



## Video as a Tool for Teachers' Professional Development

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# Video as a Tool for Teachers' Professional Development

This paper was presented to the topic group on video and film at the International Congress on Mathematics Education, ICME 6, Budapest 1988.

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*This paper will discuss the production and use of classroom video-tape as follows:*

- 1) *The academic (as opposed to technical) production of video-tape of mathematics classrooms.*
- 2) *The use of video-tape as an inservice education tool for teachers of mathematics.*

*It results from extensive experience and research by members of the Centre for Mathematics Education at the Open University, UK, in filming real mathematics lessons of teachers of pupils in the 5 to 18 years age range, and the use of the material produced for teachers' professional development. This use is two-fold, including both face to face workshops with teachers and as a component of distance learning materials. The paper will not discuss technical details of filming or tape production.<sup>1</sup>*

*The two stages described are independent of each other. It is possible to produce video-tape which others will use. It is possible to use video-tape which others have produced. However, in what is described below, each stage has been enhanced by experience gained from the other.*

## **1. The Academic Production of Video-Tape of Mathematics Lessons**

Any study in Mathematics Education will consider aspects of teaching and learning mathematics in the classroom and video-tape of mathematics lessons can support this study in many ways. For this reason Open University courses produced in mathematics education in the 1980's have had a budget for video materials. More recently specific video material has been commissioned by outside agencies such as the Department of Education and Science and the Mathematical Association. Video tapes produced with this external funding have been aimed at the inservice education of practising teachers. In working on the production of this video material, members of the Centre for Mathematics Education, together with production staff from the BBC Open University Productions Centre have explored ways of capturing mathematics

lessons and of compiling the material for its various uses.

An important aspect of the uses for which video-tape was planned was the ability to look closely at pupils working, to hear their discussion and see any written work. A camera in the corner of a room could not achieve this, and a single camera, even in close-up mode was inadequate. Most of the filming was done using two cameras in combination, cutting between facial expressions and written work. This inevitably involved a large presence in a classroom when camera, sound, technical and production staff were required.

One of the first lessons which we learned was that it is impossible to prescribe what will be captured on tape if it is important to film *real* lessons. For credibility with teachers for whom the video-tape was designed, it was important that the lessons filmed should not be specially constructed or 'stage managed'. If teachers are to genuinely relate to what they see on tape, then this should correspond realistically to situations with which they are familiar. Thus, for example, illustrating a particular teaching technique by withdrawing a small group of pupils and filming them working with a teacher outside the classroom, where it is quieter and easier to capture what is said, would be likely to be viewed sceptically by teachers with comments such as,

*'It's all very well for that teacher, but I would have to keep my eye on 25 others at the same time. I couldn't do that.'*

Comments such as this are barriers to effective discussion among teachers, and so it is important that the video-tape give as little provocation as possible. More will be said of such barriers in part 2.

It is always possible to question what is *real* in classroom terms, especially where a filming crew of up to twelve people are present in a lesson, offering potential distractions. In any lesson the teacher is likely to have objectives which condition her questions and instructions to pupils, and to some extent her responses to them too. She might

structure a lesson in a particular way for convenience of the filming. However, she cannot program the responses which pupils will make, and these teacher-pupil interchanges offer insight into the teacher-learning situation. It is important to capture these interchanges, but impossible to know beforehand what will be captured. Thus preparation for filming cannot be in terms of a script or shot list, but must rely on knowledge of the teacher's intentions and of the way in which she and her class are accustomed to work.

This has considerable implications for the preparatory work which precedes the actual filming. Experience shows that the most successful filming has occurred when it has been possible for a member of the production team to spend considerable time with the teacher, both in and out of the classroom, observing her ways of working with pupils and discussing her intentions for and reflections on the lessons observed. In producing any video-tape the production team have their own objectives with regard to its contents and ultimate use. These can often be translated into what might crudely be called a *shopping list* in terms of what is required from the classroom. Rather than expecting to find a teacher who is able and willing to perform according to such a list, it has been common to look out for teachers who exemplified in their practice the general principles of what was sought, and then to work closely with them on the detail of what was to be filmed. It is difficult to generalise about how we have found our teachers initially, but it has been mostly through personal contacts with teachers themselves or with the advisory teams who work with teachers. In producing materials for teachers' professional development we have needed to give evidence of having worked in schools in a variety of geographical regions and with pupils of the various ethnic origins represented in our schools, so that this has also conditioned our choice of teachers.

An example will be of help here in illustrating some of the general principles involved in the preparatory work. In 1983, as a result of the publication of the Cockcroft report<sup>2</sup>, we were asked by the Department of Education and Science to produce video material showing *Appropriate practical work in the mathematics classroom*. The production team had ideas as to what such practical work might involve and as to how it might be set up and debriefed. However, even if these ideas were communicated to a teacher who agreed to reproduce them in the classroom, the result would be no more than one teacher's interpretation of the

ideas. When ideas are presented abstractly they admit of a degree of generality which is lost as soon as one interpretation is viewed. It was decided that what we produced should not attempt to provide an example of good practice on which teachers should base their own work, but rather provide an example on which teachers might base discussion of the principles involved.

Thus, once a teacher had been identified, it was the job of one person from the team to explore what *practical work* meant in that teacher's classroom and identify aspects of the teacher's and pupils' work which might valuably be filmed. This occurred with the general principles in mind, but not set as a precondition for what should be filmed. As a team member in this position, I spent many hours observing lessons, working with some of the pupils in the lessons, talking with the teacher about plans for the lessons, and discussing the outcomes of the lessons. As I came closer to understanding the teacher's objectives and her responses to pupils in the light of these objectives, I became better able to envisage what film of one of her lessons might capture, and how this would relate to some of the general principles which the team had identified. Thus rather than coming to the teacher with abstract requests, it was possible to refer to moments from her lesson, such as *'When you were talking to Danny about the way in which he had constructed his tetrahedron, it was very interesting how the discussion showed that he hadn't fully grasped what 'platonic' meant'*. Danny had considered the possibility of constructing a six-triangular-faced solid, which he called a *hexahedron*, as a result of putting two tetrahedra face to face. He had not considered the angles of the solid, or apparently thought it necessary to consider them in defining a platonic solid. Through conversation about his construction, the teacher was able to open up the question of what a platonic solid actually is, and discuss this with him. I was able to use this as an example of something from her teaching which it would be valuable for us to capture on film. It exemplified the principle that practical work in and of itself is usually not enough to ensure the development of mathematical concepts. We were interested in capturing instances where the teacher reinforced the practical experience in various ways. Here, I was able to say that if such circumstances arose when we were filming then this would be something which we should find very valuable. Thus we were not so much making demands on the teacher as helping her to be aware

of the aspects of her teaching which we found of particular interest where filming was concerned.

In this way our mutual understanding developed, so that when eventually we were there with cameras, when decisions had to be made irrevocably on the spur of the moment, it was much easier to know where to be at any instant, and what we wanted from it. Pupils are surprisingly unaffected by cameras and work normally in camera range providing that the classroom environment is familiar in all other respects. Their confidence in us was increased by having one or more of us working with them over a period of time, and the relationships which this built meant that we could take some liberties in what we asked of them. While striving for reality in the classroom situation, there seemed to be acceptable compromises which increased our ability to capture salient classroom events. On one occasion I had a conversation with a group of girls while the cameras were busy with some other group. During the conversation they identified a very interesting mathematical disagreement which they wanted the teacher to help them resolve, and it was clear that this would be something which was valuable for us to capture. Without too much difficulty, I was able to persuade them to reconstruct for the camera what I had heard them say, and then the teacher came in to talk with them and we filmed her tackling the situation. This episode eventually formed a part of the published tape.<sup>3</sup> The reconstructing was valuable for the girls in clarifying their own ideas, but it also allowed us to have access to classroom moments which we should otherwise have missed. I felt strongly that we could not have expected the same degree of understanding and cooperation from teacher and pupils without having worked with them for some time before the filming.

When planning to film a particular lesson, the filming itself might be seen as the culmination of a lot of hard work. However, it is rare to film only a single lesson because of the use of scarce resources and the expense incurred in taking out a crew, and any of our video-tapes is likely to be a compilation of excerpts from a considerable number of lessons in a variety of schools. The task which awaits on return from the filming is as formidable as anything which happened before it. Experience of one or more of our team in viewing the material as it is collected helps to signal particularly significant classroom events, but nevertheless, most of the tape collected needs to be viewed by everyone in the team. The physical requirements of a number of people viewing hours of video-tape

are extremely demanding. Ten hours of tape take at least ten hours to view. If it is not possible for everyone to view together, then this must be multiplied by the number concerned. After initial viewing, particular excerpts need to be identified and discussed for inclusion or rejection. This inevitably involves refining of the principles to which we each think we are working in terms of the examples from practice. It is rewarding work in that it helps us clarify what we think, sharing ideas and concerns, and making production of distance learning materials more viable. It is soul destroying in trying to trim excerpts from classroom recordings to fit budgeted tape lengths, or to trade one excerpt off against another. Yet it is only as a result of many hours of this that final editing can be done, in terms of compiling the selected sequences, and a product completed for publication.

The production of video-tape to provide a basis for discussion of, for example, *the use of practical work in the mathematics classroom*, led to a consideration which became fundamental from our early days of filming, which was that rarely would any particular issue of concern be the *only* possible focus of any excerpt on video-tape. As well as issues to do with the value of *practical work*, we were at the same time asked to film examples of *investigational work* and *discussion* in mathematics classrooms.<sup>3</sup> A three part tape had been envisaged, each part devoted to issues in one of these areas. It proved ultimately too difficult to separate the three areas of consideration where practical examples were concerned. Investigational work often involved the use of practical apparatus and mathematical discussions permeated throughout. What we had collected were excerpts from lessons. They could have been classified in many ways, but it seemed that to classify them in one particular way might constrain viewers from seeing them in other guises or interpretations. This desire to constrain the viewer as little as possible greatly influenced our production and generated not inconsiderable debate in our group as to any *message* which we wanted to promote. At one end of the spectrum would lie a video-tape with text on screen, with a lot of explanatory voice over picture and numerous graphics to add detail to classroom events. At the other end of the spectrum would be only the classroom excerpts, edited as appropriate, but with little of an explanatory nature to accompany them. Our feelings were for something much closer to the latter than to the former, but *how* close was in contention, and ultimately varied from one publication to another. For example *Working*

*Mathematically with Low Attainers* had substantial commentary, by our standards, whereas *Working Mathematically with Sixth formers*<sup>4</sup> had hardly any. A style which we developed was to record a teacher's views on the lessons which we had filmed, and then to overlay some of the teachers own words as commentary. This seemed more justified than any interpretation which an outside observer could put onto the event, and is a feature of some of our later productions in the Working Mathematically series. It has implications for and from the way in which we believe that video-tape can contribute to teachers' professional development.

## 2. The Use of Video-Tape as an Inservice Education Tool for Teachers of Mathematics

Video-tape has a number of potential roles to play in aiding practicing teachers. Some examples are:

- To offset the isolation of teachers who rarely see beyond their own classrooms, by providing glimpses of other teachers at work.
- To provide opportunities for viewing other teaching styles and observing other teachers' strategies in the classroom.
- To provide a medium for recording and re-viewing a teacher's own classroom as an aid to reflection on teaching.
- To provide a shared experience which can form a starting point for discussion of teaching, leading to identification of important issues and the possibility of working on these issues in the classroom.

Although we feel that our video-tapes can contribute to the first two of these, and we have been involved in projects concerning the third (see for example Jaworski 1987), it is with the fourth that our concerns lie chiefly. Our video-tapes are produced in one of two ways, *either* as part of an *undergraduate or associate course* which is supported by the University in terms of tutorial support and assessment; *or* as part of a *pack* which may be purchased from the University, but which is unsupported in tutorial or assessment terms. Each of these would contain textual support which could be very brief in a *pack*, and very substantial where a *course* is concerned.

Our aims for the use of the video material would be related to the particular *pack* or *course* of which it forms a part, but certain aims would be common to all. These concern ways in which we think the video material can be used most effectively, and they are the ones on which I shall concentrate here (see also Jaworski 1989).

One of the main problems for the classroom teacher is the isolation of teaching. It is very difficult to share lessons with even one colleague. This makes discussion of the practice of teaching very difficult as it is never clear what is the common ground. Consequently discussion often dwells in generalities, where meanings are assumed, rather than getting through to the real concerns. A lesson recorded on video-tape can act as a basis for discussion, for a group of teachers, by providing a shared teaching-learning event. It has the advantage that everyone has seen something in common with others, and this can act as a starting point for the discussion. Invariably there will be different interpretations, but this, treated constructively, can feed the discussion and lead to valuable conclusions for the individuals concerned.

Experience shows that effective discussion is not always easy to achieve. There are a number of reactions which have commonly been barriers to a constructive event. These are usually reactions of the teachers viewing to the teacher in the video — to the teacher's style, the teacher's activities, or some aspect of the way the particular teacher works with the pupils concerned. Negative reactions often arise from seeing a teacher act differently to the way we, as teachers, would expect to act ourselves. Sometimes we feel threatened by what we see another teacher *doing*, and excuses and justifications arise in us. Sometimes we are envious of what we see, but are unable to envisage how we might achieve that ourselves. These sorts of feeling are manifested in comments like:

'He was railroading them — they didn't have a chance to think for themselves.'

'I couldn't do that with my pupils, they can't work quietly enough;' 'they're not intelligent enough;' 'they don't wear uniform;' 'we can't arrange the classroom like that;' etc.

'I could never do that — I just don't have the right sort of personality.'

The problem with comments such as these is that they invest all of their energy in interpretation and judgement of the acts and intentions of the particular teacher of the video. Such comments, particularly if from the first speaker to open the discussion, can condition what follows and result in little of value for the teachers concerned.

To avoid this occurring, we suggest a way of working which we have tried many times successfully with teachers with whom we have worked face to face. When a group of teachers have viewed a classroom video excerpt, the first

step, on switching off the machine is to invite everyone to spend a minute or more silently replaying what they have seen, trying to reconstruct for themselves the most significant parts of it. Participants are then asked to join together in pairs, and try to *agree* on what they have seen, if possible without overtly entering into interpretation at this stage. This might be described as *giving an account of* what was seen. It is often surprising to the members of a group that what they notice in a video excerpt varies very considerably from one to another — how what is significant for one might go unnoticed by another — and this draws attention to what emphasis they put on what they see. If pairs then form into small groups and continue to discuss exactly what was seen, then a more complete picture emerges than anyone had constructed individually, and this provides a firm basis for subsequent discussion. If there has been disagreement about what was seen, then it may be appropriate to replay the excerpt at this stage.

Discussion can then move into interpretation, and it is now more possible to back up any interpretation which is made by reference to what happened in the video excerpt. This stage might be called *accounting for what was seen* — trying out possible meanings and explanations. People are less likely now to jump in with unjustified interpretations, and at this stage it is likely that personal feelings about the teacher viewed have been deflected. Experience shows that extremely profitable discussion can result, that issues are raised which are important to the participants, and that the constructive atmosphere can lead to genuine consideration of classroom consequences.

Once people are accustomed to working in this way, almost any piece of video can act as a focus. However, some thought needs to be given to how the length and content of the video excerpt will be regarded by the viewers. Someone who is not accustomed to watching video of classrooms might for example find it slow and boring. It is rarely possible to show more than ten minutes of real time of a lesson before people fidget, or start to exchange comments. It must be realised that classroom video is not television. It is not designed to be slick and entertaining. Watching the routine aspects of teaching — setting up a lesson, moving between groups, answering routine questions etc. — seems to take an age when watched on tape. Furthermore, watching pupils struggle, or watching a sensitive teacher listening and only gently prodding, soon produces viewer-boredom.

Yet it actually takes a long time for pupils to see things for themselves. In the classroom a teacher would move on to work with other pupils, and would rarely see pupils working by themselves. A teacher's perception of a classroom may be dominated by pupils who are struck, or likely to cause trouble. One of the advantages of a video recording is that it does allow teachers the luxury of sitting and watching pupils at work and studying how they think, which is impossible in the pressures of the classroom.

So there is a dilemma: real time in a classroom seems very slow to the viewer, yet it is often necessary to see a classroom in real time to fully appreciate the interactions which take place, and how they influence the thinking of the pupils. In the main, our video-tapes are composed from short classroom excerpts, or from longer sequences of edited classroom footage, where our aim has been to include brief episodes which will promote discussion. The disadvantage of this is that these brief episodes lack the events leading up to and following on from what is seen. They can thus seem unnaturally slick, and leave the viewer lacking context. This can result in a feeling of not being told enough about what occurred to really make sense of what has been seen. Back-up notes can help, but are never sufficient. It is also true that however much is shown of a particular classroom, there will always be unanswered questions about the teacher's intentions, about the work that has been done previously, about pupils' previous experience and so on. A rule of watching video excerpts has to be that you know only what you see. Speculation and conjecture about what occurred at other times can rarely be verified. What is important is to distil general principles about teaching and learning from what has been seen.

Teachers very often offer pupils many examples of a particular mathematical idea or concept from which they hope that pupils will distil general principles about the concept. However, the pupils may never see beyond the particular examples without some help in reaching towards the generalities. Generalising from the particular is not always automatic. The same is true in viewing video excerpts. It is all too easy to dwell in the particular — the particular teacher, the particular pupils, the particular classroom — which is seen on the screen. It takes some effort to project attention from the particular event (about which so little is known) into the more general teaching-learning issues which lie behind it. One way of helping viewers to do this is to ask them overtly to relate what they have seen

to similar instances in their own classroom — ‘when might *you* have asked such a question?’, ‘what sort of activities in *your* classroom lead to pupils showing that sort of behaviour?’, ‘what might *your* response have been to that pupil?’ This deflects the emphasis of the discussion from the video excerpt into an area which each individual knows well, but is often too busy or too insecure to interrogate — their own experience. If a supportive atmosphere exists in the teacher group, this relating to own experience can provide an opportunity for participants to share anecdotes from their classrooms which help them to home in on the more general issues. It can help individuals too, in making evident to them the value of reflecting on their own teaching. This process of teachers working together using classroom videotape has itself been recorded on video-tape for use by teachers.<sup>5</sup>

In all of our work with teacher groups using video material we have been very conscious of the teachers who have so willingly allowed us into their classrooms with video cameras. It is worth remembering that for classroom video-tape to exist, some teachers have been trusting enough to allow video cameras into their classrooms in order to provide material on which others can work. Their trust is invested not only in the video-makers, but also in the video-users. When discussion focuses narrowly on the good or bad practice of the teachers concerned, this trust is being abused. If it is possible to try to imagine that the teacher who was filmed is present in the room where the discussion takes place, then it is more likely that discussion will be positive and productive.

In conclusion, discussion of video-tape has been known to be most effective when members of a teacher group have participated in the stages of first *giving an account of* what they have seen (possibly individually and in pairs) before going on to *account for* it (possibly as a group). Relating what is seen on the tape to ones own experience deflects attention from dwelling in the particular example of classroom practice which was seen, and helps the move towards consideration of the more general issues of classroom concern. The teacher group then has the opportunity of considering what action might be taken in the classroom in working on the issues which have arisen.

## Notes

- Such details can be obtained from the author, or from members of the Centre for Mathematics Education at the Open University, or from members of the BBC, Open University Productions Unit, as the Open University, Milton Keynes, UK.
- Mathematics Counts. Report of the Committee of Inquiry into the Teaching of Mathematics in Schools under the Chairmanship of Dr W.H. Cockcroft. (Known as the Cockcroft Report) HMSO 1982.  
In paragraph 243, the Cockcroft Report referred to a number of elements which should be found in mathematics lessons. These included *Investigational work*, *Appropriate practical work* and *Discussion between teacher and pupils and between the pupils themselves*. *As a result of this paragraph there was considerable energy amongst teachers and educators to find ways of making these elements a more regular constituent of mathematics lessons.*
- Secondary Mathematics Classroom Practice: A 90 minute compilation of excerpts from secondary mathematics classrooms in a number of schools, produced as a discussion document for all engaged in teaching mathematics at secondary level. The video-tape is associated with a number of booklets relating to the Cockcroft 243 elements. Commissioned by the Department of Education and Science. Published by the Open University.*
- The *Working Mathematically* series consists of a number of 60 minute video tapes produced as discussion documents, or for research purposes by the Open University, and includes the titles: *Working Mathematically with Sixth Formers*, *Working Mathematically with Low Attainers* (Commissioned by the Mathematical Association), *Working Mathematically with Infants*, *Working Mathematically on Film with Sixth Formers*, *Working Mathematically on Mental Imagery with Third Formers*.
- Video recordings of teachers working with classroom video-tape:
  - Part of Video Anthology (Tape B) ME234 Using Mathematical Thinking. Open University half-credit course
  - Working with video-tape of mathematics classrooms. A sixty-minute video-tape published by the Open University.
 Information about Open University publications can be obtained from the Centre for Mathematics Education, The Open University, Milton Keynes, MK7 6AA, UK.

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