The term multimedia has become, for good or ill, the latest in a long line of developments in the computing world which is being touted as being the solution to all of the problems of education. It is unfortunate that the important underlying concepts which are at the core of multimedia are being overwhelmed by the hyperbole which surrounds them.

Multimedia is seen as being important to education because it holds a promise of improving the quality of education by providing students of all ages with opportunities to access a wide range of information types. It enables students to experience this information via multiple channels of communication and encourages active learning. By permitting the learner to access and manipulate information via the computer, multimedia encourages active participation in learning and the development of accurate information retrieval techniques leading to restructuring of elements which consider as being the constituent elements of, and means of acquiring, knowledge are being redefined.

In recent work Fred D'Ignazio (1991) stresses the fact that in order to maximise educational gain from the potential of multimedia there needs to be considerable change in the methods, attitudes and the nature of curriculum practices used by teachers. He maintains that while multimedia has considerable potential, its benefits will be lost if there is not radical reassessment of not only the means by which students and teachers learn but also the relationship which exists between teacher and taught.

This article will attempt to outline several issues which need to be addressed no matter which level multimedia is employed as an aid in developing skills and processes in education. The issues presented in the article are those which emerged from consultation and discussions undertaken with teachers using multimedia in the classroom. The teachers were drawn from four schools — two primary and two secondary — and participated in an investigation into the educational value of multimedia when used in the classroom. The schools were provided with a combination of IBM-PC compatible, Macintosh and Apple II series computers. Software, ranging from relatively simple applications such as Super Story Tree to complex programs such as Macround Director and Linkway, were also provided. The teachers in the primary schools used the resources in social studies and language arts; while those in the secondary schools used multimedia as part of their geography and journalism programs.

In essence the issues fall into four interrelated components:

- the implications of multimedia format for student learning
- the implications of the use of interactive multimedia technology upon teachers and learning strategies and classroom management
- curriculum implications of the use of interactive multimedia technology
- implications for teachers' roles and professional development needs.

In European cultures there has been, and in certain quarters still is, a preference for print as the favoured form of communication. Multimedia, however, by its very nature requires the integration of several types of communication channels, (i.e. print, visual, auditory) which are fused into an holistic presentation. One of the central issues which has emerged is the need for reassessment of and reorientation of the values placed upon the different modes of communication. The increased use of integrated multimedia presentations which combine several communication channels points to the necessity for an evaluation of the effectiveness of this type of learning environment.

It is essential to recognise that in this multimedia environment that visual, auditory, text and graphical components of a student's multimedia document are of equal value. The combination of these elements to form a multi-modal text, combined with the interactivity that students and teachers can build into their work, provides a new and stimulating educational environment about which we know relatively little.

MULTIMEDIA FORMAT AND STUDENT LEARNING

Since the use of multimedia software requires students to comprehend and compose multimodal texts, the study of the creation of meaning in multimodal texts becomes increasingly important.

Discussions with teachers, at primary and secondary levels, involved
in the production of the multimedia presentations have indicated that both teachers and students need to develop the skills, processes, attitudes and knowledge required to effectively compose, comprehend and communicate in multimodal texts. Teachers and students found that their early attempts to use this type of software resulted in work which displayed virtuosity with the software rather than concentrate upon clear and effective communication. Early work with multimedia formats reflected the early attempts with desktop publishing where users are overwhelmed by the richness of their environment and used many different fonts and style on one page.

Only with the early experience behind them was there an appreciation of the importance of consistency in screen design and layout production techniques including identical means of linking on screen of information with another (e.g. via a particular type of fade/wipe/dissolve). It was also evident that using 'off the shelf' audio clips provided by the software package could prove to be distracting to the audience and contribute little to the meaning of the work in hand.

SEQUENCING
It is also important that students and teachers are aware of the implications and effects of the sequencing and complexities of their work. It became apparent that the very complexity of these programs also contained within them the seeds of confusion.

It is important therefore to recognise that the process of sequencing will focus the manner in which information is accessed by the users and consequently it directs and constrains the range of meanings available to the audience. While this theoretical perspective is accurate it was that in some cases classroom use indicated that the sequencing process in itself could provide too many paths for the user. Experience indicated that unless there was an overview or 'concept map' of the whole presentation to provide a user with a sense of direction and location, in effect a 'big picture', of his or her position in the presentation, that student would become lost and the opportunities for interaction became opportunities for distraction.

To avoid the distraction, confusion and consequent loss of direction on the part of the user the participants in the investigation realised that an understanding that every word, sound, image, screen layout and indeed the design linking the presentation elements needs to be constructed on the basis of its contribution to the meaning making process. It also became apparent that for effective communication to occur the audience likely to use the presentation had to be considered on their own terms of reference (e.g. the level of comprehension for early primary differed from that of senior secondary).

This process of focusing upon the audience also meant that an explicit recognition of the nature and complexity of the information being presented had to be tailored to maximise its effect and in doing reinforced the contextual nature of multimedia within present teaching guidelines.

Interactivity represents a key element in multimedia, especially in education, but the nature and degree of interactivity also represented one of the major areas which had to be addressed before commencing the construction of the interactive text. The participants in the project found that, to be effective, the design of screens and the level of interactivity not only required an understanding of the potential of software to combine text, graphic, images and audio elements but also a clear understanding of the project's overall aims and objectives.

It was essential that before a project commenced that a clear picture of the structure of the interactive program was defined. This process was usually undertaken by cooperating in the design of a story board or flow chart which indicated the type, number and direction of the paths which would become available to the user. The wide range of resources which could be drawn upon, and their seductiveness in terms of information which could be included, made this design process essential both in defining the designers' intentions and in ensuring that members of the group were fully aware of the type of tasks being undertaken. It was also clear that such a clear definition became possible only when the designers had developed a series of questions which not only served to define their own intentions clearly, but also communicated those intentions to the audience of the program. In doing so the student designers were in effect establishing the conditions for learning (Gagne 1966).

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STUDENT-CENTRED LEARNING AND MULTIMEDIA
Multimedia in the classroom moves the focus away from the teacher's traditional position as a leader of learning towards a much more clearly defined student-centred approach to learning. In doing so using multimedia also alters the relationship between student and teacher emphasising the necessity of mutual cooperation, clarity of thinking and the development of both interdependence and independence on the part of the students. The teacher is able to move from one of attempting to cater for a wide range of abilities on the basis of compromise to one where he/she can develop individual or small group extension programs which can be negotiated with students. Once the multimedia process is firmly established within the classroom it becomes possible for the teacher to give more attention to those students requiring additional support.

In such a situation it is vital that the students undertaking multimedia program design are able to clearly formulate their hypotheses or questions which are to be the bases of the investigation. The processes which the student groups developed indicated that the construction process of the multimedia presentation was significant not only in itself but also in helping to develop their problem-
solving skills.

One of the experiences which teachers in the project found disconcerting was the degree to which it was necessary to inculcate a culture of enquiry among students and to encourage them to take responsibility for their own role in the decision-making process (Gott 1989). Past experience on the students’ part was one in which decisions were not required or were confined to choosing from a limited range of clearly defined options. Multimedia was a strange territory which they entered on their own terms, defining their objectives and establishing their own guidelines, and teachers noted that even after undergoing programs to help them build their self-confidence that some students would still turn to the teacher for detailed guidance.

By constructing their own terms of reference students are able to undertake an information gathering process which allowed them to follow paths determined beforehand and to follow up interesting materials gathered incidentally during this process. The acquisition of these materials also permits them to explore the relationships and nature of the links between materials as well as developing their own relationship with the multimedia materials to be integrated into their programs.

The user not only gathers information but also then makes effective use of the information so gathered by collating, synthesising, prioritising and analysing it to fit the purposes established beforehand. During this process the skills developed can be employed to maximise the student’s capacity not only to gather multimedia information but also, by actively linking this information, to participate in the pursuit of individually developed associations.

Both teachers and students found that this information gathering process, which was undertaken with specifically defined objectives in mind, also served to develop small group skills and the capacity to share information and develop problem-solving skills. While the information gathering process resulted in the accumulation of materials for inclusion in the presentation it also laid the foundation of a cooperative learning process which continued during the multimedia construction itself. It also became apparent that while a considerable amount of cooperative learning occurred during this period that the students also shared several different roles during the construction process.

Teachers and students found that it was possible to develop a better perception of how individual elements in a process were related. Much of this appreciation occurred at the planning stage when it was necessary to define questions and link the disparate elements. This process seems to have resulted in a better understanding of the nature of the subject and manner by which differing elements can lead to particular end results (e.g. the inter-relationship of characters in a novel).

The multimedia environment not only provides teachers and students with challenges when gathering evidence to present a particular viewpoint but also, by enabling selective construction, both teachers and students are made more aware of the manner in which the information can be created for the audience.

The different means by which issues can be explored and linked within the multimedia presentation, enables the user to examine a single topic from many different viewpoints by considering multiple texts, encompassing both ‘casual visits’ as well as structured enquiries. This type of approach is already apparent in the commercial development of multimedia packages such as The Holy Land, however, by using software which allows students to create their ‘documents’ a much wider range of learning opportunities exists. Because multimedia can cater for differing approaches to learning the individual student’s learning styles can be accommodated easily.

TEACHING AND LEARNING STRATEGIES IN THE CLASSROOM

A theme which emerged is the emphasis on the changing role of the teacher and the need to ‘let the kids go’ when they embarked upon gathering and presenting materials. The teacher’s role became one of a consultant providing a sympathetic but critical ear listening to the students’ problems and suggesting alternative approaches which may or may not lead to a solution. The process becomes a learning path for both teacher and students.

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The classroom experience with multimedia indicates that it is vital that teachers and students not divorce learning strategies, skills and processes which have been developed in other areas and become seduced by the potential of the production possibilities. However, this advisory role, however, is often defined more by circumstance than by some preordained set of guidelines. On occasion the teacher has had to reassert their traditional leadership role when it became obvious that projects were
floundering, however it was equally important that the teacher did not retain this position for any longer than was necessary while encouraging students to take over the direction of the project.

Paradoxically it was initially apparent that the only way to ensure that some students could develop independence and a sense of direction was to provide that with initially at least a firm sense of direction. To establish this sense of purpose teachers delivered structured lessons which dealt with the key issues (e.g. the development of designs and flow charts to identify specific objectives mapping out students' roles and responsibilities during the project).

Although many multimedia advocates emphasise the many layers existing within a presentation and the high degree of interactivity available, one teacher considered that linear presentation could be just as effective, when explanation of a single concept could be supported by and clarified by a simple demonstration. The necessity of retaining a sense of direction was driven home when on one occasion students exploring a multimedia document became thoroughly 'lost' both within the program and in failing to comprehend the nature of their original task.

Interactivity therefore often touted as being an indicator of involvement was therefore seen, in certain circumstances, as being more a source of frustration and annoyance distracting from the original intent of the work.

The existence of a number of small groups created pressure on available resources and evidence gathered in the investigation points towards the need to adopt and adapt of already established learning activities which complemented the topics under development. By ensuring that students were productively engaged in learning activities the sense of frustration that could build up as groups 'waited their turn' was reduced. It was also viewed as being important that multimedia is seen as being another, albeit attractive, means of learning rather than be central to the learning process.

In general, multimedia was not seen as being the solution to learning but a valuable addition to the range of strategies and activities which could be incorporated into the classroom learning environment. It was also seen as being a useful stimulant to gifted students as well as being valuable in developing cross-curriculum skills. The very fact that materials could be generated by students and teachers on a small project team also changed the emphasis of between teacher–student. There was also a belief that over time, as experience and expertise grew, suitable materials could become available for use by other students and teachers in a number of curriculum areas.

In essence the learning strategies needed to undertake the development of multimedia were ones which emphasised cooperative learning, improved self-esteem, problem solving, communication skills as well as students defining their own objectives and the means of achieving them. These skills and their accompanying strategies should remind educators that multimedia is being only one component of the learning process.

CURRICULUM IMPLICATIONS OF THE USE OF INTERACTIVE MULTIMEDIA TECHNOLOGY

All teachers interviewed remarked that multimedia as a learning tool had considerable application across the curriculum simply because it was a means of combining a number of stimuli and incorporating a degree of interactivity leading to greater involvement on the part of the student. The combination of this type of software allowed students and teachers to develop a sense of control and direction over their product.

It is important at this point to differentiate between the commercially available products, such as the computer-assisted learning packages which provide the students with a specific range of options, and a central focus which was the exploration of the learning processes undergone when students construct their own presentations.

The teachers perceived the capacity of multimedia in terms of their own particular teaching area, however, experience indicated that this type of program was more important because the skills gained were generalisable. Multimedia can be linked to a teacher’s program and, thus indirectly, the philosophy of the curriculum at any point where students and teachers felt that they were appropriate.

The trend towards the development of syllabus based upon integration of content and context are the key elements of multimedia.

For example in the recently developed Queensland Department of Education language arts syllabus this view is apparent in a view that:

Whether composing language ourselves or comprehending the languages used by others, we make meaning through features associated with both the modes, spoken, written, nonverbal, visual and auditory. (1991, p. 5)

and a subsequent comment:

In any text, or instance of language use, the meaning is not carried by any one type of mode or feature, but by all types in combination. (1991, p. 5)

We make meaning from texts holistically by combining verbal, nonverbal, visual and auditory components. Meaning therefore is constructed through the combination of language components which are the very heart of multimedia. This particular Queensland syllabus indicates that English language arts programs should include a balanced range of genres and social contexts, integrate the various modes of language and address a range of complex genres and social contexts. All these components are reflected in the multimedia process.

The position formally stated in this curriculum guide is supported by work undertaken in the United States which emphasises the necessity of overcoming conceptual and organisational barriers which are likely to hamper the exploitation of multimedia as both a teaching and learning tool (Dede 1989, pp. 23–6).

The potential of multimedia to combine communication modes was
underlined, both for students and teachers, by the need to develop effective communication skills not only in the traditional areas of text and audio but also in, for several teachers, the relatively new areas of graphics and images. It was in this latter area, analysis, selection and manipulation of images, that the teachers felt that they needed greatest support in order to exploit the potential present in a multimedia environment.

While developing materials for use both students and teachers became aware that the nature of the multimedia environment demanded much more in terms of higher order cognitive skills. It became evident that it was not sufficient to collect enormous amounts of information if the students were unable to sift through the data to develop and support their own ideas while drawing upon skills relevant to several curriculum areas.

TEACHERS' ROLES AND PROFESSIONAL DEVELOPMENT NEEDS
One of the central issues in introducing multimedia, however, is not the questions, the hypotheses or even the roles of the individual teacher and student but the school culture, itself constrained by a second unofficial agenda which operates within each individual classroom. The multimedia agenda, however, requires that teachers and students develop learning methods and styles which may conflict with previous sanctioned methods of inquiry. An indication of the latent power of these previously sanctioned methods was the teachers' discussion of manner in which these agendas were reflected in their initial reluctance to allow this to occur. The initial reluctance also stemmed from the teachers' sense of moral responsibility for their students' education.

The key change in the student–teacher relationship was that which moved away from the directed lesson and the perception of the teachers as the source of knowledge.

Multimedia was found to be a great leveller, in one student's case tapping into a latent talent to think in multidimensional terms when designing presentation. Students also found that because they did not negotiate the terms of their work they were placed in a more responsible position which imposed advantages and constraints on the way they 'learnt things'. The nature of small group work also meant that teacher and student dealt with each other on more informal terms and the degree of consultation and participation in decision making was higher.

The whole nature of the teacher's basis for providing a sense of control and direction in such a context is an issue of some consequence. The more informal nature when combined with the student's capacity for developing aims and objectives alters the perception of the teacher's role shared by students and teachers by altering the basis on which it has been built as a 'leader' in the classroom.

It became apparent that ongoing professional development programs were essential if multimedia was to be introduced successfully into the classroom.

Though initially requirements from the teachers were for programs which supported the introduction of the technology and associated software, it was recognised that educational and curriculum application were of the greatest long-term significance. Another area of need was knowledge of the existence of additional useful software programs; however, this item was seen as becoming important only after teachers and students had become 'comfortable' with the technology.

It became obvious that in order to exploit the potential of multimedia there also was a longer term need for consultation with other educators to establish a sense of direction for each teacher's program and to encourage cross-fertilisation of ideas.

Despite the diverse needs of teachers there was consensus that a number of meetings over a lengthy period would ensure not only that valid educational programs were established but that sufficient time was provided to enable teachers and students to establish, and achieve, realistic goals. The need to establish regular network meetings was also seen as being important psychologically, helping to remove a sense of isolation as well as establish a sense of continuity for those embarking in this area of education.

CONCLUSION
The introduction of multimedia into the classroom while making an opportunity for further integration of information technology into the curriculum cannot be considered to be a radical departure from the underlying purpose of education. Multimedia will certainly enable students and teachers to develop new skills but much of its effectiveness will rest heavily upon practices and skills such as higher order thinking skills, problem solving techniques and improved communication skills already established as forming the basis of a relevant and comprehensive education.

An area which will require modification if such an objective is to be achieved is that of the classroom culture. These changes will bring modifications to the teacher–student relationship resulting in a considerable departure from the traditional assumptions about leadership, knowledge and management. It is also evident that multimedia will require ongoing commitment to professional development programs if its promise is to be fulfilled.

Finally, full credit must go to the teachers and students at Noosa District State High School, Ipswich State High School, Mount Marrow State School and Currumbin State School who not only discovered much about the value of multimedia but also struggled through the apparently endless difficulties encountered during these multimedia learning curves.

REFERENCES


