British Journal of Educational Technology *Vol 30 No 4 1999* 359–367

The Images for Teaching Education Project: developing multimedia resources within an integrative educational framework

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Abstract
The University of Exeter heads a consortium which has developed multimedia resources primarily for initial teacher education. Amongst a range of resources produced are *Critical Encounters in Secondary Education*, which deals with critical incidents in the classroom and how to deal with them, *Multimedia in the Learning Environment,* which deals with both the nature of multimedia and how it may be used in support of a range of approaches to teaching and learning and *English Chalklands* which deals with interpretational and judgemental responses to landscape. The resources are described and discussed in the context of the educational framework which has been developed to guide their use.

Introduction

The Images for Teaching Education Project was funded by the Higher Education Funding Council for England, the Scottish Higher Education Funding Council, the Higher Education Funding Council for Wales and the Department of Education Northern Ireland under Phase 2 of their Teaching and Learning Technology Programme (TLTP). The Project was based at the University of Exeter. Collaborative work on the development of multimedia resources, and a framework for their educational use, involved staff from the University of Reading, Sheffield Hallam University and the University of Northumbria at Newcastle (Dillon *et al.*, 1998). A number of other universities supported the project through contributions of materials and advice and the provision of facilities for trialing.

Amongst a range of multimedia resources produced were: *Critical Encounters in Secondary Education* developed at the University of Exeter, *Multimedia in the Learning*

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF, UK and 350 Main Street, Malden, MA 02148, USA.

Environment developed at Sheffield Hallam University and *English Chalklands* developed at the University of Reading. The resources were produced with an emphasis on the use of images to support teaching and learning. They were aimed primarily at student teachers, but other potential users are university tutors and co-tutors (teachers overseeing the work of students in schools, "mentors" in some institutions), staff in schools and providers of in-service education. *English Chalklands* may also be used by undergraduates following courses in geography, archaeology, agriculture and environmental education and professionals on vocational courses which address policy making and management in three areas of rural land-use: agriculture, recreation and conservation.

This paper describes the resources and discusses their use in the context of an educational framework, common to all titles, which was developed in response to the need to integrate the resources into an appropriate supported self-study framework.

The resources

Critical Encounters in Secondary Education consists of a videodisc, videotape and barcoded support materials. It is concerned with critical incidents in the classroom and how to deal with them. Whilst it is impossible to completely recreate reality outside the classroom, image-based interactive technologies provide surrogate classroom experiences. These surrogate experiences may be used to stimulate focused interaction and discussion between tutors and student teachers, as well as providing resources which cater for a more flexible approach to learning.

The approach adopted in *Critical Encounters* is both complementary and supplementary to that offered in many classroom management courses. There will be occasions when a critical incident occurs in the classroom. Such incidents can, and do, occur regardless of the experience of the teacher. Whilst it is essential to adopt good working practices which minimise the possibility of critical incidents occurring, they can never be avoided altogether. Consequently, student teachers need guidance on how to deal with them. A number of critical incidents have been captured on video and laid down on a videodisc which makes them accessible in a variety of ways.

Multimedia in the Learning Environment consists of a videodisc, videotape and barcoded support materials. It is concerned with both the nature of multimedia and how multimedia may be used in support of a range of approaches to teaching and learning. A video montage has been produced which deals with the learning environment and the place of multimedia within it.

The video montage is made up of scenes of teachers and students working in different learning environments, notably classrooms and resource centres. Like *Critical Encounters,* the video montage is laid down on a videodisc. This is using multimedia as a means of studying multimedia. In particular, the concern is with multimedia in relation to the infrastructure of the learning environment, the management of the learning environment, teaching and learning styles, support for staff and students, and integration and implementation within the curriculum.

Multimedia in the Learning Environment promotes the development of skills to give student teachers the confidence to effectively exploit relevant information resources and services. The resource will reflect both the school environment that student teachers are about to enter and their present learning environment within higher education. The resource has been designed to stimulate learning and discussion, provide a detailed reference source of examples, and provide a diagnostic environment to support the development of skills.

English Chalklands: In contrast to *Critical Encounters* and *Multimedia in the Learning Environment*, which are concerned with resourcing and managing learning, *English Chalklands* has been developed to support subject-based work. The resource consists of a photo CD portfolio (100 images with commentary) and support material presented on computer disc which includes a case study and a theoretical framework for interpreting landscape.

The resource deals with the North Wessex Downs, a chalkland region in central southern England. It provides opportunities for exploring technological, socio-economic and aesthetic perspectives on landscape as well as the more usual geographical content. The main types of rural land-use, rural vernacular architecture and some of the principal prehistoric sites in the region are illustrated.

The educational framework

The educational framework within which the resources were designed is integrative in that it is an attempt to maximise the fit between the characteristics of the media adopted and certain approaches to teaching and learning. It has a constructivist underpinning, and the resources were designed to accommodate as far as possible prior knowledge, user expectations, and affective as well as cognitive factors. However, a number of characteristic features of the behaviourist approach to multimedia design, particularly in terms of the serial structuring of material are also present. The resources are thus typical of the current generation of multimedia in that they incorporate both constructivist and behaviourist design elements (Atkins, 1993; Beruvides and Koelling, 1994).

The constructivist base was adapted from Osborne and Wittrock (1985) and extended to take account of multimedia. Its central premise is that all knowledge is constructed by the student as he or she interacts with the environment and tries to make sense of it. These experiences are unique although there may be some generalisable things that can be said about them. In particular, students tend to generate perceptions and meanings which are consistent with their prior experience and these are likely to be different from those held by fellow students and tutors. In this view of learning, representations and interpretations are offered through multimedia resources to help students construct meaning. It is accepted that the construction of meaning may happen in unanticipated ways.

Considerations such as these are particularly important given the multiplicity of uses for which the resources were designed. At one extreme, the resources may be used on

an "open access" basis, at the other, they may be "embedded" in different course structures in different institutions and used with and without the mediation of a tutor.

In the embedded use, course goals and educational aims define the context in which the resources are used. Learning objectives, derived from the course goals, and educational aims define the individual and specific requirements that users have of the resources.

In the embedded use, *Critical Encounters* and *Multimedia in the Learning Environment* are accessed through barcoded courseware. This approach, of utilising the particular qualities of videodisc storage of images and barcode access to them, has been used successfully at Exeter and elsewhere for some years, (Wright and Dillon, 1990; Wright and Tearle, 1990) and was adopted for the following reasons:

- the replay facility of barcoding allows users to review visual sequences from a carefully thought out perspective and to watch them a second or third time with a specific purpose in mind. They are able to look at, and reconsider, a specific set of images noticed during a first viewing or to which their attention was drawn during discussion;
- use of the freeze frame facility to study a specific still image. The stability of a videodisc still frame provides excellent picture quality. The user can therefore concentrate on the picture content, and not be distracted by poor picture quality;
- the paper-based barcode access makes it easy to move around the disc content in order to review, discuss, compare and contrast relevant material from different visual sequences. This is not always possible when controlling a videodisc through computer software when user access to sequences may be pre-determined by software design. A facility which allows a user to look through a complete set of sequences on a single page enables faster and more frequent comparisons to be made.

Critical Encounters was designed to maximise these advantages and at the same time address the considerations about prior knowledge set out above. Each incident incorporates about one minute viewing time and consists of an "introduction", a "stem", and a number of "outcomes". The stem plays through the incident up to the critical point. Some incidents have associated with them a commentary which raises points for discussion relating to the human and environmental elements of the situation.

"Analysis" of the stem is encouraged. The analysis may be of behaviour, for example, conformist, confrontational, indifferent, and/or the environment, for example, room layout, organisation, management, approaches to teaching and learning. The analysis raises a number of "issues" about which "judgements" are made, for example empathy between student and teacher, appropriate and inappropriate practice.

There are many different ways in which each incident could be handled, so for each several different short "outcomes" are presented, each reflecting different practice. These are scripted where appropriate to pick up the issues and judgements which may be raised through the analysis of the stem. This approach is designed to promote discussion rather than invite student teachers to label practice "good" or "bad".

At each stage in this model for the use of *Critical Encounters,* there is the potential for diagnostic use of the images, either in open format or in conjunction with some analytical text, to address users' prior experiences and personal agendas. The following are some of the ways in which this has been achieved:

- through a tutor working with a group of student teachers using certain "trigger" sequences, followed by small groups of student teachers accessing the same and additional sequences in directed study time;
- by student teachers viewing the video sequences on a school site with appropriate courseware and support from a practising teacher mentor;
- by student teachers calling up clips of video stored on computer, either directly or from a distant source to use in presentations to fellow student teachers, university tutors or co-tutors.

The *Multimedia in the Learning Environment* materials have been designed to accommodate an embedded use based around course goals, educational aims and learning objectives. For these materials, however, the precise needs of student teachers, university tutors, co-tutors and other potential users are not so easy to anticipate. The video montage is divided into 34 short sequences organised into six chapters: technology, applications, learning activities, learning issues, management issues and learner interaction. The sequences are accompanied by a commentary interspersed with teacher and learner comments that raise issues. There are three main modes of use, each with its own support documentation:

- an open, quick access route to the video sequences, designed to support tutor-led discussion and the single user and to cater for situations where delivery platforms are provided as stand alone facilities in libraries and resources centres;
- a guided tour which provides more information about each sequence and allows the user to make an informed choice based on individual need;
- focused routes which address specific needs. Five key needs are identified and relevant issues and questions are raised. Each route combines video sequences with issues to consider and directs the user to other video sequences that may be relevant. These routes are designed to support tutor-led sessions and open and distance learning where an individual user or small group can work through a route in preparation for further work with a tutor.

In *English Chalklands,* the commentary is used as a vehicle for posing questions about the images. "Interpretational" questions help users establish what they know, or need to know about the landscapes depicted; "judgemental" questions elicit a response from the user, often a very personal one. The overall meaning that an image holds for the user is a synthesis of the interpretational and the judgemental. The resource is "flexible" in the broadest sense in that it addresses multiple and diverse user groups and may be used in a number of different modes. The following are some of the ways in which it has been used:

- in its entirety as a self-contained, supported self-study module;
- as a means of focusing on the case study or any of the sections within it;

- by selecting images to set an agenda for researching the landscape history of any other defined region;
- by selecting images to explore the assumptions on which the theoretical framework is based;
- by a tutor working with a group of students using images to illustrate certain themes, followed by individuals or small groups accessing the same and additional images and text in directed study time;
- by students selecting images to use in presentations or seminars;
- by students "negotiating" a route through the materials based on a series of questions and their responses to them;
- by tutors "channelling" students through the materials based on needs identified through responses to key questions;
- by tutors or students selecting images as a stimulus for research, analysis, problem solving, simulation, argument, debate, reporting, exposition, and evaluation.

With *Critical Encounters* and *English Chalklands,* the prior experiences and expectations of the different user groups can be established partially through their responses to the images themselves (Dillon *et al.*, 1997). With *Multimedia in the Learning Environment* it is necessary to adopt different strategies to elicit this information. One possibility, currently under investigation, is a "diagnostic" section involving the use of text-based questionnaires. There are some well tried instruments to determine the extent to which users agree or disagree with particular statements. Responses to clusters of statements may be used as a means of routing users into appropriate sections of the materials. The routing may involve exercises which explore attitudes or stances with respect to a particular situation.

Although constructivist considerations dominated the design of the resources, other theories of learning influenced the educational framework through which the use of the resources was promoted. These included conversational theory (Pask, 1976; Laurillard; 1995), which emphasises the importance of exposition and discourse, and experiential learning (Kolb, Rubin and McIntyre, 1976), mastery learning (Palardy, 1993), reflective practice (Schön, 1983) and situated cognition (Brown, Collins and Duguid, 1989) all of which emphasise in various ways the importance of first-hand experience.

The central premise of conversational theory is that student and tutor set out their views on a matter under consideration so that the tutor can set a learning task which enables the student to explore differences between the two views. Further discourse between student and tutor leads to a reformulation of views. This is the "tutor-mediated" mode in which, for example, *Critical Encounters* is used. The task in this instance is a surrogate one. Both student and tutor are viewing a classroom incident, the dialogue and reformulation are an integral part of the analysis of the images.

Experiential learning is based on the notion that there are different learning styles which can be matched to learning activities so that the differences of individual learners are

catered for. Differences in the learning styles of individuals are acknowledged implicitly in the Images for Teaching Education resources although no attempt has been made to formalise them in ways defined by Kolb and others. Although cases have been made for accommodating formal distinctions within the design of self-instructional materials (Sadler-Smith, 1996) the very act of defining these may impose its own form of determinism.

Mastery learning is concerned with the ways in which a student demonstrates progressive mastery or attainment over defined elements of learning. The embedded use of the Images for Teaching Education resources allows for content to be specified in ways which could accommodate a mastery learning approach although this has not been made an implicit part of the educational framework.

Reflective practice emphasises the role of reflection in learning from experience and in integrating theory and analysis with existing understanding. Writing about distance education, Thorpe (1995) points out, that the challenge of reflective practice is to allow students to *bring into* the course the experiences they have and to stimulate them to engage with both experience and course content through a process of critical reflection. In many respects this is a practical manifestation of constructivism and the Images for Teaching Education resources were designed to accommodate this. The commentary in *English Chalklands*, for example, encourages a reflective "dialogue" between judgemental and interpretational responses to landscape.

The central premise of situated cognition is that all knowledge, like language is a product of the activity and situations in which it is produced and that concepts are both situated and progressively developed through activity. The activity is centre stage in this theory of learning which, again, in some respects may be regarded as a practical manifestation of constructivism. Surrogate activity is at the heart of the *Critical Encounters* resource and demands constant re-visiting so that personal classroom management practices can be formulated. In this instance implementation comes later during the student's school experience. Thus once again, situated cognition is an implicit part of the educational framework guiding the use of the Images for Teaching Education resources.

Piloting and evaluation

Piloting, of one or more of the resources, was undertaken in teacher education departments at the development sites and a number of other higher education institutions across the United Kingdom. Tutors and student teachers from a variety of specialist subject areas were invited to view the resources critically. The student teachers included undergraduates and postgraduates training for both the primary and secondary sectors. Evaluative data were collected by questionnaire, interview and observation of the resources in use. Instruments and outcomes are described in full in Davis and Thornton (1995) and Davis, Tearle and Thornton (1996). The data were collected to serve the purposes of an evaluation of TLTP. They are concerned with the effectiveness of the resources in meeting certain programme objectives and deal only indirectly with

the processes of learning and interaction, although some inferences about these matters can be made.

The project team subscribed to the view that to be successful, multimedia resources must comprise both good electronic technology and effective instructional technology (Riding and Rayner, 1995). They recognised, however, that the underlying capabilities of the technology and the type of interaction it makes possible are still limiting factors.

The interaction between tutors and students promoted by the resources was as much a design concern as interactions with the technological interface. Wood and Wood (1996) provide an overview of what is known about effective interaction between tutor and student in collaborative learning. Important considerations are:

- tutors provide a bridge between a student's existing knowledge and skills and the demands of the new task;
- by providing instructions and help in the context of student activities, tutors provide a structure to support student problem solving;
- guided participation ensures that the student plays an active role in learning and that he or she contributes to the successful solution of problems;
- effective guidance involves the transfer of responsibility from the tutor to the student;
- not all guided participation involves deliberate or explicit attempts to teach and learn.

How far have we achieved this sort of support for learning through the Images for Teaching Education resources? We have moved some way towards addressing the formal and routine elements of support: establishing a context, bridging with existing knowledge, problem definition. We have made some progress with diagnostic strategies, tracking users' progress with, and experiences of, the materials so that their raised awareness and knowledge and skills acquisition can be monitored and their personal agendas and expectations reviewed. There are implications for using multimedia for trying to achieve this (Fleming, 1993). The most obvious pitfall is that technologies often impose their own ways of doing things.

However, we are some way off multimedia resources that address the informal, the non-routine, the situationally-dependent, the equivalent of the anecdotal. As Wood and Wood (1996) note:

> "what is internalised during instruction is not simply speech, but rules of action, in the service of goals, which become activated by symbol systems such as language and diagrams. Whilst such rules can be described as proposition-like structures, they are not available to conscious inspection. However, they are, we suggest, plausible candidates for the 'inner speech' that Vygotsky argued arises out of social interaction to form 'higher mental processes'."

Only when the "inner speech" and "higher mental processes" of teaching and learning with multimedia have been adequately defined will we be in a position to develop systems based on the way we actually think, remember, solve problems and communicate with others.

Acknowledgements

The Images for Teaching Education Project is directed by Professor Niki Davis. The authors would like to thank Niki and colleagues in the participating universities and the institutions involved in trialing and piloting for their contributions towards the development of the resources. Earlier versions of this paper were presented at the Association for Information Technology in Teacher Education Annual Conference, Sheffield, 1994, the 6th International Federation for Information Processing World Conference on Computers in Education, Birmingham, 1995 and the World Conference on Educational Multimedia and Educational Telecommunication, Boston USA, 1996.

References

Atkins M J (1993) Theories of learning and multimedia applications: an overview *Research Papers in Education* **8** (2) 251–271.

Beruvides M G and Koelling C P (1994) An educational framework for course development *International Journal of Engineering Education* **10** (3) 249–260.

Brown J S, Collins A and Duguid P (1989) Situated cognition and the culture of learning *Educational Researcher* **18** (1) 32–42.

Davis N, Tearle P and Thornton P (1996) *Images for Teaching Education Consortium. Interim Evaluation Document* University of Exeter, School of Education.

Davis N and Thornton P (1995) *Multimedia in the Learning Environment Evaluation Report: Pilot Phase* University of Exeter, School of Education.

Dillon P, Wright B, Still M and Thornton P (1997) Conducting research over the internet: an interactive, image-based instrument for investigations in environmental education *Journal of Information Technology for Teacher Education* **6** (2) 147–156.

Dillon P, Coupland J, Edwards T, Hudson A and Tearle P (1998) Multidisciplinary collaboration and the development of multimedia resources: the Images for Teaching Education Project *Innovations in Education and Training International* **35** (4) 347–355.

Fleming D (1993) A gradualist model for the development of a flexible learning framework *Educational Technology and Training International* **30** 319–326.

Kolb D A, Rubin I M and McIntyre J M (1976) *Organizational Psychology* Prentice-Hall, New Jersey.

Laurillard D (1995) Multimedia and the changing experience of the learner *British Journal of Educational Technology* **26** (3) 179–189.

Osborne R and Wittrock M (1985) The generative learning model and its implications for science education *Studies in Science Education* **12** 59–87.

Palardy J M (1993) Another look at mastery learning *Journal of Instructional Psychology* **20** (4) 302–305.

Pask G (1976) Conversational techniques in the study and practice of education *British Journal of Educational Psychology* **46** 12–25.

Riding R J and Rayner S (1995) The information superhighway and individualised learning *Educational Psychology* **15** (4) 365–378.

Sadler-Smith E (1996) "Learning styles" and instructional design *Innovations in Education and Training International* **33** (4) 185–193.

Schön D (1983) *The Reflective Practitioner* Temple Smith, London.

Thorpe M (1995) Reflective learning in distance education *European Journal of Psychology of Education* **x** 153–167.

Wood D and Wood H (1996) Vygotsky, tutoring and learning *Oxford Review of Education,* **22** (1) 5–16.

Wright B and Dillon P (1990) Some applications of interactive video in initial teacher training *Educational Training and Technology International* **27** 43–50.

Wright B and Tearle P (1990) *The Solution finds a Problem* National Centre for Educational Technology, Coventry, UK.