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Contents

New Multimedia Technologies (NMT) as Educational Tools.....	2
The Educational Potential of DVD.....	6



Youth today routinely use new multimedia information technologies in their daily lives. Educational research on new information and communication technologies centers more on analyzing the educational potential of products that dominate the marketplace than on developing tools specifically for teaching. The former enjoy popularity among students, who are therefore familiar with their use. As for the latter, nobody with purely commercial interests would be interested in manufacturing products specifically for the world of education.

The popularity and market penetration of DVD (Digital Versatile Disc) is growing quickly in homes in developed countries. We can safely assume that it will also have a presence, although somewhat delayed, in education centers. We are going to briefly analyze the potential of DVD as an educational tool, the characteristics that are specific to this medium, and its possible advantages and drawbacks.

New Multimedia Technologies (NMT) as Educational Tools

New media, including content and methods for presenting it, unmistakably contribute to the informal education of our students outside the classroom. In addition to considering new media (television, video games, Internet, etc.) as educative agents and keeping their influence in mind, educational institutions incorporate these media into programs of study as content—including analysis of their importance in society, how they function, and the repercussions they may have in our lives. In the study of NMT, as in the study of any other subject such as history or languages, new media are also used as educational tools to enhance learning, and it is this aspect that we will discuss in this paper.

In their role as an educational tool, new multimedia technologies must fulfill three basic functions:

- represent and present both real and virtual worlds
- facilitate teaching
- enhance student learning.

These functions are mutually inseparable and relate, respectively, to the three principle elements of the teaching-learning process: content, teachers, and students.

As arguments in favor of using a new device in the classroom, be it DVD or any other technology, we often hear only of its technical characteristics, or we are presented with market criteria such as price and availability. On other occasions, and due to the prevailing educational models, transmission and reproduction, the educational potential of a medium is measured in relation to how useful it can be to the teacher in the presentation and use of content. Nevertheless, the primary function of educational tools is to help the student learn, and the role of both content and the teacher should be to improve student learning.



Potential Advantages and Drawbacks of NMT as Educational Tools

Although in Gutiérrez (1997)¹ we dealt with this subject in greater detail, in this paper we will give only a partial list of the advantages and disadvantages of NMT as educational tools, paying special attention to the potential of DVD in teaching. The principle **advantages** are:

- NMT facilitate the presentation, treatment, and comprehension of certain types of information, and they make it possible for the student to study representations of worlds not easily accessible otherwise.

With the arrival of computers, written textual language was first to be digitized because it required the least amount of resources. Digital text offers considerable advantages over text printed on paper: the new text can be modified more easily, it can be sent from one place to another, words or strings of characters can be searched for and found instantly, etc. We can say that computers enormously facilitate the processing, storage, and transmission of written alphabetic language. We cannot say with the same confidence, however, that they facilitate the presentation and comprehension of that alphabetic language. In this sense the advantages of new media, although there are some, are not so significant. They derive from the facility with which information can be modified and managed, and they affect presentation the most. A computer presentation of purely written information has its advantages, but it also has disadvantages when compared to the use of transparencies and overhead projector, and paper itself.

When it comes to the treatment and presentation of visual information, new technologies are clearly superior to more traditional media like illustrations in books or other formats like maps, signs, murals, etc.

Many of the things represented are not visible to the human eye in any other form, i.e. the representation of reality is superior to reality itself as an educational tool in cases like microscopic or macroscopic photography, or the study of the interior of the human body.

No one doubts the advantages of new systems for projecting images in teaching and learning, from the now almost obsolete slide projector to more modern video and data projection systems. When dealing with the representation, explanation and understanding of processes, actions, or behavior in which the temporal dimension is a fundamental element, the moving image is indispensable. Digitizing and presenting 25 or 30 images per second requires a device with a very large processing capacity. Personal computers have not had that capacity until only recently, and consequently analog video continues to be the most common medium for presenting information in audiovisual language. As we mentioned previously, the progress of digital video leads us to believe that in just a few years DVD, or

¹.- GUTIÉRREZ MARTÍN, Alfonso (1997): *Educación multimedia y nuevas tecnologías (Multimedia Education and New Technologies)*. Ediciones de la Torre. Madrid.



another similar technology, will substitute the VHS cassette in most homes and education centers. Furthermore, digital technology allows interactivity in audiovisual documents, by which video becomes "interactive video" and participation or *immersion* in the document, in the representation of reality and in the action, somehow becomes possible. This is one of the reasons that the potential of DVD as an educational tool is superior to that of traditional linear videotape.

- *NMT motivate students and help them to be protagonists in their own learning.*

In the new millennium students are usually very familiar with audiovisual language and multimedia equipment. Despite all this, alphabetic language and books continue to be the predominant and almost exclusive format in schools. Consequently, incorporating the image and new technologies would be an incentive in and of itself, a motivating element that would improve students' predisposition to actively participate in their own learning. We cannot, however, deceive ourselves by just assuming that if we use NMT students will always learn more actively. In many cases new media serve to reinforce old models of passive learning, in which the teacher is the gatekeeper of knowledge and transmits information (using NMT, to be sure) to the student, whose task is to memorize that knowledge and reproduce it as faithfully as possible on a test.

There are two factors that must be present for NMT to facilitate active learning: (1) students themselves use and operate the media, and (2) documents used for learning have an interactive quality. The former does not depend so much on what technology is used as on which methodology and pedagogical model are followed. As for the interactive nature of educational documents, we should remember that digital media lend themselves well to the production of documents with information in interactive form. In the case of audiovisual documents, which require very large storage capacity, DVD may be the ideal format.

- *NMT contribute to methodological variety, attention to diversity, and individualized learning.*

We know that students have different abilities and ways of learning. While some learn best from oral presentations, others need to read or see information represented in audiovisual format. The more variety we incorporate in methodology and media, the better will be our chances of attending to and developing the specific abilities of each student. Learning can be individualized: we can attend to the interests and needs of each specific student using interactive multimedia equipment like DVD, so long as the content is programmed (selected and sequenced) to that end.

The possible **drawbacks** or risks resulting from inappropriate use of NMT fall into two main categories. In the first we find possible problems resulting from teacher and student attitudes such as *technophobia, fascination/preoccupation with technology, and the perception of NMT and audiovisual language as media for fun and entertainment* and not as tools for learning. In the second category we find drawbacks resulting from the nature of NMT documents and the conditions in which they are used. In other words, on one hand we have **organizational problems** of how and where to situate and use shared media, and on the



other, **the design, structure, and encoding of information in multimedia materials.**

Most multimedia applications, including those labeled “educational,” are conceived as commercial products and not curriculum materials. Sometimes sounds and graphics are incorporated into programs to make them more “fun,” even though they hinder learning instead of facilitating it. The way contents are presented onscreen in educational documents, including structure, timing, format, and style, should follow educational criteria in addition to esthetics or entertainment value. Based on his research on multimedia learning (2001)², Mayer offers seven principles to keep in mind when designing educational multimedia messages. The first is that students learn better and remember lessons longer if they utilize images with verbal language than if they are delivered using words only. What Mayer calls a principle of multimedia is often put forward as an argument in favor of using audiovisual media in the classroom. Some believe that the more senses are involved in perceiving and processing information, the better learning becomes.

Mayer’s second principle, “spatial continuity,” states that learning and memory are better when words and corresponding images are close together than when they are further apart on the page or screen. When text and image are closer, learning improves.

From his research Mayer likewise deduces that learning improves when words and images are presented simultaneously as opposed to one after the other. This he calls the principle of “temporal continuity.”

According to the “coherence principle,” students learn better when a multimedia application does not incorporate strange images, words, or sounds (for entertainment purposes, as mentioned above). Their alleged motivational value is usually used as justification for these superfluous elements.

Mayer’s fifth principle is “modality,” which states that learning and memory improve when animation is accompanied by narration instead of written text on the screen. This seems paradoxical if we consider that information presented in written form can be read and re-read by students at their own pace, while spoken words are ephemeral, *like dust in the wind*. This is true; however, the case of a multimedia presentation that uses animation in addition to verbal information is a bit different. Spoken commentary is processed via the auditory channel, while written text is processed visually, and since it overlaps with the animation’s graphical information, it could interfere.

One might conclude that the best solution is to incorporate both spoken and written commentary with the animation, but according to the “principle of redundancy,” this is not the case. When alphabetic language accompanies animation only as narration, students learn and retain more than when the written form is added as well.

Finally, according to this author’s interesting research, not everybody learns with multimedia

². - MAYER, Richard E. (2001): *Multimedia Learning*. Cambridge University Press.



in the same way. The design characteristics discussed in this section influence learning for each individual differently. It seems that good design in a multimedia presentation benefits students at a lower “intellectual level” more than other students. Good design also improves learning more for students with good spatial orientation than for those without it. For example, if an animation and a narration are presented consecutively, students with good ability to process spatial relationships and those with less ability will both have trouble matching those two representations in working memory. When both representations, animation and narration, are perceived and stored in working memory simultaneously, the students with more spatial ability can establish relationships between the two representations more easily, and consequently they learn better.

The Educational Potential of DVD

As its name indicates, DVD is a technology with *versatile* storage. Its main advantage lies in the fact that it can store a large amount of data of all kinds (text, image, sound, graphics, video, etc.). This storage capacity has made it the medium of choice for digital video, above all for long-duration documents like movies, which are traditionally on VHS videotape. DVD entered the market mainly as a vehicle for linear audiovisual documents like movies. As a supplement to the movie itself, the DVD version usually offers additional, complementary information about the actors and the filming, as well as the ability to use different soundtracks and subtitles—a minimum level of interactivity that does not significantly change the way the document is used. Movies and educational documentaries on DVD do not provide any advantages over videotape versions as long as they do not utilize interactivity beyond just choosing language or subtitles. It was already possible to select between two languages using *dual* (or two channel) broadcasting and recordings. If documents continue to be linear and are used as such, the new technology does not contribute much from an educational standpoint. The educational potential of DVD lies more in the ability to interact with audiovisual documents in a nonlinear fashion, which is impossible with video tape, the popular technology that preceded DVD.

In education DVD functions in two basic ways:

- As a storage medium for interactive multimedia applications
- As interactive video, or “hypervideo” (as in “hypertext”)

Multimedia documents can also be presented using other formats with less storage capacity like CD-ROM, but if the document requires a large amount of video, DVD is the best medium. In this case the disc format is similar to data CDs in that they can only be read in a DVD player connected to a computer. The digital disc is the equivalent of an external hard disk drive that can be easily connected to any computer. Applications can be displayed on a computer screen or even on television. Nevertheless, a traditional video cassette player, not



a computer, is usually connected to the television—although, as mentioned earlier, VHS may soon be replaced by a stand-alone DVD player similar to the audio compact disc player. This type of player is not a computer component, and it can be connected to the TV to play DVD video format discs, audio compact discs, and CD-ROMs with “.mp3” sound files or “.jpg” graphics files.

As we pointed out, until now DVD discs have been used mainly for storing movies and other non-interactive audiovisual documents. It would therefore be premature to discuss *interactive video* or *hypervideo*. In the same way that digitized text does not offer the advantages of hypertext, video that has simply been dumped onto DVD does not take advantage of the potential of the digital format for creating nonlinear, interactive documents.

We can use the evolution of hypertext in educational materials as an example of what may happen with audiovisual documents. In its beginnings, hypertext educational material added some links and minimally restructured the existing linear text. Now when new content is designed as hypertext, it is conceived as interconnected blocks of text with a certain degree of autonomy. It is written with nonlinear reading in mind. With audiovisual documents—with video—we are still in the first phase of adapting existing linear material. Producers want to reuse existing linear material, so they slightly modify it by dividing it into chapters and adding corresponding links. Nevertheless, the document is still linear, and on very rare occasions do the chapters make any sense on their own.

DVD and digital video will have reached their educational potential when they are used to design, produce, market, and play nonlinear, interactive audiovisual products. This kind of educational use of audiovisual material has an interesting precursor developed at the beginning of the eighties: *interactive video*. A personal computer was connected to a video disc player in order to combine the image quality of the “laserdisc” with the computer’s capacity for controlling information. The video program or audiovisual document was controlled by the computer, which could in turn be controlled by the user. That technology was much more complex for its day and age than DVD and digital video are today, and although it never reached the classroom, interactive use of all types of documents including video now *can* become a reality with these new technologies.

Digitized video is much more versatile and much easier to integrate into educational multimedia documents. Now it falls on us to take advantage of these strengths and turn DVD into a highly useful tool for teaching and learning.

