

# Inside and Outside Primary School Mathematics

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This article is an exploration of several interrelated concerns that I have had over the past year. At the beginning of that year I changed my job; I used to work in a primary school, now I am involved in training primary teachers. A new job offers a space within which to view an old one; this retrospective look perhaps also offers a space within which to view a new job.

## “Inside”

When I was still teaching in a primary school I was asked by somebody, now a colleague, to go along and talk to his post-graduate students about the mathematics in our school.

For the purposes of this article I thought it a reasonable device to reflect on that talk since it was a public presentation of aspects of my job that were important at that time. I have the OHP transparencies I used in front of me now as I write and they reveal some issues that I had put to one side in the interests of coping with new demands.

Before the talk to students I recall that I was anxious to set a context within which they could view what I was about to say. I had brought along some work, e.g. straw models and patterns produced by my class, and although I wanted to generate some excitement about the possibilities available in working at mathematics with children, I also wanted to caution that what they were seeing was, partly at least, a result of my years of thinking about what was suitable for children of this age. It is easy to pretend, as government reports are apt to, that there are methods of working with children that are independent of personal and school contexts. For this reason I wanted to make it clear that the particular kinds of teacher skills that the children's work implied might take time and patience to acquire.

As I look at the first OHP transparency I showed, which gave hints about the school I worked in, several features seem significant. The organization of the school and in particular the “real” rather than notional involvement of teachers in decision-making are of particular importance since they create an atmosphere within which there can be more honest exchanges about the difficulty children and teachers have in learning or teaching maths. In the specific area of mathematics, the use of Cuisenaire rods throughout the school and a philosophy of starting from where children are, rather than where teachers hope they are, is also of great importance.

The second OHP transparency set out the beliefs that I considered informed our work in mathematics. It summarised the following points

1. *Children should be confident with numbers*  
They need to do a lot of “informal” work where recording is not especially important. They need to get to know numbers by  
—splitting them up  
—halving/doubling  
—writing in number sequences  
—counting in 10's, 100's, 50's, 60's, etc  
—using one-ty, two-ty, three-ty, four-ty, etc., at an early age.
2. *Children are best dealt with individually or in groups.*  
Everybody has their own way of coming to terms with numbers.
3. *Children do not need an endless diet of sums to become good at number work.*
4. *Mathematics must involve taking a serious and respectful look at what children actually do.*
5. *Teachers as researchers*  
We don't know the best ways of putting children in touch with mathematics and are still learning.
6. *Structural apparatus (e.g. Cuisenaire rods) helps children to form images of numbers that they can then manipulate in their own way.*
7. *The printed word is extremely limited as a medium for children learning mathematics*  
There is no ideal textbook that will solve everybody's problems.
8. *Children really do proceed at their own rate. You literally cannot make them understand.* (Although you can do things that may help in the long-term if not the short-term.)

Clearly any of these points could be further expanded on. I did this in my talk but I am content to leave the list in shorthand form here. The phrase “teacher as researcher,” borrowed from John Dichmont [1], is one that I have found particularly powerful over the years.

It is however the last OHP transparency that gives me, now, the most pause for thought since it deals more clearly than any of the others with the social context within which I worked with children in mathematics. The OHP is concerned with how I operated within my classroom and with three aspects in particular:

- (i) that I worked mainly with small groups and with individuals. This raises the question of what the rest of the children do while this is going on.

- (ii) that I made a distinction between “business maths” and “other maths” “Business maths” in this context is the work that I felt obliged to do because of social pressures: it included, for example, teaching specific recognisable formats for numerical computation “Other maths” are the more informal activities such as “playing around with numbers” and work of a more open nature such as “shape and number investigations.” It arose either from my own interests or from those of the children
- (iii) that only part of the primary school day involves maths and the time spent on it varied from day to day and from week to week.

I expanded on the reference to working with groups and individuals by talking about the various choices that face teachers in organising mathematics in their classroom. For this I made use of the notion of “systems of neglect”, an idea first developed by John Dichmont [2] and explored by myself elsewhere [3]. The phrase derives from the observation that with such large classes any teacher is put in the position of choosing between alternative “systems of neglect”. The two extremes are represented by, at the one end, teachers working always with a whole class, which makes them neglect individuals because they are unable to respond to any one of them fully, and, at the other end, teachers always working with individual children, thereby “neglecting” the rest of the class in the sense that they cannot pay them specific attention.

It is, however, the division into “business maths” and “other maths” that I find most significant in this summary. The dichotomy is crude and not susceptible to detailed analysis. Instead I see it as a statement in a metalanguage that makes a distinction between what I “have to do” and what I would like to do, in such a way that I can cope with these different and often conflicting pressures. For the moment, I want to leave aside the question of whether I *really* have to do certain things because what matters, I believe, are the feelings that result in making that statement. I report, and have written about at length elsewhere [4] that it *felt* to me as if there were things in the classroom I *had* to do because of the social context within which I worked. I report also that I notice some resistance in myself to saying publicly that I tackled some of the things I felt I had to do in an expedient way. Perhaps this resistance arises because expediency seems contrary to the spirit of “enlightened mathematical education” as expressed by myself and others in journals such as this. Yet, although issues of this kind are not often addressed in the mathematics education literature, they seem to me to form part of the reality of our working lives.

As members of a teaching staff most of us felt under pressure from several sources. The predominant pressure most of us felt was from parents. Pressure from the local secondary school was more abstract and only those teachers in dispute with the philosophy of the school felt real pressure from the headmaster.

Many parents were confused by what we offered to children as mathematics because it was so far from what

they had experienced in their own schooling—they had been used to a diet of computations by standard methods. They were confused by the use of Cuisenaire rods, which some saw as nothing more than “bricks” to play with. They were worried about our apparent lack of attention to learning multiplication bonds and about the relatively small amount of written work that often resulted from our mathematics work with them. It would be easy for an outsider to say that there was clearly an enormous gulf of understanding here that could only be put right by parents and teachers meeting to talk. This did, of course, happen, and we gained a number of allies during mathematics workshops and termly parent interviews about children’s progress as well as informal talks arising from specific pieces of work. And there is no doubt that all of these factors contributed towards the greater acceptance of our style of teaching mathematics to the children.

What we discovered, however, was that, in trying to attend to parents’ needs and worries, we had invented a second job for ourselves, namely that of working with parents. Since our real job was to prepare for an work with children there was a limited extent to which this second job could be done. Nor were we only having to explain ourselves in the mathematics area. Our commitment to problem solving in other subject areas, and our emphasis on giving children more responsibility for their own learning, led to other misunderstandings with parents that took time to deal with. Over the years we began to pay more attention than we would have wished to areas like tables learning and standard algorithmic layouts in computation. We did so because we felt that the signals these activities would convey to parents living in an area where other schools were attempting much less “adventurous” things would create a space within which we could pursue some of the activities I designate as “other maths”.

### “Outside”/“inside”

I was concerned to try to put the prospective teachers I talked to in touch with some of the context of the work in my school and it was to this end that I spoke of “business” and “other” mathematics. I didn’t want to sound like a Government report giving decontextualised recommendations about good practice. As a teacher I was always irritated by reports, books and articles which, although well-intentioned in their way, paid no attention to the pressures that teachers faced and instead cheerfully heaped another pressure on the pile.

There is an idealised version of “good practice” that exists in many documents and although it can, in certain circumstances, exite teachers into new forms of action it can also depress them by offering them a glimpse of an apparently realisable way of operating with children that bears no relation to the constraints they face in their own situation. Pieces of writing, however careful, often unwittingly reinforce the notion that consistently good schools or classrooms really exist. There are certainly “good schools” but the label itself is a problem, presenting an image for many, I suspect, of a mythical perfect school where things are always completely worked out and always go according to plan. It is debatable whether any

“good school” would recognise itself in this myth. Any realistic notion of a good school has to acknowledge the dynamic of how schools operate within their constraints and the *ad hoc* methods that they may often have to employ to deal with them.

I wrote earlier that it was not easy to be sure whether the constraints on my work in school were “really” there. An insider, as I was at the time, would certainly say that they were.

An outsider might perhaps decide that the constraints weren’t “real” at all, but neither insider nor outsider has a neutral place to stand—the insider is too wrapped up in the context of where he or she works and the outsider is too little wrapped up in it—although talking across the gulf that exists here may sometimes provide insights for both. The question of whether or not constraints are “really” there is a tricky one. We act as if constraints exist independently of those who see them, but in the early days of the school I recall that we behaved differently with regard to parental concerns: we got on with the job as we saw it and made very few concessions to them.

Bill Brookes has commented that if you can’t see constraints they may not be there. By this, I take him to mean that people who are not aware of constraints, or have not been made aware of them by other people, may be able to act in direct and powerful ways that are not available to those who *do* see the constraints. It is interesting to consider whether in fact the “constraints” are “really” there since such beliefs are a matter of individual perception. Moreover, once constraints have appeared from “nowhere,” is it ever possible to regain the innocence of that previous state of not seeing them, unless the system changes in an abrupt way, e.g. a new member of staff arrives and acts once again as if no constraint existed? If you don’t know about a constraint, you can’t see it; if you do know you may not see anything else.

An outsider might also say that it is possible to expand the space within which one views “business” and “other” mathematics such that one sees these two as a unity, but this would be to miss the point.

There are, of course, many ways of viewing what we do. Once described in words the metaphors we use and the theories we construct can be pulled apart or built on by outsiders in any way they choose, but the actual form of those metaphors may be less significant than their existence. My *words* about “business” and “other” mathematics were what rose to the surface when I had the opportunity to reflect on the nature of my job, but their relationship to the actions that I took in doing that job would not necessarily be clear to somebody who observed me working (and probably not to myself either while I was swept along by the immediacy of my actions). It might not be apparent that now I was doing “business” mathematics, and now “other” mathematics. I am suggesting, in fact, that this particular metaphor is significant in the sense that it allows me to accommodate to the constraints I feel and creates a survival space which also enables me to go on taking risks. (Recently, in the U.K. after many years of relative freedom all schools are being obliged, by law, to follow a laid-down “national curriculum” in mathematics

and pupils must undergo national tests at specified ages. It is widely feared that this hastily introduced curriculum will close down possibilities for teachers working in a more imaginative way. If this fear is realised, teachers may well have to invest in personal metaphors of different kinds to enable them to cope.)

It is also significant, and this further compounds the complex nature of “inside” and “outside,” that this metaphor for the actions I took in the classroom was arrived at during a year’s study away from the classroom where it arose from my attempt to unfold the nature of the tasks I had been involved in during the previous twelve years of teaching. However, it seems to me that in any case all of us alternate between “inside” and “outside” viewpoints in the course of our work—“inside” designating the situations in which we “just act” without conscious reflection, and “outside” describing situations where we reflect, away from the action, perhaps during breaks or in the evening. There is a necessary dialectic between the two for any particular person.

### “Outside”

As a one-off “adventure” in the field of teacher education my talk to students may or may not have been helpful. It was only one session and I put to them as honestly and carefully as possible what I was able to say about my work with children in what I considered to be a manner appropriate to their experience. There is a good deal of difference between doing this and working full-time with student teachers. Although when writing this I am only separated from “being a teacher” by the summer holidays, I must inevitably be seen to be already in a different state.

At the present moment I find myself somewhat at sea, almost “between jobs” in one sense. There is enormous “street credibility” in having come so recently from working in a school, at least in the students’ eyes. And there is no doubt that I have a fund of what the job advertisements call “recent and relevant experience” to call on to make various points. Nor am I surprised that students are impressed by recent experience—many of them labour under the simple and apparently reasonable belief that they can be told how and what to teach, and by whom better, seemingly, than somebody who has so recently been doing it?

It is easy for lecturers to act as if they can describe what they once did as teachers, but it is important to make a sharp distinction between functioning as a teacher and its subsequent description. Our language may be capable of great subtlety (although perhaps this subtlety exists in the spaces *between* the words) but it cannot match the complexity of the actions we take while teaching. Language, being linear in nature and glued together by a logic of a particular kind, cannot communicate, except by hints, those aspects that are the essence of the multi-dimensional space in which skilful teaching takes place and in which it is held together by a more tenuous but more powerful logic. In action a teacher can hold paradoxes and contradictions in apposition and continue to act smoothly in a way that is incapable of description (Bill Brookes explores this in [5]). We end up making statements like “I don’t

really know quite how I did it," or "I only know what to do when I'm doing it." Attempts to get ourselves closer to what skilled teachers do in the classroom brings us face to face with the inadequacies of a language which tricks us so easily into making statements that are apparently universal.

Even if the students want me to describe "how to do it" (which could only mean how I had done it), it would not be possible. Even if it *were* possible it would not be sensible because it would embody the assumption that the particular set of personal and institutional contexts in which I worked were completely transferable to the students and their situations. This is easy to say but not so easy to act on. Nor do I want to say that nothing good comes from lecturers' attempts to explain to students some aspects of their practices that they consider valuable. We have probably all had the experience of taking issues and ideas raised by other people in their situations and working on them in ours. It is a common experience in reporting back to somebody that an idea supplied by them has proved enormously valuable, that they are likely not to remember saying it, and may even deny that that is what they said!

I am struck by how difficult it is sometimes to unravel how I did act in the classroom. A remark of Alan Bishop in this journal [6] provides an example of my difficulty. He considers that the idea of the "autonomous" teacher is prevalent in the U.K. and states that:

"This idea is a myth, of course, in the sense that every teacher is subject to all kinds of pressures, but it is a myth that we value and preserve."

He goes on to point out that such a myth has its blessings and dangers.

As I read what he said I could see only the dangers. Teachers are subject to enormous constraints and pressures from many sources, as I have always been anxious to point out. But something made me consider the situation a little further in terms of the *actions* that I took as a teacher rather than what I *said* about those actions. On reflection, I realise that the myth can be both believed and not believed when embedded within those actions.

I discover that I have rejected the myth on some occasions and accepted it on others, as it suited me, despite the fact that "logically" I have felt obliged to reject it. Secure in the confidence that, when I chose to, I could act *as if I did* have autonomy in the classroom and that the authority of this belief would carry me through, I could afford to reject the myth for the purposes of academic discussion. The students I work with may not, however, have the confidence, and in attending to their needs I discover that there is a time to encourage them, implicitly, to believe

that the myth can be true if only for a day or even an hour at a time. Equally, they need to know that attention does need to be paid to the context of the schools within which they work.

The problem for me as a new lecturer is to know what to do, or rather what to do for the best. I am now in a situation that has all the richness of my former classroom experiences but is different in kind. In the classroom I knew at least some things about mathematics which the children I taught did not; in my new position I know something about working with children which by and large the students don't know. In neither case can I simply transfer what I know to them, although there will be occasions when I make very direct statements. In a classroom I considered part of my job was to make bridges between what the children already knew and what they might come to know, using the structures they already had. I developed skills that are only partly accessible to me if I try to describe them. Similarly in my work with students the challenge is to make bridges with what the students already know, either from their own knowledge of learning, doing mathematics and being in schools as pupils, or from their developing knowledge of working as teachers with children in schools. I find myself more vulnerable than before, but as always in the position of learning how to make those bridges with people I'm working with at the moment, within the various institutional and personal constraints that seem to exist.

I have some "working notions" of how to proceed that as yet I cannot give expression to. It feels as if I won't be able to for some time. At the present moment helping students develop into teachers feels quite mysterious. There are so many choices to make concerning what words to offer them or what experiences to provide.

This article was triggered by looking over the OHP transparencies prepared for my talk, as an experienced teacher, to some student teachers. I am curious to imagine the set of OHP transparencies I might use in 15 years time to present my thoughts as an experienced lecturer reflecting on how I had been working with students during that time.

## References

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- 3 K.C. Delaney [1986] Action in Teaching: Personal Exploration. Unpublished. M. Phil. Thesis. University of Southampton
- 4 K.C. Delaney [op.cit.]
- 5 Bill Brookes [1978] Standards in Mathematics Teaching. *Mathematics Teaching* 83
- 6 Alan Bishop [1985] The Social Construction of Meaning—a Significant Development for Mathematics Education? *For the Learning of Mathematics* 5. 1