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TITLE

Developing a critical framework for the evaluation and application of multimedia based resources in secondary Humanities subjects.

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Abstract:

This report considers how multimedia resources can be best used in the light of learning theory and practitioner research. The research questions focus on how multimedia frees and constrains the learner and how the revelatory paradigm promotes successful learning. This results in a critical framework for evaluating multimedia resources combined with policy recommendations for its integration in learning. Multimedia should be very clearly evaluated, their use well planned and learners must be allowed to learn through discovery to benefit fully from the resource.

Key Words:

Humanities, History, Geography, Revelatory, Paradigm, Learning, Cognitive, Multimedia, Hypermedia, Secondary, Education.

1. Title:

Developing a critical framework for the evaluation and application of multimedia based resources in secondary Humanities subjects.

2. Justification:

Massive investment into multimedia based learning resources has taken place in the past 10 years. In my experience schools have purchased interesting sounding titles with Geography and History having a large number of titles available to them, but they are usually purchased without the benefit of knowing how effective a learning tool they will be and certainly without understanding how to best use them in practice. The intention here is to consider work and thinking of others, concerned with the freedoms and constraints imposed by using multimedia and the, in the light of current learning theory and of my own experience, to suggest a framework for the evaluation of multimedia in the interests of best practice for its use in learning.

3. Research Questions:

1. How can multimedia best be used to support learning in Humanities subjects?
2. Which learning paradigm supports best practice in use of multimedia and how does this relate to learning styles?
3. What possible freedoms and constraints are imposed on learning by exposure to multimedia experiences?

4. Literature review:

4.1 Definitions of Terms:

Terms used in Title

Critical framework:

A conceptual frame designed to help guide thinking or practice in a reflective and evaluative way. (Own definition)

Multimedia:

See definition in commonly used terms, below.

Impact:

The degree to which a theory, rubric, pedagogical tool or specific piece of software changes thinking or outcomes within its sphere of influence. (Own definition)

Secondary Education:

Education in the age ranges of 11 – 19, generally. (Own definition)

Humanities:

This is commonly accepted to be Geography, History and Religious Education within the context of this study.

Commonly Used Terms

Multimedia:

Collins et al (1997) help to define what Multimedia is. They suggest a definition:

> "..a way of presenting material (often learning material) which involves three or more of the following media within a computer environment:
>
> - Speech or other sound
> - Drawings or diagrams

- Animated drawings or diagrams
- Still photographs or other images
- Video clips
- Text, i.e. the printed word" (Collins et al (1997:3))

Hypertext:

Now widely used term, coined in the 1960s by Ted Nelson to describe the idea of linking textual information and presenting it in a non-linear way. (Collins et al (1997: 134))

Hypermedia:

Broader version of the hypertext concept where text is combined with images. The terms hypermedia and multimedia are sometimes seen as interchangeable.

4.2 Book and Research Review:

Multimedia, have been in educational use for a relatively short period of time. As a result the research and literature that exists is fairly recent and, unfortunately, limited. It was important to find as much previous research into this area as possible to help highlight the key issues from my research questions, particularly in terms of best practice and learning theory. The literature was found by explicit searches for "multimedia in education" and "multimedia in humanities", from book, journal and internet sources. These were then read and analysed to gather relevant information.

Collins et al (1997) look at the impact of multimedia on teaching and learning. The text focuses on learning theories and how multimedia has developed and is likely to develop. Perhaps my greatest criticism of this reference is its predisposition toward Primary education and multimedia resources. Although the case studies can be seen as valid from a Secondary point of view, it would be useful to see how more

independent learners have reacted to the approaches employed. The writing of Steve Bruntlett in: Leask & Pachler (2001: 71-94) focuses on the same issues in a much more generalised way, providing useful summaries and a checklist of criteria for evaluating CD-ROM based multimedia (Leask, M & Pachler, N (2001: 81)). This checklist offers some excellent criteria in terms of suitability, coverage and relevance to the National Curriculum but a few points are less important, such as the quality of audio and video. These continue to improve apace and current titles are generally acceptable. I would expect to adopt most of these issues as they stand in my own criteria. Williams suggests some questions that can be asked, specifically to do with interaction (Williams, N. (1998) in: Monteith, M. (Ed 1998: 158). Collins et al discuss the need for evaluation of resources but from a reflective point of view and without suggested strategies (Collins et al (1997:96-99).

Steve Bruntlett observes that:

"The power of a CD-ROM (sic) lies in its interactivity, the way in which its content can be navigated and explored in as much or as little detail as the user desires." (Bruntlett, S. in: Pachler, N. & Leask, M. (2001: 74)).

This supports my view that the interactivity and non-linear linking of materials are cornerstones of the multimedia based learning experience and help attract both teachers and pupils to the Multimedia resource. Teachers perceive the interactivity as a means to independent learning and the students perceive it as more fun, because they are able to follow their own path. Essentially, either the teacher or the student can plan a route through the Multimedia, or allow the student to progress at their own pace – a good tool for differentiation. (Bruntlett, S in: Pachler, N & Leask, M (2001: 74)). Williams also notes that interaction implies choice (Williams,N. in: Monteith,

M (Ed 1998:153)) and he also cites the work of Reynolds and Iwinski who show that benefits of multimedia include:

- Access to information as wanted by the learner
- Individual, self-paced instruction for individual students
- Enable instructors to concentrate on instructor –related tasks, allowing them to attend specifically to students who may be having problems.
- Provision of an excellent means of simulation situations that need individualised, yet co-ordinated task performance.

(Reynolds and Iwinski, 1996 in: Williams, 1998)

These points are generally borne out by my own experience of working on the "Castle Acre" project in History and from other titles that we have employed in both Geography and History. The point about simulations is well supported from our experience of Geography titles.

Negatives highlighted include the constraint on the learner of being bound by the resources chosen by the author. This can result in "increased cognitive load" (Williams,N. 1998:155) in trying to select appropriate resources. Drawing on Papert (1994) he also highlights the possible instructional or constructivist nature of learning materials and determines that multimedia "offers learners interaction of constructivist kinds." (Williams, N. 1998:157) Another point Williams makes that supports my view is that just because students prefer to use it doesn't mean it is any better than other systems.

As a learning system, the multimodal approach is considered to be a proven educational approach, supported by evidence from the British Audio Visual Society

suggesting that we remember 90% of what we see hear and do at the same time. (Bruntlett, S in: Pachler, N & Leask, M (2001: 75). Collins et al (1997: 104) describe how this flexible learning approach is seen as constructive and useful but clashes with the teachers' need to control learning outcomes and work within the constraints of the "content-laden syllabi". Within the Humanities context, Niall Johnson, in an editorial for the Journal of Geography says that students actually have an expectation that information will be delivered in alternative ways. A specific benefit is that:

"Using animation to enliven communication not only makes the understanding of a dynamic concept or phenomenon easier but encourages students to use such techniques in their own work." (Johnson, N. (2002:13)

This, again, supports the views of Reynolds and Iwinski cited earlier and also Prof. Heppel's theory that multimedia works in 3 stages:

1 A 'narrative' stage, where pupils can watch and note

2 An 'interactive' stage, where pupils can choose and do

3 A 'participative' stage, where pupils can contribute and create

(Heppel,S (1993) in: Pachler & Leasch (2001))

Seymour Papert's book "Mindstorms" (Papert, S. (1993)) aids understanding of the potential of multimedia as a partly constructivist learning based tool. This issue is also drawn on by Williams (1998) who refers to Papert in his discussion of interactive multimedia, otherwise little direct research is available that ties multimedia to one specific theory of learning. There are several references to the fact that students benefit from self-guided interaction (revelatory paradigm) and that it allows them to progress at their own rate, allowing the less able to reinforce

understanding and the more able to extend theirs (Bruntlett, S (2001) in: Pachler and Leask (2001:1)) Collins et al discuss the learning paradigms and definitively link multimedia to the revelatory paradigm:

"the revelatory paradigm is exemplified in early educational programs and now in multimedia by simulations of various types." (Collins et al (1997:16))

Most texts give case studies of multimedia in schools to illustrate the views of the author(s). Jessel & Hurst (in: Somekh and Davis (Ed 1997: 85-94)) discuss the potential of multimedia in this way. Again, the study focuses on pupils of Primary school age, although the inclusion of an 11 year old allows some phase cross-over. The small number of pre-dominantly female students involved begs questions over the validity of the conclusions. However, this doesn't prevent the authors from making bold statements about the "Piagetian" nature of learning being demonstrated by the older students.

Professor Angela MacFarlane referred me to one of her papers which focuses specifically on pupils authoring their own multimedia which, while outside the main focus of my study, still offer some highly relevant points:

- Successful use of technologies such as multimedia authoring software will contribute to learning outcomes that are not measured in current forms of assessment.
- The use of multimedia authoring has been shown to lead to positive educational outcomes in pupils' attitudes towards learning.

Little positive impact on achievement levels has been demonstrated

Noel Williams in Monteith (1998: 153- 170) does offer some very useful insights into the possible benefits of Multimedia, and specifically about how interaction can be assessed and evaluated for its learning benefits.

Ross & Bailey's "Handbook on Technology based Learning"offers real insights into hyper-learning in education. There is comment about the changing role of the teacher in this type of learning environment and comments on best practice (tips and tricks) as well as bad practice (traps) in using multimedia type resources (Ross & Bailey (1997)). Despite a lack of references owing to the work's nature as a handbook, there is a useful bibliography.

Summary

- A checklist of criteria for evaluating multimedia resources is important to ensure suitability.
- Checklists can also focus teachers on appropriate planning for use of a resource.
- The revelatory paradigm is closely identified with successful learning with multimedia.
- Full access to interactivity is essential to gain the full benefits of "learning through discovery"
- Multimedia can also be linked to learning styles and multiple intelligences theories.

5. Theoretical Framework:

Theories of Learning which can inform the promotion of successful multimedia based learning include cognitive theory (at least in general terms, referring to existing Humanities based resources) are, specifically, supporting Learning Styles (Kolb, Ellis , Reid) and Multiple Intelligences theory. Gardner's Brain-based learning theory suggests that individuals can develop 8 types of intelligence: Linguistic, Logical-mathematical, spatial, musical, bodily-kinaesthetic, interpersonal, intrapersonal and naturalist (Gardner, 1993 in: Mitchell 2001). Particular strengths or weaknesses in intelligence type, or indeed a combination, may determine what types of task / learning a student will find difficult. Learning styles theory also suggests that learners have stronger or weaker cognitive processes. A learner who finds it hard to learn from listening may benefit more from watching or doing. Different elements of multimedia resources will have greater or lesser success dependent on preferred learning style.

In my experience multimedia based learning resources are most successfully utilised when used in a non-instructional, discovery based way. The revelatory paradigm as described by Bruner (1973) and Ausubel (1978) is the most relevant theory. This is described by Mitchell (2001) using the following table:

View	Instructional (Skinner, Tolman)	Revelatory (Bruner, Ausubel)	Conjectural (Kolb, Vygotsky)
Key concepts:	Knowledge transfer	Intuition, revelation	Experiential, social learning
Curriculum orientation:	Content	Student	Interdependence

Curriculum delivery:	Quality instruction Linear programmes Atomistic: parts prior to whole.	Staged opportunities for discovery learning. Strategies include using questions to increase the degree of learning	Scaffolding,modeling, collaborating. Cross-discipline. Holistic.Whatever learning experience works. Specified outcomes
Knowledge:	Storehouse of facts	Terrains to explore	Bicycle to ride
Learner image:	Consumer/ competitor	Explorer, team worker	Producer, collaborator
Learning process:	Throughput	Discovery	Output, input
Evaluation of learning:	Internal	Shared	Self- and external evaluation
Role of computer:	Structured, hierarchichal presentation, feedback	Simulation, information handling, things to explore	Manipulable space for collaborative creation of knowledge
Assumptions:	Behaviouristic learning theory	Theory of learning by discovery	Problem-oriented theory, cognitive theory
Idealisation / caricature:	Patient tutor/page turner	Rich learning environment/ 'black box'	Milieu, venue/ expensive toy

Table 1: *Three paradigms for computer assisted learning*, Macdonald et al 1977 in: Mitchell, A (2001)

For me, the image of the learner as explorer, navigating a terrain of information and learning through the discoveries made, is what multimedia and hypermedia based learning is about; in my experience best practice is found where students are allowed to be independent learners through this paradigm. The result is improved students' motivation and time on task, but not always raised attainment as measured in normal ways (i.e. grades) This should challenge the "normal" ways of measuring attainment. Conversely, application of the instructional paradigm could actually constrain the student, unless the resource has been specifically designed as an instructional tool rather than an interactive learning resource.

Summary

- Learning when using multimedia should be planned to utilise the revelatory paradigm with students being allowed to interact with the software fully. Thus learning through discovery is encouraged.
- The revelatory paradigm empowers the students to take more control of their own learning. Progression is individual to the learner.
- Learning styles theory is relevant with preferred learning style being a strong motivator in choice of multimedia options (for the learner).
- Some benefit can come from conjectural learning where the multimedia resource demands a team approach.

6. Methodology:

This Dissertation considers aspects of my previous work and experience within the sphere of educational multimedia in the light of cognitive learning theories and within an interpretative paradigm. These choices reflect my key concern with the views of practitioners and researchers. As these views will be subject to individual interpretation and bias a non-positivist approach is the most appropriate

Research Methods to be used are a mixture of personal observation from 10 years in practice, a review of a specific project I have been involved in – Case Study and a book and journal review. These methods will allow the collection of a very broad range of experience from different learning establishments and practitioners, thus providing a broad and diverse spectrum of views. This broad base will be more likely to show general consensus of views on value, good practice, etc, compared to a more tightly focused method like interview. The Case study will allow me to examine the research questions within the context of a single project and in the light of personal experience.

7. Case Study: The Castle Acre Project

One of the key experiences which I draw on when reviewing the potential of Multimedia is a package that we created ourselves specifically for the purpose of enhancing learning in History.

Students in year 7 always undertake a field trip to Castle Acre Priory in Norfolk – an English Heritage property that is now mostly derelict. Many difficulties existed with the traditional methods of learning (constraints).

1. Weather couldn't be guaranteed and often resulted in soggy worksheets.
2. Many students couldn't focus on learning when excited and missed key elements of information.
3. Worksheets often disadvantage weaker students unless clearly differentiated.
4. The whole day was too much for some students to take in.
5. The day was focused on the physical attributes of the site and this became divorced from the Historical context delivered in the classroom.
6. The traditional walk and talk methods didn't encourage independent learning.

We produced a simple web based multimedia resource that students could access on the school network or from home on the internet, which encouraged independent investigation of the chosen information thus addressing point 6. The site was designed as a mixture of relevant text, produced by the History department, and images taken by us on site or borrowed from English Heritage. The main aim was for students to tour the site accessing the information and resources as they needed, allowing a completely independent learning experience, ostensibly learning through

discovery. As an extension to this we also included recordings of Plain song music and discussion between teachers in role as monks.

Fig 1: Castle Acre Website

Fig 2: Castle Acre Mail a Monk

Students enjoyed using the online material which was relevant to their needs and targeted at what they needed to know for assignments. This cut down on wasted "search" time. Images were readily available for them to illustrate their work with (Fig 1), encouraging a more creative approach to their work and freeing them to develop their ideas without the constraint of capturing resources. The audio material was used to enhance their understanding of what life was like for the monks, giving the students a different insight into the context and addressing point 5. In addition resources like field sketches and "Mail-ye-a-monk" email to teachers enabled students to be more involved in their learning process (Fig 2).

On review with the History teachers involved, the following points were determined and agreed.

7 Motivation was improved for the majority of pupils.

8 Quality of presentation was improved, in general.

9 Ability to link visit with facts was improved for the majority of pupils.

10 Off task behaviour decreased in lessons where ICT resource was used – *particularly important in the light of points 2 and 4.*

11 Quality of learning appeared to be improved in the view of teachers.

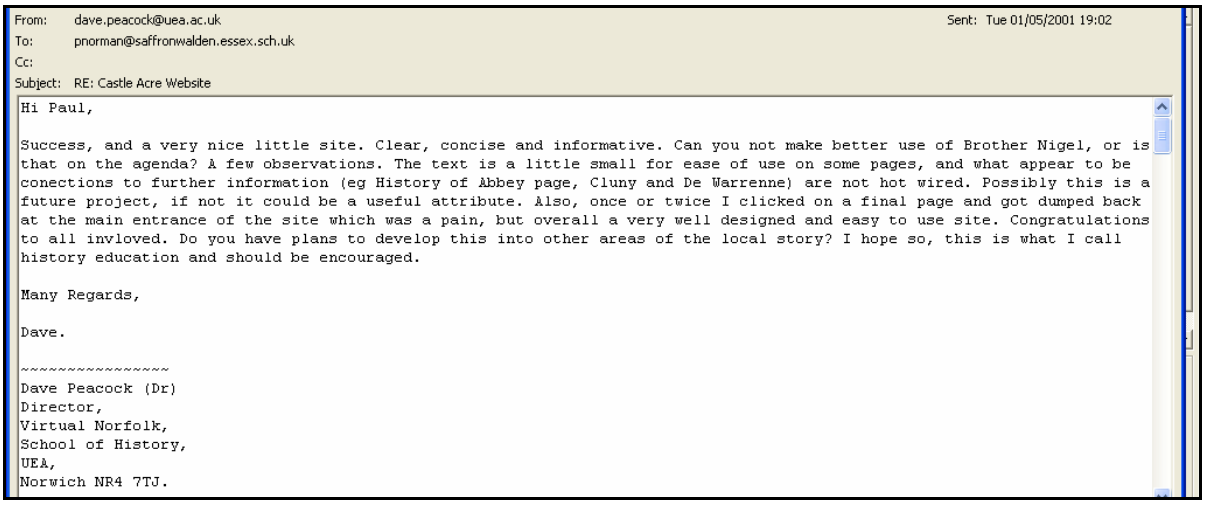
12 No conclusions were drawn as to attainment.

13 Students who previously may have found the visit too much were more able to engage with the topic on their return - *addressing point 4.*

14 Further enhancements and resources should be developed.

There were some constraints, also. A few teachers felt out of their depth in the ICT environment and some felt the learning was out of their control – due to the unfamiliar nature of the revelatory paradigm. Students were constrained by access to resources and the availability of internet access at home.

Third party sources such as UEA (University of East Anglia) and English Heritage also thought that the site was a good idea and fed back positively.



From: dave.peacock@uea.ac.uk Sent: Tue 01/05/2001 19:02
To: pnorman@saffronwalden.essex.sch.uk
Cc:
Subject: RE: Castle Acre Website

Hi Paul,

Success, and a very nice little site. Clear, concise and informative. Can you not make better use of Brother Nigel, or is that on the agenda? A few observations. The text is a little small for ease of use on some pages, and what appear to be conections to further information (eg History of Abbey page, Cluny and De Warrenne) are not hot wired. Possibly this is a future project, if not it could be a useful attribute. Also, once or twice I clicked on a final page and got dumped back at the main entrance of the site which was a pain, but overall a very well designed and easy to use site. Congratulations to all invloved. Do you have plans to develop this into other areas of the local story? I hope so, this is what I call history education and should be encouraged.

Many Regards,

Dave.

~~~~~~~~~~~~~~~~
Dave Peacock (Dr)
Director,
Virtual Norfolk,
School of History,
UEA,
Norwich NR4 7TJ.

Fig 3: Response to Castle Acre site from UEA
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8. Analysis and Discussion:

1) How can multimedia best be used to support learning in Humanities subjects?

- **Full interaction is essential.**
- **Content and time constraints mustn't be allowed to override the resource.**
- **Using the resource as a text book should be avoided.**
- **Students should be guided to material suiting their preferred learning style.**
- **Teachers should encourage use of animation / audio-visual models to support understanding of difficult concepts.**

When used as a fully functional interactive learning tool, multimedia can and does positively support the learner, but, at worst it is no better than a text book. The danger is that in order to meet content requirements and deadlines it is too often used as a computerised text book. In Humanities for example, I have observed teachers direct their students to a specific part of a multimedia package, because of fits the scheme of work. However, the constraint of self-navigation and the closing of access to the remaining materials negate the real potential of the resource. The power of multimedia is in the interactivity and that can be effectively removed because of "time" or "relevance". Freeing the student to fully interact with the resource encourages development of independent learners and supports the learner's self-paced and preferred learning style based programme of learning.

Students must be able to access the full audio-visual facilities of the resource, particularly animations or resources supporting difficult concepts or models, in a well planned and time-tolerant context. A process of resource evaluation and training for

all humanities teachers will enable them to be confident in facilitating students learning in this way.

2) ***Which learning paradigm supports promotion of best practice in use of multimedia and how does this link with learning styles theory?***

- **The revelatory paradigm is most appropriate.**
- **Learning through discovery via interaction is key to the promotion of best practice.**
- **Facilitation by the teacher to ensure students access materials suited to their intelligence and preferred learning styles is essential.**
- **This paradigm will result in raised motivation and enjoyment levels for most students.**

The successful learner will be allowed to access the resource in a discovery based way. The Revelatory paradigm supports promotion of best practice, where learners take responsibility for their own interaction with the multimedia resource. This may well be guided by preferred learning style. The essential element for best practice is that teachers release the desire to control the resource in an instructional way and allow the student to explore and interact with the materials. The level of engagement and enjoyment is positively reflected in active learning – the hallmark of a cognitive approach. Students are able to progress at their own pace and reinforce or extend knowledge as desired. Although none of the research demonstrated hard evidence that this style of learning results in higher grades, it is the perception of teaching professionals that that is the result.

Conversely, using the multimedia in an instructor based way can actually have the opposite result, with a content led and teacher defined route through the material completely undermining the most positive learning potential of the resource.

3) ***What possible freedoms and constraints are imposed on learning by exposure to multimedia experiences?***

- **Students are freed to be independent learners.**
- **Students can learn in a preferred style.**
- **Audio-visual material and animations are a powerful tool for the engagement of students with difficult or emotional concepts.**
- **Higher grades should not necessarily be expected.**

Use of multimedia in Humanities subjects enables the learner to control their own learning and can greatly enhance students understanding of key concepts. Animations and simulations provide a visual explanation of concepts that a static image cannot do. Provision of real audio-visual footage of human events can engage the learner intellectually and emotionally with topics outside of their experience – such as war; and free them to engage in their preferred learning style. Access to relevant, high quality resources can encourage them to produce higher quality presentations of their own.

Students will spend more time engaged on task than when using "traditional" learning methods and are freed to become more independent learners IF given the opportunity to explore the multimedia resources in their own way. Weaker students can benefit from the ability to revisit difficult concepts and see / hear supporting

material and more able students are free to develop their understanding in ways that would, perhaps, not be achievable in a book-led project.

Student response to learning is more positive, although there is not enough evidence other than observation to support the view that raised attainment is inevitable.

Students are constrained by the materials and by the preferred focus / bias of the author. A German authored resource on the Second World War may differ greatly from an English one. Some students may be intellectually constrained by the limitations of technology – desiring a level of audio-visual input beyond the capabilities of the resource. Students may also be constrained by the lack of skill or confidence of their teacher and by how well the resource has been evaluated for suitability and effectiveness prior to use in the classroom.

9. Summary and conclusions

Multimedia resources are a valuable and powerful tool to aid students in their learning and experiences within the Humanities subjects. Use of multimedia as a learning resource and opportunities to produce multimedia are both highly valid learning pathways and is highly recommended where difficult concepts or emotional contexts are present. E.g. discovering the war through photos and speeches or exploring glaciation through animations.

Demonstration of best practice is evident when students are free to develop their own learning and have full access to the full multimedia resource. There is great support for the validity of multimedia as a tool for the revelatory paradigm - learning through discovery and also through provision of individualised learning pathways and support for preferred learning styles. Potential value is reduced when the package is used as an instructional tool.

Teachers who use multimedia within their schemes of work, should have fully evaluated and tested the resources before trialling them. This can be done using a checklist of criteria as shown in Table 2, below.

	Criteria	**v**
1	Is the balance of information appropriate?	
2	What is the extent of the information?	
3	Is the information up to date and accurate?	
4	Is it targeted at the right level?	
5	Would it require a change in teaching style?	
6	Is it designed for teacher use, pupil use or both?	

7	Is it appropriate in terms of reading age?	
8	Is the resource easy to use?	
9	Do the structure and help features conform to your preferred style?	
10	Is it easy to navigate?	
11	Is the quality of presentation up to a high enough standard?	
12	Are the images large enough and of high enough quality?	
13	How well do the audio – video resources compare to other titles and TV / Video?	
14	Does the resource offer sufficient opportunity for students interaction?	
15	What additional facilities does the resource offer – printing, tests, etc?	
16	What is the quality and extent of support materials for both teacher and pupils?	
17	Were any technical problems encountered when you tested the resource?	
18	Is the resource better than an equivalent text book?	
19	Was there anything else that struck you when you first used the resource?	
20	Has the resource been piloted with students? What were the outcomes?	

Table 2: *Criteria for evaluating multimedia resources,* (Adapted from Bruntlett, S. in: Pachler & Leask (2001: 81)

The needs of individual students should be considered so that the teacher can help facilitate learning in the most effective way. This is only possible if the teacher is an "Expert user" of the software.

10. Policy Recommendations

The following points should be adopted as policy to ensure the most effective use of multimedia resources in humanities, both in terms of learning and cost effectiveness.

- *All multimedia products must be fully evaluated in terms of suitability for purpose before schemes of work are generated or adapted – using the criteria shown in Table 2.*
- *All staff using the resource must receive full training and time to investigate the resource for themselves.*
- *All multimedia learning resources must be supported with full access to headphones and suitable processing / graphic requirements to enable full effectiveness.*
- *All use of multimedia must be planned to allow full and unhindered access to the resource, not used as an "electronic chapter" of a textbook.*
- *Students must be encouraged to interact with the resource in the ways most appropriate to their understanding and preferred learning style.*
- *Students and teachers should all have time to reflect on the benefits of the multimedia resource on completion of a topic.*

11. Acknowledgements

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