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DVD technology for educational purposes

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Abstract

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Introduction

Background

The beginning of a new century has given humanity many new and different challenges to face and understand. One of those new challenges is the world of technology advancement. The direction of this paper is to explore one of the avenues that is being developed to maintain and store data, as well as different forms of media that can cheaply and easily moved for general use.

One of the new technologies which have come to the forefront of uses in our society is the Digital versatile Disc (DVD). The term DVD initially stood for Digital Video Disc. But even as we traveled through the growth spurts and changes of DVD technology, the name did not stay the same. The term DVD now refers to Digital Versatile Disc. Many of the new uses and expanding flexibilities of the DVD technology no longer allow it simply to be referred to as a video disc. The uses for the disc have been expanding with more applications being created as time allowed for the growth of the technology (Cinram Company, 1997).

The first real glimpse of the computer in any form would have to be seen as the abacus in Asia Minor about 5000 years ago. Even though it was simply moving beads back and forth on different levels of strings, it was the beginning of manipulating information by using of some form of numerical hierarchy. Creative thought continued to creep forward, but very slowly, even with the advent of paper and pen. But the start of a machine that could do simple calculations was the numerical wheel calculator created by Blaise Pascal. The next true development that could be looked at as a computer would come in

with the creation of the steam powered thinking machine called the difference engine in 1822, by Charles Babbage and Augusta Ada King. And finally from the difference engine, their work would lead them to the creation of the analytical engine, which would be considered as the first general-purpose computer (LaMorte 1996).

The real drive for more defined and faster thinking machines came from the ashes and destruction of World War II. The need to process, understand, and have accurate information became critical in the efforts to turn back the dictatorial armies of Japan and Germany. Though both sides during World War II worked extensively to create computer prototypes, the work completed by the Germans was never revealed (Rheingold, 1985).

The computer has taken many twists and turns since World War II, only to become a global phenomenon. The continued production and use of the personal computer now exceeds a billion machines. The next billion machines are predicted to be sold by the year 2008. With the growth of the computer, the DVD world will be a storage partner for multimedia and large amounts of data (Miller, 2002).

Purpose

The purpose of this review is to explore the history of DVD technology. This writer will address the technical data that differentiates this technology from other areas of data or information flow. From this technology, what possibilities exist to enhance different aspects of education, both current and future.

Research Questions

1. What is DVD technology?
2. Does DVD technology have value added attributes to contribute or compliment a productive educational environment?
3. Can DVD technology enhance the on-going research and provide positive growth for multimedia uses in education?

The Review of Literature

DVD technology begins to expand the amount of information in different areas that can be manipulated and transferred with relative ease. The multimedia possibilities have only began to emerge for the general use. But to clearly understand how the DVD technology came into existence, the Compact Disc (CD) technology needs to have a brief explanation .

The birth of the CD began in 1980 when Philips and Sony created standards for the optical disk-based digital audio format. The first audio CD player was not produced until 1983 for $1000. These formats were only for the audio segment, with the read-only standards being created in 1985 for use in the computer. In 1996 the Compact disk-record able (CD-R) disc drives appeared on the market. The major factor of the CD-R was the ability to now be able to record data, one time only, (also know as WORM-Write Once, Read Many Times) on a blank CD for one time use. People were now able to load music onto their hard drives at home, place them in what ever format they chose and record them back on to a blank CD. This allowed people to record items of their choosing much like the cassette tapes had earlier. The market for recording CDs expanded greatly, not only for data storage, but mainly in the area of music. In 1997, the compact disk-rewritable (CD-RW) appeared in the market place. This was also known as the compact disk-erasable, which would allow the users to write data to a disc and overwrite the files that had been created (From CD to DVD: The Evolution of CD Technology, 1997).

Looking at the technical aspects of the CD, the disc diameter is 120 mm, with a thickness of 1.2 mm (Tacmar, 1996). These dimensions are exactly the same as the DVD. The major difference is that the CD track is 780nm (infrared) wide and has a single substrate. To put it into simpler terms, the CD has only one layer to store data, compared to the multi-layered DVD. The area that information is deposited on is larger than the DVD. The other major difference is the width of the track is also wider than the track of the DVD. So in short, the storage area for information on the CD is longer and wider than the DVD technology. This data storage along with the type of laser reader that the CD employs, seemed to have determined the direction that would lead the CD technology (Spiwak, 1998). With all the specifications defined in a CD, the major draw back was the limited amount of storage. The maximum amount of data that a CD could hold originally was only 680MB. At the time of its creation, this seemed like a huge amount of information. How could we ever need or want more? But the world turns faster and in many different directions, only to demand more storage and better quality, which soon is taken for granted.

One of the things that the innovators of the DVD world watched closely was the acceptance time it took for the CD to be adopted by consumers (Goodnight, 1997). They did not want to have to experience the long customer acceptance time it took for the CD to become popular with the buying public. They made the DVD readers backwards compatible with the CD formats. All the data, music and images that had been placed on CD could now still be used or transferred when needed to the new technology (Balkanski, 1997).

DVD Specifications

The technology behind the DVD world is considerably different than the CD world. Even though the diameter (120MM) and the thickness (1.2MM) of both technologies are the same, this is where the similarities end. The DVD has two bonded substrates of 0.6mm each per side. The laser wavelengths that are used equal 650nm and 635nm. The track pitch is .74m, which is less than half of the compact disk track pitch (1.6m). Along with a 0.4m pit and land length, the CD had a larger area of 1.6m. Through all of the technical jargon of DVD technology, this means that there can be two layers per side on each disk. The tracks are narrower and the spots that hold the information are smaller (Pioneer, 1997). This allows about 4.7 Giga Bytes (GB) on a single layer and 8.5 GB on a double layer. The same amount can be applied to the other side of the disk. If a DVD contained the maximum amount possible to store of data, it would hold 26 times the amount possible to store on a CD. This equates to about 2 hours of high quality video per layer. Along with this, it also supports up to 32 languages of subtitles. An actual 90-minute movie, if uncompressed, takes about 158.2GB of storage. But because of the Moving Pictures Expert Group (MPEG), the movie is compressed down to 4.7 GB. MPEG-1 is the type of compression storage used on the Web and for CD-ROM. MPEG-2 is the compression type used for DVD. The reason this method, MPEG-2 is so successful is because it avoids compressing the areas of the picture that are not changing. It works only with the parts of the picture that change from one frame to the next frame. To further add to the

detail, a DVD can easily encode six or more channels of surround sound to each movie. So you can now hear helicopters coming from your right side and landing on your left side, all while you sit in your easy chair in the living room (Huttle, 1997).

History of DVD

The DVD dates back to 1996 (Spicer, 1996). The information and the some of the standards had been defined but yet there were many skeptics (Liebenson, 1997). The battle seemed to be more over which format should be used. Many people still had the memories of the VHS-BETA format war, which lasted for many years. When talking to a person who is a true student of film, about VHS versus BETA film, the discussion could be endless. But also within the battle for the format was the fight over copy protection, which also included encryption of the materials on the disk. The people who were mainly opposed to the standards that had been proposed were the moviemakers and the consumer electronic manufacturers, namely computer producers (Dell, HP, Compaq and IBM). They determined that a simple two-bit code would be added to every recording. This coding would not keep out the serious hackers, but copy protection laws were being created that would go after the major copiers (Grossman, 2000). This idea, along with the legislation that was being drafted, seemed to appease the movie producers. The monitoring group for DVD copy protection seems to be very active working to maintain the content scrambling system that is in place (DeFrane, 1997). Watermarking to maintain the copyright protection of the music

industry and the movie world continues on, but as with every aspect of this technology, there are various groups that can not seem to agree on one standard for the use and direction for watermark uses (Galaxy Group., 2001).

But the manufacturers of the processors for computers were now worried that this two-bit code would cause too much computational burden for the processors. With the direction of IBM, who had devised the code along with the help of Disney people, a solution was soon found. The engineers realized that every frame did not need to be encrypted to make the picture unviewable. The digital data on the disc is stored in sectors, with about 10 sectors of data needed on average for every frame. The coding would be placed on every fourth to sixth video frame. This would allow the video data to be scrambled thoroughly (Schechter, 2002).

With all the posturing and politics seeming in agreement, DVD technology was ready to be introduced to the public. In January of 1997,at the Consumer Electronics Show, several studios announced their intention to begin to release movies on DVD. With that announcement signaled the approval for the movie industry to move into the technology. Every new technology has critics who predict that the new applications will fail. DVD was no exception. Critics expressed the idea that without the ability to record, the technology was doomed. Some critics stated the first VCR units did not sell due to the fact they did not record, especially from the television. The touted options that had been first talked about were also missing from some of the early movie releases. But even with the options on the movie, such as special programming and playback

options, they would be looked at once by the public and then quickly forgotten or never looked at again. The manufacturing of the disc would be of such a magnitude that only poor resolution quality and errors would occur. But maybe the best criticism was that the movie industry was looking for more ways to make money and the electronic people were in need of a new gadget to spike up sales. In general, they felt that the entire direction was directed by greed (Chamberlin, 1996).

The major obstacle or competition came from Digital Video Express (Divx) (Patrizio, 1997). This was a pay-per-view DVD type format mainly sponsored by Circuit City. A person could buy the disc for five dollars and watch the movie as much as they wished for the first 48 hours. After that, they could throw the disk away, purchase another forty-eight hours, or buy it for permanent viewing, on a credit card. With this direct competitor, it now split the major movie studios into two camps. Paramount, Universal, Disney, and DreamWorks SKG were going with Divx. 20th Century Fox, Sony Pictures, and Time-Warner had committed to DVD. Also Suncoast Video and Tower Records stated they would not sell Divx discs. The constant paying for more time, a track able record of what films were being watched, and the lack of support from the major studios, ended the Divx competition (Patrizio, 1998).

The major problem still continued with DVD technology not being able to record any media. Whether the input came from a television or even from a CD, the activity was not yet defined. The major problem has always been that there is a format split in the way things should be done. One format is DVD-RW. This

format basically works like the CD-RW. This was a simple deposit of information within the define pits of the tracks. This type of format is also backward compatible with almost all formats that are currently on the market. The major manufacturer of this product is Pioneer. The computers that utilize this format are Apple, Compaq, Hitachi, Samsung, Sharp, and NEC/Packard-Bell. The other format is called DVD+RW (Hewlett-Packard, 2002). The difference between the two formats is that the grooves in the DVD+RW "wobble". This causes a higher-frequency timing signal, along with no fixed address areas that interrupt the grooves. This format is being supported by Dell Computer, Hewlett-Packard, Mitsubishi Chemical, Phillips Electronics, Ricoh, Sony, Thomson Multimedia, and Yamaha. Microsoft has also announced that they will now incorporate the DVD+RW format into future Windows operating systems. This will not standardize the recording format, but will now make devices having the DVD+RW format easier to use (Shim, 2002).

The Sales of DVD Players

The sales of DVD-video players since April of 1997 has increased yearly by an average of about fifty percent (Consumer Electronics Association., 2002).

US DVD-Video Player Sales

(Data courtesy of Consumer Electronics Association)

	2002	2001	2000	1999	1998	1997
JAN	545,698	572,031	370,031	125,536	34,027	
FEB	736,118	555,856	401,035	109,399	34,236	
MAR		1,207,489	412,559	123,466	38,336	
APR		631,353	409,192	269,107	42,889	34,601
MAY		523,225	453,435	279,756	47,805	27,051
JUN		920,839	654,687	326,668	79,044	29,037
JUL		693,013	537,453	325,151	84,709	19,416
AUG		673,926	557,617	260,225	81,170	34,021
SEP		1,768,821	1,296,280	501,501	113,558	34,371
OCT		1,516,211	1,236,658	603,048	163,074	56,407
NOV		1,781,048	866,507	449,242	136,908	37,657
DEC		1,862,772	1,303,091	646,290	233,505	42,575
YEAR TOTAL	**1,278,816**	**12,706,584**	**8,498,545**	**4,019,389**	**1,089,261**	**315,136**
CUMULATIVE TOTAL						**27,907,731**

The total number of units that have been produced from that date in 1997 is under twenty-eight million machines. With the popularity and increase of films being released on DVD, the expected video player production should be well over fifty million by the year 2005. With production increasing, the consumers now benefit greatly from the competition for sales, which in turn pushes the prices lower (Peddie, 2002).

The Future of DVD

The future for DVD seems to be extremely encouraging. With recent announcements that several companies are making progress in formulating methodologies that will generate a holographic DVD. The advances that this holographic DVD will provide is the amount of storage of data will increase from about 17 GB to approximately 100 GB. If we begin to transform this information into more comprehensible data, it would translate into this type of structure. The National Geographic Magazine has been in publication for over 110 years. In that time they have published more than 180,000 images and over 9,300 articles. All of that information can be stored on four DVDs (CNN., 1998). The normal movie is stored on a single side of the DVD. The holographic DVD could now store approximately 20 movies with all the added features that are being presented with the movies. A full thirty minutes of uncompressed high-resolution video could now be store on a single disc. So the new DVD would now store all of the National Geographic information plus an additional 15 movies on a single disc.

The concept of such storage now begins to boggle a person's mind as they try to equate how that would relate to our libraries.

The technology of the holographic DVD (Goodwins, 2002) resides around the use of a split laser beam. This would allow for interference patterns to be generated. By changing the reference beam, another hologram is now created in the same location and does not interfere with the first. So different levels of information can be stored without conflicting with another. The exact number of levels that can be held on a disc is still being determined. Some of the optimistic people working with this technology feel that a Terabyte (1000 MB) of storage is possible, with 10 Terabytes of data capacity not out of reach in the near future. There is also a competing group of inventors using fluorescent photosensitive glass discs that are advocating the same amounts of storage (Next Big Thing in Data Storage, 2000).

Features of DVD Technology

The term, "features" applies to the different functions that a DVD will perform. Those features can be divided into two types of functions. The standard type of features that come with almost all DVDs. The second are features that are added for a particular type of film, a special segment, or to promote special interest or understanding that is being brought forth by the producer (Reuther and Foster & Davis, 2001).

Looking at the standard features, we begin with the audio. DVD comes with the Dolby® Digital sound, which includes English 5.1 surround, English

Dolby surround, and French Dolby surround sound. Also included in most films are subtitles in English, French, and Spanish. The film can be viewed using different languages for the actual verb age through out the presentation. Again the three languages most commonly used in the United States is English, French, and Spanish. The video is set for digital wide screen or full screen. The use of wide screen now allows for access on the upcoming high definition televisions that will be coming forward in the near future. One other feature is being able to select whatever scene the viewer would like to directly go to (Cameron & Landau, 1997).

The special features begin to show the real attributes of what DVD technology is capable of. In the Movie *Swordfish*® (Krane & Silve & Sena, 2001), the film comes to a defined conclusion. But the viewer can now go back and select two alternate endings, giving a very different conclusion to this action movie. The up coming 20th anniversary film release of *ET*®, the producer has decided to add back to the new release, extra segments and pieces to a re-edited newer version. Along with the new version, the old version will also be on the same DVD to allow the viewer to enjoy and compare both versions. This has never been possible in the past with previous technologies. One of the more extensive uses of the DVD technology is in the movie *Thirteen Days*® (Deason,P. & Montiforte,M. & Donaldson, 2001). The film covers the period of the Cuban missile crisis in October of 1962. Along with the film, New Line Home Entertainment also provides historical figures commentary, a documentary on the background leading up to the crisis, a historical figures biographical gallery,

and a historical information track. At various points in the movie, the viewer can break out of the movie and get comments or background from sources that reflect the current activity from the immediate timeframe. The three previous examples now begin to reflect the creativity that the technology provides in the building the information flow.

Sphere of Educational Difference

This paper has devoted the previous information to the focus of the technology. The use now needs to become applied to a practical use. The abilities of the film world are still beyond the grasp of the people that promote and educate the general populace. The tool to enhance knowledge growth may now be evolving to better fit the *learning environment* (Heinich,Molenda, Russell & Smaldino, 2002). This learning environment includes the physical facilities, the psychological atmosphere, instructional methods, media, and technology. As we look at the elements of the learning environment, can one of the attributes supplement or enhance the others to create a better learning environment or even to establish a conduit of creative knowledge flow from teacher to student?

If we now take the examples that we looked at earlier, can they be applied? By taking current examples of situations or problems, and adjusting the conclusion to a different result, will we be able to learn from the alternate strategy or outcome? Using a Civil War battle, Gettysburg for example, and changing the conclusion to show different events. By showing what would

happen if Pickett's charge had succeeded in breaking through Union forces, would this have shortened or lengthened the Civil War? Also at the same time, being able to move in and out of an information track that provides the thoughts of the leaders of the battle and the circumstances that were prevalent at the time. This would now begin to take the learner beyond the colored map, located in the book in the classroom, and add more of a sense of how the emotions, feelings and realism of the actual event (Katz and Esparz & Maxwell, 2000).

The DVD technology now goes further and brings the information to those who are not in the classroom. That group of people who are not in the classroom now begins to grow exponentially. It includes the physically handicap, people who can not afford to go to the classroom, monetarily or because of time constraints, people with learning disabilities, the mentally handicapped, technically disadvantaged, slow learners, the elderly, and even the timid (D.G. and E.M. Devore, personal communication, July 15, 2002). The information that can be created on the DVD can be viewed by so many more with a relatively inexpensive machine. But one of the best features is that it can be repeatedly watched in the home of the learner. A class can be recorded, compressed to a computer hard drive and copied to a DVD for distribution. Along with the class presentation, an electronic textbook, any scanned pictures or documents, and any other source documents or video presentations that relate to the focused subject can be sent on one disk (Howard & Ozer, 2002).

Current Benefits

But once again we turn back to what is applicable to our current world. While some of the abilities of the DVD technology are just out of reach currently or in the very near future, what do we have now? The resources for educational purposes are already being used, but it is a silent movement.

The hearing impaired can view and understand the information that is being brought forth by the pictures. Before now, that form of knowledge was closed. The words now come with the pictures. The learning door of the elderly now reopens. Adults can listen to or read at their own pace without asking questions or only getting partial bits of information from a fast gyrating world. People who have difficultly comprehending the written word will have more and better methods to consume the information, specifically a slow learner or a person with attention disorders. Finally, the people who have come to America from other countries can listen and read their native language to help get them acclimated to the surroundings where they now live.

The largest areas that the DVD technology can add value is in the schools, universities, and through distant education applications (Herring & Smaldino, 1998). Because of the large volumes of information that could be generated to formulate value added applications both in the schools and universities, this document will not journey into defining those applications. But the ability to create study aids in problem areas of learning could be easily and quickly be produced for students to study and use in the privacy of they home after classes. These study aids could also include interactive practice tests for students to gain total comprehension of the subject matter.

Distance learning would also become one of the larger benefactors of this technology. We often times see CDs being shipped with bundles of books to students, now we can offer the option of including the book with the DVD which can easily be included on the disc. But once again the DVD can offer resources that supplement current methods of distant learning. As explained earlier, to record classes and be mailed to locations of the students. This now allows the teacher to set the tone and environment of the learning schemata. Also selected resources could be included on a disc that normally may or may not be available to the students at their location. This once again attempts to provide information flow to areas that may have slow Internet access, no Internet access, or even lack of conventional forms of communication, such as telephone, television or radio signal (Mirabito, & Morgenstern, 2001).

Conclusion

The evolving technology of the DVD world is just now emerging. We have only just seeing the beginning of the possibilities of the things DVD will bring. The best part of this emerging technology is that it will be totally "backward" compatible with current educational functions. It will supplement the uses and functions of books. It will lend structure and detail to uses by the Internet. It can provide aids to the classroom presentation. But mostly the DVD technology will continue to flourish and expand to uses and areas that may or may not as of yet be defined.

Adams and Hamm (1998) remark that the direction that the DVD world may enhance would be:

> Science is not just for scientists or poetry just for poets. As teachers, it is our job to open children's minds to the wonders of the linguistic and the natural world. One of the most important goals of science instruction is to expand the perception and appreciation of water, rocks, plants, animals, people, and other elements of the world around us. The next step is being able to use technological tools to communicate those understandings. The technological products of science are important for many reasons, not the least being their effect on human communication. Using the technology and intellectual tools of science (scientific process) to explore that world can spark curiosity, interest, knowledge, and action. (Adams & Hamm, 1998)

The demand continues for more and faster from the technology world. The future of DVD is to fill some of those demands for more storage with 100 gigabyte capacity and 20 megabyte per second transfer rates discs that can be stored for 50 years with no lose of integrity. The possibilities for uses now seem to be endless, but mankind will continue to demand even more in a short time (Rhey, 2002).

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