THE MATHEMATICS INVOLVED IN COMMUNITIES OF PRACTICE AND SCHOOL MATHEMATICS: IS THERE A DIFFERENCE?

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Although school mathematics is necessary for the enculturation into abstract and formal ways of thinking, there is essentially no difference between school and everyday mathematics. Rather than two different kinds of mathematics, any mathematics that can be discerned in practice is the same kind of mathematics that is taught in school but used differently in different situations. However, paradoxically, the everyday mathematics of a community of practice is different to that of schooled mathematics: the former is tied to competency and task fulfilment while the latter is epistemic.

INTRODUCTION

The situated learning involved in communities of practice applied to schooling is a paradox. On the one hand there is no fundamental difference between the mathematics involved with a 'community of practice' and schooled mathematics, yet on the other hand there exists a fundamental difference between the everyday mathematics of the former and the scientific (schooled) concepts of the latter. Both the community of practice and the classroom use the same mathematics, but the former is dependent on the learner's participation in a social and material context, such as an apprenticeship or 'guided participation', whereby the mathematics is tied to competency and task fulfilment, whilst the latter is tied-up with the aim of schooling, which is epistemic. Given that the aim of the 'situated learning' of Lave and Wenger is to replace the formal mathematics of the classroom with the mathematics involved in communities of practice, this article attempts to show how disastrous this aim will be for the majority of school learners, who would learn only the mathematics of a skilled workforce. While what Lave and Wenger propose may be consistent with the aims and aspirations of Gordon Brown and New Labour, educators must show how necessary it is for schoolchildren to learn the formal, academic concepts of mathematics that are decontextualised from the everyday. Schooling is about *development*, whilst situated learning in a community of practice is about competency and task-fulfilment. Any notion of creating a community of practice should be left to the employer in order to create a post-16 apprenticeship. Given the influence of Lave and Wenger in the mathematics education community, it is time to take a reflection on what is actually being proposed.

IS THERE A DIFFERENCE IN THE MATHEMATICS?

Studies of everyday mathematics have had an impact on mathematics education. The well worn example of the Brazilian market boy, adept at mental arithmetic but hasn't a clue when it comes to the equivalent mathematics taught in the classroom, is a case

in point. Situated learning, the forming of concepts appropriate to the fulfilment of a task, does appear more fruitful than the algorithmic learning of school, but Lave and Wenger posit classroom learning as a form of rigid learning almost by rote, serving as a contrast to the multi various ways in which the mathematics of a real problem situation arises as strategy. A contrast is made between everyday mathematics and school/academic mathematics (e.g. D'Ambrosio, 1997; Masingila et al. 1996), but is there really a difference? There are hundreds of examples, but let us take a few that are archetypal.

Take, for example, Lave's (1988) studies of Liberian tailors, the strategies involved in dieting, family money management or supermarket shopping. While each case shows that the arithmetic involved can arise and be solved outside of formal schooling, any discernible mathematics can be placed within the school context rather than contrasted as an alternative form of mathematics. Dieters may employ a cup as a measure of rice, but that is only to replace the required number of kilograms of rice as a measure, there is no *fundamental* difference between the two. Contrary to what is being claimed, one isn't quantitative and the other non-quantitative, as the rice cup still retains the correct quantity of rice (Greiffenhagen and Sharrock, 2008). Contrary to Lave, there is *no* difference between 'stashes' of money employed by households for special purposes to meet expenditures, and the "universal monetary system and medium of exchange that in principle provides a universal standard" (Lave, 1988, p.131). In fact, the former *presupposes* the latter rather than setting itself up as an alternative (Greiffenhagen and Sharrock, 2008). The mathematics of the shopper is very low key, with most comparisons made between commodities done almost unconsciously. If anything, it reminds us of the literature brought out in Maths Year 2000, where apparently you need mathematics to "space out the candles" on a cake (DfEE, 1999). Well, no you don't, aesthetic ability will do fine; and as for the statement that you need maths to mix (Pete Tong, BBC, 2000), well, you do, but only to count four-to-the-four beats. This isn't to deride such activities (personally I love house, techno, trance and breakbeat) but if anything, these examples show how unnecessary schooling is, since any mathematics is already inherent in the activity (Rowlands and Carson, 2002). However, any mathematics that can be discerned in these activities is no different to the arithmetic taught in schools. The underlying principles are the same; the differences only exist in terms of the practice itself, such as carpet laying, tailoring or being a DJ etc. That difference lies in the way the classroom is a special environment for the learning of decontextualised, academic concepts. This is discussed next.

THE REALTY OF APPRENTICESHIP TRAINING IN A COMMUNITY OF PRACTICE PLACED WITHIN THE SCHOOL CONTEXT

Apprenticeship training is the peripheral participation in a community of practice. The participation in a community of practice will be initially peripheral until expertise ensures membership. Unfortunately, nearly all examples are "low-tech" and contrasts with what is actually involved in "high-tech" practices (Ben-Ari, 2005).

Ben-Ari gives the example of the elite training of gastroenterologists, which involves a three-year residency in internal medicine, but to gain entrance into this community of practice you have to successfully complete medical school and learn the decontextualised concepts of anatomy, physiology, pathology, microbiology, pharmacology, etc. an antithesis of what Lave and Wenger refer to as the uprooting from specificities and meaningfulness of practice to the decontexualisation of knowledge (Ben-Ari, 2005).

Formal, academic concepts comes first prior to any consideration given to becoming a member of a vast number of (what is essentially non-elite but hi-tech) communities of practice, such as engineers, doctors, architects, accountants, etc. (Ben-Ari, 2005). Many pupils leave school with aspirations higher than apprenticeships in low-tech occupations, such as factories and farms (Ben-Ari, 2005). If, as a major part of their schooling, children learn apprenticeships then they will not be exposed to different subjects that exist outside of the specificities of that practice (Ben-Ari, 2005). To teach the mathematics of 'real' situations, the career choice and cultural background of each pupil must be taken into consideration:

> A class of rich kids could be asked to compute the most efficient route to sail a yacht from Nice to Barcelona, while a class of poor kids could be asked to compute the salary at which it is advantageous to give up welfare and take a job. Most so-called real situations and real dilemmas are necessarily totally artificial for students. The criterion for problem design should be pedagogic efficacy, not reality (Ben-Ari, 2005, 372).

This is not to undermine the mathematics involved in communities of practice, but the career choice and aspirations of schoolchildren, essentially dependent on what social class backgrounds they are situated, will determine the mathematics of 'real' situations, whether 'hi-tech' or 'low-tech', if schooling is to imitate communities of practice. In short, if you are a working class child then you will participate in a low-tech apprenticeship, and if you are middle or upper class then you will participate in a high-tech apprenticeship; although, paradoxically, in real high-tech apprenticeships you have to learn the decontextualised concepts of a discipline prior to the apprenticeship. Arguably it is the duty of educationalists to ensure that all children, independent of social background, learn the decontextualised concepts of science, mathematics and the humanities if they are to participate fully in the highly technological world that surrounds them. Then, and only then, will they be in a position to determine what apprenticeships will suit them.

What Lave and Wenger and socioculturists in general advocate is a dismissal of the capabilities of working class people and leaves you wondering: *how did the working class cope prior to the advocation of apprenticeships in the classroom?* Did the carpet layers in Masingila et al. (1996) *need* apprenticeship training prior to leaving school? Lave, Wenger and socioculturists are reactionary because what they advocate undermines the capabilities of the working class; however, the working class know how to survive in the everyday without any prior instruction of schooling.

THE PARADOXES OF SITUATED LEARNING

Similar to the work of socioculturists, Lave and Wenger (1991) identify their situation learning with the work of Vygotsky. This is not surprising given Vygotsky was a Marxist and for Marx, "It is not your consciousness that determines your being but your social being that determines your consciousness" (Rowlands, 2000, 2003). What we know and how we know is shaped culturally and within the communities of practice that make up that culture, but for both Marx and Vygotsky the decontextualised concepts of schooling has to be distinguished from the everyday concepts that make up a practice. As well as his socioculturism, Vygotsky was an Enlightenment Abstract Rationalist who believed, along with Marx, that consciousness, through science, will progress historically (Wertsch 1996). Hence Vygotsky's distinction between everyday and scientific (schooled) concepts: the former is contextualised and does not help in the *development* of the child, which can only be accomplished with the learning of the latter. Unlike the former, it is the latter that encourages reflection and abstraction. To understand Vygotsky, his ZPD has to be understood within the context of schooling and the learning of decontextualised scientific concepts. It must be emphasised that this is *not* the ZPD of Moll and Whitmore's "child-in-social-activity" that emphasises sociocultural conditions (1993), nor is it McNamee's (1990) "ZPD of the community" nor Moll and Greenberg's (1990) "funds of knowledge" of different class family backgrounds brought into the classroom (Rowlands, 2000, 2003). Of course, this isn't to say that scientific concepts should not be contextualised (use of metaphors, examples that relate to the everyday etc), but the situation is not so simple. These concepts, by their very nature, are tools of the mind stripped from any unique and context-bound situation. A straight line is no longer a stretched rope or the intersection of two walls but a geometrical object that cannot be seen. Latent heat is a concept far removed from the experience of frozen lakes or steam coming out of a kettle. The atom or its constituents cannot be seen or experienced and you would be hard pressed to find the quadratic formula or the mid-point theorem related to the everyday. Situated cognition has no use of such mind-tools unless the practice is situated within some aspect of a discipline, and to *participate* in such a practice you would need to know and understand the formal concepts of the discipline prior to the participation (graduate engineering is a case in point). Otherwise, at best, you will only pick-up (comprehend) the way these tools are used, but without any understanding of their nature or why they are used in that way. To take Lave and Wenger's apprenticeship scheme seriously, to participate in pure mathematics the child would have to begin her apprenticeship by participating in a community of pure mathematicians, but would be left clueless as what is actually going on.

In formal learning we have the deliberate construction of meaning that opens the way to development that cannot be directed by haphazard stimuli of the situations and spontaneous 'needs' of the child (Štech, date unknown). Štech gives three paradoxes of the emphasis on the practices of spontaneous learning:

- Learning in the form of apprenticeship which imitates practices should ensure a development of competences and of the whole personality of the child. However, children will have no notion of why they do what they do. Such learning may make it possible to be efficient in a situation but it will fail to encourage development.
- Learning that is bound to the practical situations of everyday life will enclose the child to her personal experience, yet it will also hinder an effective confrontation of this experience with the historic experience of humankind, such as the development of scientific concepts. Without such confrontation we will at best have intersubjective exchange and the comparison of various personal experiences, thus denying the child the opportunity to make sense of her own personal experience.
- Participation that reflects communities of practice should enable a culturally adequate access to society itself. However, the system of *intellectual* activities represents the community of practice that is essentially human. It is the school that sees to the purity of the specificities of this practice, otherwise, children will fail to become full-blooded actors in their own social world. (Štech, date unknown).

CONCLUSION

Perhaps unintentional but if taken seriously on a large scale, Lave and Wenger's pedagogic advice will leave a two-tier system whereby the children of the rich will learn the formal, academic concepts of mathematics (because the rich knows what is good for them), and the children of the poor learn some community of practice in order to become work-skilled (because some educationalists, employers and the government 'knows' what is good for them).

While it may feel good to liberate children from formal, academic mathematics and to plunge them into the mathematics of a community of practice, such aspirations come from the privilege of living in an academic community. One has to ask Lave and Wenger: *from which community of practice did you get these ideas?*

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