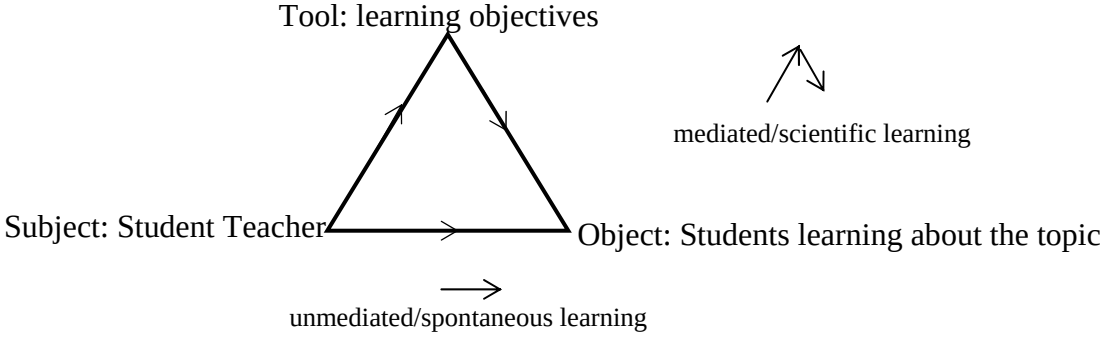

figure 1

For Vygotsky, learning is mediated through the use of tools (such as language) and artefacts (lesson plans, debriefs). Figure 1 offers an image for learning about teaching in the context of learning objectives. The ST (the subject of the interaction) is

mediating her mathematical knowledge for the students (the object of the ST's actions). By STs telling their students the learning objectives of a lesson, spontaneous learning may occur. However, unless there is some mediation, a deliberate pedagogic act, the students' knowledge of the mathematics embedded in the objectives will be dependent upon the nature of the tasks chosen for the lesson.

WAYS OF THINKING ABOUT PROFESSIONAL LEARNING

Developing expertise, learning a professional practice, is frequently seen as a developing capacity (a) to interpret aspects of the field of action in increasing complex ways and (b) to respond to those interpretations (Eraut, 1994; Sternberg & Horvath, 1995). A sociocultural approach to learning echoes this analysis. In these terms professional learning is evident in the capacity to interpret the 'object of our activities' (i.e. what it is we are focusing our energies and attention on) so that its complexity is increasingly revealed. For example, the ST might see a pupil as troublesome, but after conversations with a mentor might learn to interpret that behaviour as troubled and revise any responses (Edwards & Protheroe, 2004). In sociocultural analyses this process is called 'expanding the object' (Engeström, 1999), i.e. seeing more of the potential meanings in an event. STs work hard to avoid the unexpected while teaching (Desforges, 1995; Edwards, 1998), they avoid expanding the object, close down on complexity and limit their learning. STs need to be guided towards richer interpretations in the act of teaching with their learning being mediated by more expert teachers in the processes of interpretation and response in the classroom. (Edwards & Protheroe 2003)

Sociocultural approaches add to understanding of expertise, seeing it as:

> [an] ongoing collaborative and discursive construction of tasks, solutions, visions, breakdowns and innovations. (Engeström and Middleton, 1996, p.4)

That is, expertise is not located within one individual but is distributed across systems in the forms of other people and the artefacts that they have produced (Hutchins, 1991; Pea, 1993), or as what Bruner has called the 'extended intelligence' of settings (Bruner, 1996). Expertise is a matter of informed interpretation of complex phenomena in professional practice and a form of resourcefulness which involves using the expertise of others in order to respond intelligently to those interpretations.

WAYS OF THINKING ABOUT COMMUNITIES OF LEARNING

The phrase 'community of practice' comes from cognitive anthropology where it was used to explain how novice members of a community were inducted into the practices of more expert community members such as weaving material using traditional patterns, or learning how to cut and make up clothes (Lave & Wenger, 1991; Lave, 1997). Here the community could be easily defined and the practices were well-established and relatively unchanging. The metaphor for learning these practices in such communities is clearly participation. There are socialisation versions of initial

teacher education which accept this model of learning, as STs are inducted into the communities of the schools in which they train.

We can be more precise about learning communities, using the work of Engeström who has undertaken developmental research with a range of organisations. His unit of analysis is what he calls the 'activity system' (Engeström, 1999). His analysis asks us to look at that system as a learning zone, figure 2, where the influences on the learning (figure 1) are extended to include consideration of rules, community and division of labour.

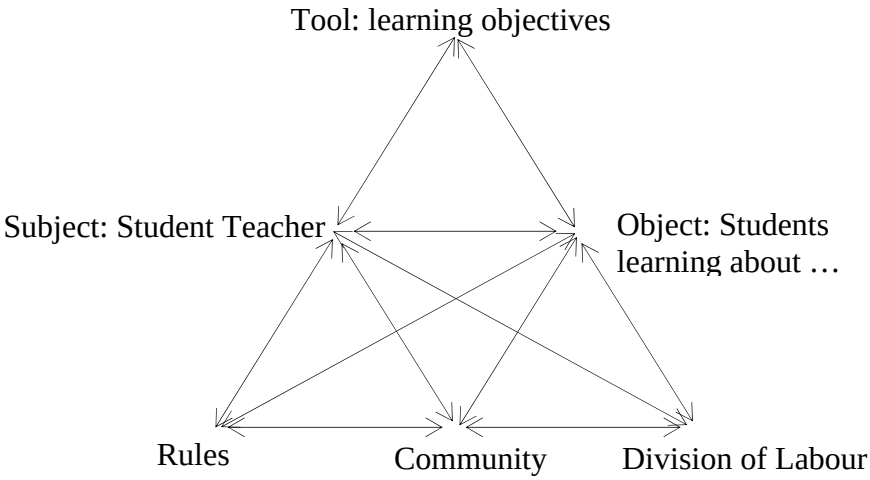

figure 2

For example, the ST-students interaction (the top triangle) uses learning objectives, supposedly to enhance the students' learning. The use of objectives as a learning tool is subject to what is classified as rules, community and division of labour. For the ST these rules come from the Strategy and will be interpreted by both school and university. In terms of the division of labour helping STs to help students learn is influenced by mentors, tutors, the class teacher and possibly learning assistants. The ST belongs to two communities in this partnership between school and university; the community where STs are learners and the community where they are teachers.

What follows are extracts from two lessons to exemplify figure 2, where the second teacher was judged to be a good mathematician, whereas the first was not, yet both used learning objectives in similar ways.

LESSON 1, CURRENCY CONVERSIONS: AN ANALYSIS

A ST, towards the end of professional training, taught a class of challenging 14-15 year-olds. The topic was currency exchange with the learning objectives written on the board as:

Learning objectives

- to carry out conversions from pounds sterling to other currencies
- to convert from other currencies to pounds sterling

- to compare prices

The main activity began with the first question: “Who is going on holiday this summer?” (practical wisdom, engage them in their ‘real world’). A couple of hands went up and they were asked, “Where to?” The response was a surprise to the ST, “Skeggie!” The question failed to engage; there was no need for currency exchanges for their holidays.

Let us pause and review the activity system. To engage the pupils in the first of the learning objectives the ST decided to use something from the real world, advice that can be employed as rule for teaching, but in order to do that successfully you have to understand the community the children come from. In terms of division of labour, who else besides the mentor is responsible for helping the ST to understand what is real and relevant?

The ST continued with his teaching, offering worked examples on the board. with the algorithm emphasised as:

£1 = US$ 1.79

£2 = US$ 3.58 “Multiply by 2 as we have 2 pounds”

£5 = US$ 8.95 “Multiply by 5”

The activity was concluded with a repetition of the rubric, “To convert from pounds to other currencies we just multiply.” The students were then given a worksheet which contained the calculations to do, but with no explanation or repetition of the worked examples. The routine was repeated for converting currencies to pounds using division.

When questioned by the observer, the ST stated that the students had met the learning objectives because the students had carried out the conversions as outlined in the lesson plan. In terms of the evidence this is so; they had been told exactly what to do, so they had done the conversions, but only by performing the designated calculations. A question remains, however, is whether the students had *learned* how to convert currency.

LESSON 2, LOCUS: AN ANALYSIS

The ST teaching this lesson is an excellent mathematician and had well-managed relationships with her classes, except this difficult year 10. She had been assessed by her school as ‘very good’. Her learning objectives for a lesson on locus were written on a flip chart as:

By the end of this lesson you will be able to:

- construct the locus of a point which is a fixed distance from a given point
- construct the locus of a point which is an equal distance from two given points.

After a short starter, students were given pairs of compasses and asked to draw a circle of radius 8cm. This was followed by an explanation with a free-hand circle drawn on the board. The ST indicated a point on the circumference and then the

‘centre’ saying, “This point is 8cm from the centre”. This was repeated for several points, with the conclusion that, “Every point on the circumference of the circle is 8cm from the centre.” The link between the objectives and the explanation was limited. The circle was explained in terms of points being the same distance from the centre, but the converse is not stressed, i.e. if you have points which are 8cm from the same point you obtain a set of points which form a circle.

The construction of a perpendicular bisector was given, the steps being

- open your compasses to more than half the length of the line segment
- draw an arc centred on each end of the line
- join the points where the arcs meet (9 mins).

The construction had as its emphasis the line segment, not the points at the end of the line segment. It was assumed that the students realised that the construction gave the set of points equidistant from the points at the end of the segment.

Students were given an exercise on locus from the text book. Some tasks needed them to choose the correct constructions. Despite twenty minutes being spent on this task few students finished more than one question. Most tasks expected the students to know whether they were drawing a circle or a perpendicular bisector but the only task that all students completed was one that told them to draw the circle. The students may have done constructions but there was no real evidence of locus.

At the end of the lesson, the students were asked what they had learned. Two students responded with almost perfect paraphrases of the learning objectives, which were still visible on the flip chart. Asked by the observer if the students had learned anything, the ST stated that they had and for evidence cited those who had reiterated the objectives. The rule, to use learning objectives, had been followed, but the ST, despite her excellent learner-knowledge, had accepted the restatement of the learning objectives as evidence of learning. The complexity of relating tasks, objectives and learning through her teaching had not been subject to scientific learning.

DISCUSSION

Using a sociocultural perspective, we argue that if learning objectives are to be useful in the classroom they need to be developed as ‘scientific concepts’ by the ST within the teaching interactions. In these two examples, the learning objectives provide a context for the lesson. The provision of a context may enable the students to make the connections themselves. But, we would ague that such spontaneous learning is necessary but not sufficient.

In an activity system, the mere existence of the tool (write learning objectives) is insufficient to influence learning. Engeström (1999) suggests that we need to consider other aspects of the system, the rules, the community and the division of labour to explain the almost irrelevant use of learning objectives. In both of these examples, the stating of learning objectives has the status of rules. The community,

the mathematics departments, claimed in their documentation that they serve a valuable purpose. This may have led to the STs stating the objectives without linking them to the learning. In terms of division of labour, if the STs are left to make sense of their use, without a supporting pedagogic exchange, they are unlikely to recognise that these links have not been made. The examples, we believe, reveal that it is not the lack of subject knowledge that leads to learning objectives being ill-connected to learning (Askew, 2004), but that the rule of stating them is considered sufficient to ensure learning.

The status of the Strategy (DfEE, 2001) in English schools has led to an uncritical use of learning objectives with an expectation that they will be used in every lesson and teachers have to account for them in their records. Their existence alongside chosen activities is often assumed to be sufficient to account for learning. This relationship is not necessarily challenged. The current challenge for education in England, where there is an overabundance of government initiatives in classroom action, is to work with new teachers on the critical analysis of the purpose of such expectations as the writing of lesson objectives if lesson objectives are to be tools not rules.

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