

THE ROLE OF THE TEACHER

David Wheeler

If we know that ineffective teaching of mathematics is not due to the difficulty of the subject matter, and if we know that changing the classroom environment by grouping the children, promoting individual work, introducing a variety of materials, and liberating the structure of the timetable, does not contain within itself the possibility of acting directly on the awarenesses of children, and if we then do not re-examine in the most fundamental way how as teachers we should act, we are guilty of a total failure in seriousness for we have stopped our progress towards a better education for children just short of the point at which we can make a contribution to it.

At this point in time it is not at all necessary to say yet again that the teacher can only begin to be effective if he respects each child and works for each child's autonomy. We have made considerable adjustments in our beliefs and attitudes about children and about teaching. We know, for example, that education is not just concerned with filling children with knowledge or with slotting them into a role in society. We believe that children can take some responsibility for their own learning, and that we do not have to programme them as if they were machines. We no longer believe that they are entirely formed and fixed by what happened to them before they came to school or what happens to them while they are in it. Although policies and administration may lumber a long way behind, at least in the classroom the child may make his personal contribution and find his contribution valued.

But if we measure this progress, positive as it is, against the distance still to go, aren't we forced to say that it is almost negligible? We still have substantial illiteracy, widespread incompetence and incomprehension in all areas of a curriculum which, God knows, is not particularly demanding. The best students we have are said by their teachers to be in many cases unskillful in performance and superficial in understanding. The drop-outs indicate a contempt for our forms and methods education at least as great as that which they direct at any other facet of our social organisation. Whatever may be found to stand in our defence, it certainly cannot be said that we have yet broken through. Judging by results rather than intentions – and what else is there to go by? – SMP and the Leicestershire primary

schools, say, move us an inch when we need to go a mile.

I do not wish to deny the inch of progress. Other things being equal, SMP is undeniably a better programme of mathematics than the syllabuses it replaces; the children in Leicestershire schools are having a better chance to develop their powers than their predecessors had. But in spite of this improvement, the effects of these reforms bear very little relation in magnitude to their aims and reputations.* Gratitude may make us acknowledge the inch; honesty compels us to admit the remaining mile.

We could say, of course, that reforms in any part of education have never been more than marginal improvements in the situation at the time. Looking back, we may see everywhere only sluggish and reluctant change. If we look outside education, though, we must wonder if this slow crawl is inevitable. The technology which could put men on the moon was developed in less than fifteen years. Is there any *a priori* reason why illiteracy cannot be eliminated at least as quickly as tuberculosis has been?

I believe we know that we can tinker all we like with programmes and classroom environments without even approaching the radical reform in effectiveness that is necessary, because what we are occupying ourselves with is not at the heart of the dynamic process of educating. We have only to acknowledge to ourselves that we are educating for a future, and are not able to know what requires to be known in it, to understand that the detailed content of the curriculum cannot possibly be of the first importance. (The present is no different from the past in this respect but the pace of change is so much greater that the impossibility of prediction has become more obvious). We have only to perceive that our minds can continue to function normally in all but the most austere and oppressive physical conditions to know at once that since our minds are not the slaves of our physical environment they will

* I have deliberately chosen to mention two reforms which are viewed with considerable admiration by educators outside this country. There is not meant to be any implication that they are the only ones worth considering.

not be miraculously transformed by alterations in it. If at some point in our lives we have experienced the frustration of not being able to do what it was necessary to do because we had earlier failed to equip ourselves with a particular skill, we know at first hand that freedom to choose our activities does not necessarily develop self-reliance and autonomy.

I also believe that we know that the barrier to rapid progress in education has little to do with the need to re-define our aims. We are ineffective not because we don't know what it is we want. If I say that the aim of a school education is to assist every child to become operational in the basic skills current in his particular society, and beyond that to acquire access to his own powers so that he can function in that society as an autonomous person, I cannot think that I will find anyone to disagree. I shall be accused of being vague and imprecise, of course, but to that I shall say that I am only being concise. There is no difficulty in expanding the definition into a working brief if we wish, but this seems hardly essential if we already understand what it means. The attempts of the philosophers and the 'behavioural objective' psychologists to get us to define our aims in shopping-list form would never have assailed us if we had got near to achieving our real aims. They are only urging us to settle for so much less in the hope that we will be able to manage at least that.

Our problems lie in the inadequacy of the means we adopt to reach our aims. I have indicated the view that we spend too much of our reforming zeal in working on aspects which, although valuable aids to the kind of education we want to give, cannot be the primary medium for the dynamic process of educating children. Suppose the disparity between aims and achievement can be traced entirely to the actions of the teacher. It is here, after all, that the process that we hope will culminate in children learning begins. There is no inference to be drawn that our intentions are not of the best; the eagerness with which proposals for reform are embraced, at some cost to ourselves, is evidence to the contrary. But we are, it seems to me, very muddled and confused in what we are doing, and unsure of what our functions in the classroom are. And before I hear any 'yesses' let me urge that what I am discussing is not verified by anyone's humility but only by a study of the facts. I am reminded, in this connection, of those extraordinary research results which suggest that differences in teacher personality have the largest detectable correlations with differences in competence. Such results, I feel, would be unlikely to hold for plumbers, artists or astronauts (although they might hold for politicians and television interviewers). We can read the results as a vindication of the significance of the teacher's personality for the high art of teaching, but an equally plausible inter-

pretation is that the overall level of competence happens to be extremely low. The best of a bunch of incompetent plumbers are no doubt the ones with nice personalities. However, that is merely a joke and an indication. I use it to introduce the notion that we tend to regard teaching as an art but we could make it into a science.

To say, as we often do, that each teacher can only teach in his own way, or that good teachers are born not made, or that a teacher's personality is the most important part of his equipment, is to turn one's back on the possibility that teaching can be scientific. Perhaps these beliefs, or others like them, are so deeply rooted in us that they account for our neglect of the science of teaching – for indeed, if they are true, there can be no way of improving teaching except through altering the secondary characteristics of the teaching situation. But if we have experienced the fact that we can use ourselves in different ways, and that these ways are under our control, to some extent at least, then we can begin to entertain the possibility of making our teaching scientific and consider what that will require of us.

The objective of science is to get to know the truth. It is concerned to remove ignorance, illusions and preconceived ideas, in order to reach reality. The method of science is observation. Sometimes when the phenomena that the scientist wishes to study are beyond his power to affect them, or when his intervention would destroy the things themselves, he can only be alert and wait upon the occurrence and repetition of the events. In other cases he devises techniques to step up the observational yield: by inventing instruments, for example, or by setting up experiments in which the phenomena occur as and when he wants them to. But the principal technique of the scientist is to act upon the situation in which a phenomenon occurs in order to change it, and to observe the consequent changes in the phenomenon. It is this technique which permits the scientific study of how children learn. It does not require that the phenomena being studied can be controlled or isolated from the situations in which they happen. The role of the scientist here is not to stand back in order to watch, but to intervene and continue to watch.

If the scientist is described as an impartial observer it can mislead us because it suggests that he is detached from the situation and lacks concern for the outcome of his observations. But the scientist is very concerned – concerned to know the truth – and he is not detached from the situation but immersed in it. The impartiality of the scientist is an attitude to his own past that will allow him to be entirely sensitive to the present which he is observing. Being human he has expectations, hopes, preconceptions, theories; but if he is acting as a scientist, he is able to abandon any or all of them at once without regrets if

his observations tell him that they are wrong.

The casting of hypotheses or theories to account for the behaviour he observes is a second-order activity which he undertakes for his own benefit and to enable him to communicate his discoveries to others. It is a means by which he can 'make sense' of his observations, by relating them to other observations he has made or to what is already known, and it serves to draw his attention to inconsistencies, or to gaps, or to further questions, which in turn send him back to making more observations. Prediction is only a relatively infrequent by-product of this general activity and not, as is often said, central to the scientific process.

When we have understood that science is only a particular mode of using oneself in order to reach reality, many of the problems which we may suppose present when we try to make the study of human behaviour scientific are seen to be illusory. Because we first meet science as a study of aspects of the physical world, where it seems to be concerned with the discovery of laws or principles governing the behaviour of all objects of a particular type in particular circumstances, we may find it difficult to conceive how any study of human behaviour can be scientific because we know that a human being can always choose to behave as a counter-example to any law or principle we have formulated. But science shouldn't be confused with collections of 'laws', which are only objectifications of the agreement of many people that the result of some scientific observation is valid for many situations. If this external view of science is taken we can find ourselves, if we are not careful, forced into the indefensible position of holding that the truth of an observation depends on the number of people who accept it, or the number of times it can be repeated. (Probabilistic models of degrees of belief fall into this absurdity as soon as they blur the distinction between believing and knowing). We are not less sure that the earth is round because there are some people still alive who believe it is flat. Crick and Watson's breakthrough was not contingent upon anyone else duplicating what they had done.

The generality of scientific truth does not hinge on agreement or replication but on the fact that the scientist can say, if he has obeyed the rules of his discipline, that his perceptions owe nothing to skills or qualities peculiar to himself and that therefore it was and still is open to anyone else to discover the truth he has found. With this understanding, we can see that what is scientific is the method of study, and that the method may, in principle, be applied to situations of any kind to yield results of infinite generality.

With those preliminaries about the nature of science in mind, we can begin to consider some of the ways in which teaching can be scientific.

Let us start by turning on their heads two inter-linked aspects of common classroom practice. The first things that a teacher usually does when faced with a new class of children is to establish himself in relationship with them. (Teacher-trainers have one sort of language for this: experienced teachers another!) This may or may not be a one-sided relationship (the class may be 'it' or 'them' or 'us'), but in either case the teacher consciously uses himself as a focus of attention for the children, frequently exploiting those of his skills or personal characteristics which he knows have a strong effect on others. Having established this relationship as a framework, he turns his attention to the tasks for which the class has met. Because he is at some level aware that he has stressed his individuality, and that this has coloured the activities in which he and the children have engaged, he distrusts his judgements about the individual children, and bolsters or replaces these with information gathered informally from chats with other teachers or formally from tests and examinations. In fact, for any important decisions concerning the scholastic progress of his pupils, he prefers the discriminating to be done by someone else.

The teacher who approaches his job scientifically will start with the tasks to be done and will consider how the attention of the children can be focused on them. He will consciously withdraw as much of himself as possible so that he will not be an interference to the activity he wants to promote. In not drawing the attention of the children to himself, but to the tasks on hand, he can be an impartial observer of their actions as they tackle them. Because he knows now what the children are able to achieve by working at tasks themselves, his judgement of their capabilities and attainments is more reliable than anyone else's, and he will reject external assessments if they conflict with his own.

No doubt both of these descriptions have been caricatured in order to contrast them, but the purpose here is to suggest that our conventional wisdom about how the teacher should work may be entirely in error. The real picture isn't so simple, but this is because we tolerate contradictory elements in our picture of what a teacher is. For instance, we are quite capable of saying that the teacher should begin by establishing working relationships with his class *and* that since it is they who are to learn it is they who must do the work. These are by implication contradictory because if the teacher takes the initiative in establishing relationships before there are any tasks, the children will know that the tasks do not have first priority; they are being thoroughly logical in subsequently working on the relationships instead of on the tasks – which can lead, for example, to the kind of classroom behaviour John Holt has described for us.

I have so far only given a taste, though, of what is implied by making teaching scientific, and to give time for the first wry flavour to dissipate, let me offer some reasons why teaching should change in this direction:

- no other reforms have yet altered teaching effectiveness substantially enough
- science has achieved radical changes in a short time in other fields
- the scientific method affords teachers the only technique available in our culture which can show up incorrect preconceptions and bogus folklore, and subordinate fantasy to reality
- science sharply distinguishes knowing from believing and can make teaching independent of persuasion, propaganda and personality (the cult of)
- scientific method is a tool which can be handed on to make its users independent and autonomous, recognising truth as their only authority.

That teaching should aim to assist children to achieve independence and autonomy is a principle carrying a good deal of weight at this time, but we have confused it with issues of freedom of choice which are not central. Children don't have to be given freedom; they already possess it. No-one can teach anything to anyone against his will. The deplorable consequences of some of our teaching – the absurd behaviour designed to avoid engagement with the tasks and values of the classroom – can be read as signs that the children are essentially free and struggling madly to preserve their freedom. Their autonomy is expressed through their acts of rejection. So we'd better consider what kind of autonomy is worth having, rather than brandish the unqualified word as a magic cure-all.

Autonomy is intimately linked with competence. The six month old baby is no less an individual, free to be himself, than the six year old, and the six year old no less free to be himself than the sixteen year old. But the baby is much less able to act alone than the others; unaided, he literally cannot stand on his feet. The six year old is less autonomous than the sixteen year old since there are so many things he cannot yet do for himself than the older child can. It is unscientific to ignore the types and degrees of competence through which children pass as they move towards maturity and to forget that autonomy is relative, related to the competences that have been acquired. To fail to assist children to acquire the greatest possible range of competences is therefore to force them to forfeit some of the autonomy which is potentially theirs. How, then, can we *dare* to equate giving children autonomy to giving them freedom?

But autonomy is also independence and self-reliance, which are matters concerning the will and the feelings as much as the extent of skill and know-

how. If we observe children scientifically, we see that these aspects are there from birth (or even before), and that we will not have to teach them to achieve independence or self-reliance, but only to do what we can to stop ourselves taking them away.

A third ingredient which everyone needs for autonomy and independent functioning is a 'sense of autonomy', that is: an awareness of what skills are at one's disposal, that one can use them to be more self-reliant, and also use one's self-reliance to acquire further skills. Without this self-awareness and consciousness of one's own powers, autonomy will not be realised in action.

Conventional teaching only meets the first of these three requirements; 'liberal progressive' teaching only the first two (or, more frequently, only the second, since in preserving children's independence it is inclined to reduce to a minimum the acquisition of competence). The three requirements together can only be met by scientific teaching, which is to say: teaching done by scientists to produce scientists. 'The learner as scientist' will not be a bad catch-phrase to adopt when we embark on this radical renewal of our teaching. It will demonstrate that we want the emphasis put on the threefold mastery, self-reliance and self-awareness of the child, and that we believe that the proper technique for teachers will be to confront the child with problems and challenges which he must tackle in the spirit of the scientist, knowing what he knows and recognising the truth when he sees it.

(Easier said than done, but better said than not said).

We must take it for granted here that teachers also have mastery, self-reliance and self-awareness in the same areas for functioning, and we leave this for teachers of teachers to consider. We will also assume that it is possible (and necessary) to build up a repertory of games, problems, and challenges, that each teacher can select from and add to, and which are of a sort to elicit from the children spontaneous activity which they can work on to yield an awareness of their own powers. Since ATM members have already made contributions to this repertory it is only necessary that this activity should continue, with perhaps a much greater awareness of our own part of the characteristics that go to make good inventions for this kind of work in the classroom (ie, we ought to become more scientific in our work too).

I feel I can now return to the point, which may have given difficulty earlier, that the teacher must withdraw as much of himself as possible in the teaching situation, and perhaps it has become clearer what this implies. He must use every means he can find to focus the attention of the children on the problem, and this means that he *must* efface himself from their attention. On the other hand, the

children will be at the centre of *his* attention because he must study them to know how to help them keep to their task. (It may not be apparent at first just how different this description is from the usual behaviour of teacher and children; we are adept at mistaking our intentions for our deeds).

If we watch this teacher at work we see that:

- he teaches the whole class or a group of the whole class much of the time
- he sets the situation, giving essential information, but beyond that tells the children nothing
- he obtains as much feedback from the children as possible, by observing, asking questions, and asking for particular actions
- he works with this feedback immediately
- he never collects answers from the whole group to check that they all have the correct one, nor does he collect all the different answers they may have obtained without working on their differences
- except on rare occasions he does not indicate whether a response is right or not, though he often asks the children which it is
- he accepts errors as important feedback telling him more than correct responses, and by directing the children's attention back to the problem he urges them to use what they know to correct themselves
- he does not praise or blame particular responses or particular children, though he may exhort or reassure by expressing his faith in the children's capabilities
- his dialogues with the children contain phrases like:
Look at the problem
Look at what you have done
Listen to what you are saying
Don't guess: tell me what you know
You know you can do this: try it again
Is it right?
How do you know that?
Are you sure?
- he respects the child's right to opt out, and if the feedback from the children assures him he is trying to make them go too fast or too far he abandons his attack at once
- if he sees that a particular child in a group who is not immediately succeeding can be challenged so that he conquers his hesitations, he gives all his attention to that child at once
- if he sees that a particular child in a group is working on the problem but not contributing to the group, he leaves the child alone until he wishes to take part
- he appears to an uninvolved observer to be impersonal in his approach, giving no favours to anyone and taking success for granted, but showing no disappointment if it does not arrive.

There are enough controversial points here to indicate that this kind of teaching is *not* what most of us practice, yet it is only a matter of detailed and unprejudiced observation (scientific observation) to assure ourselves that this teacher's method works, and works better than the normal, 'friendly' way. Watching him, we are conscious that *everything* he does directs the children to attend to the problem and to their own actions in tackling it. Naturally this way of teaching requires great skill, sensibility and integrity, and to be successful with it requires a serious and disciplined apprenticeship. But don't let us be confused by its difficulty into saying that it cannot be the right method; it is open to everyone, in his classroom, to prove that it is.

It isn't easy to describe the way in which this teacher works; I wonder what picture you have made of it? I hope that you see that it is quite different from the teacher's way in conventional classrooms on the one hand, and from the teacher's way in 'liberal progressive' classrooms on the other. I can imagine that some of you, particularly teachers in primary schools, will either find yourselves lacking sympathy with the description, or will reject it because you could not teach in that way in your situation. It seems to me to be one of the grossest educational errors of recent times that we have managed – for the best of reasons, of course – to construct situations in the classroom which make it difficult or impossible for the teacher to have much choice of ways to act. The irony of this is that reorganisation has often been introduced in order to liberate the children from unnecessary restrictions but has ended up by shackling the teacher. The 'open' progressive classroom where children work alone or in pairs 'at their own pace', perhaps on topics of their own choice, for all of the time, has exchanged one form of restriction for a worse. It restricts the children, who must work from pre-planned and packaged material, and the teacher, who cannot teach more than two children at any one time (if we allow that teaching involves more than answering the occasional question and marking the occasional piece of work). Contrary to belief, the progressive classroom *delays* the arrival of autonomy in the child because the teacher is never sufficiently in control of the situation to be able to throw him to the edge of his resources at the moment when it is necessary.

I suppose I understand that we have moved in this direction because we have become much more aware of the dreadful things that teachers have done to children in the past. I am only questioning whether the best solution is to take the pressure off, or to assume that teachers *can* learn other ways in which to act. If we don't choose the latter, we have in effect thrown in the sponge and denied ourselves that mile of progress again.

We must not minimise how much teachers will have to change if they are to act with maximum efficiency. There is still a horrifying amount of insidious folklore in the air which has *never* been put to scientific test; there are any number of liars, charlatans and fools making reputations and money out of the education business; there are, too, all the constraints – financial policy, administrative machinery, public opinion, promotion prospects, buildings, equipment, racial tensions, party politics – that impinge. Only pressure groups and political action can deal with the last category, but there is nothing, except our preconceptions, that gets in the way of our being clear-sighted and courageous in what we do in our classrooms. At various points in the past science has shown us how to remove ignorance, prejudice and irrational fears, and it could come to the rescue again if we *want* to know the truth.

Of course the siren voice of reasonableness can mimic the accent of the scientist. Take as an example the model of teaching a complex skill by breaking it down into a sequence of components which must be successively mastered, and then compare it with how we learned to play an instrument, or to play golf, or to swim, or to ride a bicycle, or to walk (if we remember). The model sounds so rational and logical that it is quite an effort to face the fact that it doesn't correspond *at all* to the manner in which we learned any of the skills we possess. In all the cases mentioned, and in many others, the learner has to cope with a complex situation (not necessarily the total possible complexity: in learning to drive he will begin on quiet roads and at a slow speed; but he must nevertheless use all the controls from the start). In the early stages he makes very many errors and progress is so slow as to be almost undetectable; he has to face and deal with recurrent failure. Eventually, if he persists, the moment suddenly arrives when a partial coordination is achieved – the first staggering step, the first ball hit in approximately the intended direction – and from now on progress is assured (even though there will be setbacks, the ground can be reclaimed) until the next major challenge has to be faced. If this is what happens in learning a skill – and we know it is – how can we be so stupid as to be seduced by improper suggestions? The consequences of the truth here are that when we want to teach a child a skill, we must offer enough of the complexity to work on from the beginning; that we must expect and accept very many mistakes in the early stages, conscious that work is continuing even though it is hard to see the evidence; that we do not help by isolating difficulties, but rather by continually drawing the children's attention to aspects of the complexity that they may have overlooked; that polishing and perfecting cannot start until coordination of the strands has been achieved – that, for the learner, analysis follows

synthesis.

But don't let's go just by the reasonableness of this story either, or we will likely be in the same boat as before. *Is it true? How do you know that? Are you sure?*

It is a further question to ask how much we are concerned with teaching skills and how much with other things. For the moment it is sufficient to say that if mathematics is seen as an activity, it must require a fair amount of sheer operational competence and know-how to get it going. It is a whole series of further questions to ask how we shall know what all the challenges are that have to be met so that a child can act as a mathematician, and it is not my purpose to give any answers here. If the rest of the article has made any sense, you will know that the answers will be obtained, if we don't know them already, from a scientific study of mathematical activity.

I cannot end without saying something to those who will feel that I have been concerned solely with the didactic function of the school and that I have omitted almost all the other aspects of school education, the ones which they happen to value most. There is only space to make a few remarks which I cannot hope will persuade, but which may clarify my position for anyone who is interested.

Children do not choose whether to go to school or not. It might be better if they did, but that is not a realistic hope in most countries of the world at present. In the enormous stretch of their lives that they spend, compulsorily, in school, they are entitled to an adequate return for their efforts just as when they are at work they are entitled to an adequate wage. Putting it another way, teachers have a responsibility not to waste children's time. If it is in fact possible by developing the science of teaching to teach all that we regard as essential for each child to know more efficiently than we do at present, and in much less time, then he is entitled to the benefits of this new productivity. One of the benefits is that there will be time for him to learn more than he can now, and another, that he will have more time in school for cultural and social activities, for the exercise of free choice and the development of initiative. Certainly nothing need be lost from all that any school can now provide for its children.

But I can imagine that some of you will agree that this is a possibility without going so far as to want it to happen. You should say, I think, that this is giving school a different character from the one you wish it to have. All right; you must work for the school you want. I will just add that for me the school is most likely to make its best contribution when it is sharply differentiated from other social organisations. It shouldn't be an extension of the home if the home happens to be 'good', or a therapeutic community if the home happens to be 'bad'. (A small number of schools may have to be thera-

peutic communities for those children who are most seriously deprived and disturbed). In England most parents and teachers want schools to be an extension of or substitute for the home. They want children to have a middle class education because they are simply afraid of what may happen to children if they leave school without that particular protection. This attitude over-rates middle class values* whilst simultaneously under-rating children. It is an understandable attitude as long as most of our teaching is so ineffective, because it seems better for children to have a partial substitute for education than to have no education at all. But if parents and teachers could see somewhere, in a few classrooms at first, that professionally skilful teaching could offer each child access to and awareness of his own powers, they would be so amazed at what all children could achieve that they would see that protection was no longer necessary, and we could put away placebos and palliatives and get on with the real thing.

No one article can possibly do justice to all the facets of the role of the teacher. This has concentrated on the teacher's func-

tionings in the classroom, ignoring everything else that might be said to belong to his responsibilities, and moreover has dealt exclusively with ways in which his work in the classroom can become scientific. Teaching is indeed an art too. But a thousand years (or more) spent in developing it as an art have taken us almost nowhere, good teaching being as rare as it has always been, and bad teaching very little better. It can be left for another article, or another writer, to consider how the art of teaching can be developed from the solid base of a science of teaching.†

* Value systems, like politics, are about priorities. Western middle class values rank ambition above the will to learn and success above self-knowledge. To this extent they are really on the side of schools as they are and against schools as they might be.

† I am aware that at several points in this article I have gone beyond what can legitimately be said in my own capacity as a scientist, and to this extent I have betrayed the principal cause for which I attempt to argue. But because some, at least, of what I have written is scientifically verifiable, and because the exercise of disentangling this from the rest that is not may be a valuable exercise for readers as well as for me, I have allowed myself to publish this inadequate and unrevised attempt to confront a central educational issue.

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- Generous discounts on a wide range of publications and software.
- A network of mathematics educators around the United Kingdom to share good practice or ask advice.
- Active campaigning. The ATM campaigns at all levels towards: encouraging increased understanding and enjoyment of mathematics; encouraging increased understanding of how people learn mathematics; encouraging the sharing and evaluation of teaching and learning strategies and practices; promoting the exploration of new ideas and possibilities and initiating and contributing to discussion of and developments in mathematics education at all levels.
- Representation on national bodies helping to formulate policy in mathematics education.
- Software demonstrations by arrangement.

Personal members get the following additional benefits:

- Access to a members only part of the popular ATM website giving you access to sample materials and up to date information.
- Advice on resources, curriculum development and current research relating to mathematics education.
- Optional membership of a working group being inspired by working with other colleagues on a specific project.
- Special rates at the annual conference
- Information about current legislation relating to your job.
- Tax deductible personal subscription, making it even better value

Additional benefits

The ATM is constantly looking to improve the benefits for members. Please visit www.atm.org.uk regularly for new details.

LINK: www.atm.org.uk/join/index.html