An Exploratory Study of Multimedia Education

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ABSTRACT

Multimedia technology has been widely used by electronic media for program production and broadcasting in recent years, and this occurrence has also been observed in the education industry. In theory, education should be have a longer standing in the broadcasting industry and have more value than the electronic media services which focus on commercial and entertainment purposes, if it can widely utilize the new broadcasting technology. By investigating in new broadcasting technologies such as virtual studio, animation, and motion capture, this article discusses how these tools can be applied to the production of multimedia education that would stimulate students’ learning desires and enhance teaching results. We will also explain the origin of and the future trend of how multimedia education can fundamentally change the traditional ecology of the education industry.

Key words: multimedia education, Internet broadcasting, new broadcasting technology, the education industry.

INTRODUCTION

Ever since multimedia production technologies began to be favored by the education industry in the second half of the 1980s, the development of the software and hardware of multimedia teaching tools has been vigorous. Multimedia teaching software has especially become the mainstream in the software market.

In China alone, the sales volume of educational software in the first half of 2002 reportedly shows a 47% increase over its counterpart in 2001. Educational software occupies 17% of the entire software market. There are currently more than 300 educational software developers with more than 3000 products, and new products are constantly being delivered.

According to this report, China’s rapid development of online education has provided the educational software market with a broad space and great business opportunities. Currently, 70% of the colleges have their own campus network, and more than 4000 primary and secondary schools are also having a rough shape of their own campus networks. In fact, people worldwide are moving toward multimedia education. In terms of the visual aspect, we expect the synchronization of graphs, animations, images, and texts; in terms of the auditory aspect, we expect harmony in voices, stereo sound, and sound effects. Users would further like to come into touch with the information that incorporates the above mentioned visual and auditory elements from multimedia computers. Because the content manifested by multimedia education is far more novel and interesting than the traditional teaching methods such as printed material and lectures, multimedia education will not only become the mainstream in future teaching, but will also cause the educational industry to change its ecology fundamentally.

This article begins with the meaning of multimedia education and its prospects. By making references to domestic as well as foreign literatures, we will describe the cause and effect of the development of multimedia education, unveil its secrets, and take a closer look at its potential educational contributions. Moreover, this article intends to borrow certain components from the new broadcasting technologies that are already developed and are being applied on video productions such as virtual studio, animations, and motion capture to see their possible applications on multimedia
education. Certain aspects of this kind of application have already been utilized in electronic media’s education programs, whereas some of them are still based on purely theoretical speculations.

Lastly, this article quotes the analyses conducted by the academic society regarding the trend of multimedia education, and contemplates and discusses the possible future development of multimedia education based on the existing multimedia educational software.

The Meaning of Multimedia Education

“Multimedia education” is not a new vocabulary. The multimedia teaching method that incorporates multiple video and audio equipments in a single teaching environment has existed for quite some time. However, the concept of “multimedia” as we know it has been given new meanings along with the constant advancement and application of new broadcasting technologies. Because the tremendous capacity of data storage offered by optical drives, information from different media such as texts, graphs, sound, and images can be integrated via digitization, and thus “multimedia” can pass on information more effectively (Liao, 1997, P.1).

What are the specific meanings of multimedia education? We can make references to the features of “multimedia broadcasting”:

1. Digitization: This refers to the facilitation of information electronization through the integration of different symbols such as texts, graphs, sound, and images into “data” in which 0 and 1 mean “off” and “on” of electric current respectively. Computers process information through the binary system in which data is treated as 0 and 1 (“off” and “on” of electric current), and this allows texts, graphs, sound, and images that are of different formats to be processed uniformly, creating a multimedia environment. Once this kind of multimedia education exists in education, information can be passed on simultaneously through texts, graphs, sound, and images, thus greatly increases educational efficiency.

2. Internetization: Even with digitized educational content, the scope of education will be limited if a complete channel is lacking. Therefore, whether computers that process digitized information could be effectively connected together to transfer and exchange information would determine the success or failure of multimedia education. Since traditional phone lines only need to transmit voices that do not require a lot capacity, copper wires are sufficient to get the job done. If we were to transmit multimedia educational content, however, traditional phone lines become severely insufficient since the size of digitized information is millions times more than voices! As a result, different industries are replacing traditional phone lines with fiber-optical cables to transmit huge digitized files. Therefore, in order to effectively materialize multimedia education, telecommunication providers or TV stations would have to connect families or businesses with fiber-optical cables so users can conveniently download or upload multimedia information.

3. Interactivity: It is still insufficient when we have rich multimedia educational content that can be smoothly downloaded or uploaded via the fiber-optical network because users would inevitably encounter problems when they are accessing multimedia educational content, or they would require other supplementary information in order to fully understand the material. If there was no mechanism that can help users inquire or demand further information, learning effectiveness would be compromised. Therefore, how to design effective mechanisms of interaction such as hyperlink or content markup that allows easy access is an equally important issue.

4. Intelligence: The value of multimedia education is its innovative content, not old data being “resold” via the applications of new broadcasting technology such as digitization, internetization, or interactivity. In fact, human civilization is often scattered around the world, and different people often have different interpretations for same information. If
multimedia education can effectively connect different cultures as well as different interpretations, much like providing users with a complete database or library for learning, sophisticated human knowledge can be acquired and further innovations can be inspired. Naturally, in order to have such a complete database or library, educators would have to jointly gather and edit all types of educational content.

By summarizing the characteristics of “multimedia broadcasting” discussed above such as the application of digitization, internetization, interactivity, and intelligence on “multimedia education,” we can see that the application of multimedia broadcasting technology is done in the hope of creating a healthy and complete learning environment that is free of temporal and spatial boundaries, stimulates students’ desire of learning, and enhances learning efficacy.

**Anticipated Results of Multimedia Education**

According to the cognitive perspective, individual cognition is not directly given by external stimuli but is produced by the interaction between external stimuli and personal psyche. Therefore, how school education guides students to express interactivity and enthusiasm determines the success or failure of education.

Experimental psychologist Treicher (2001) has conducted two renowned psychological experiments to determine the channels from which we acquire information, and the methods through which we retain knowledge in our memories. For the former question, Treicher has conducted many experiments and found out that 83% of information is acquired via vision, 11% via hearing, 3.5% via olfaction, 1.5% via the tactile sense, and 1% via the sense of taste. Multimedia education allows one to see, hear, and feel like actually being in a certain surrounding. The information acquired via multiple senses is a lot more than what one gets from lectures or books. Information is closely related to knowledge, and gathering a large amount of information would allow one to grasp a large amount of knowledge.

For the latter question, the result that Treicher (2001) has found through experiments is that humans generally can remember 10% of what one has read, 20% of what one has heard, and 30% of what one has seen. One can, however, remember 70% what one has spoken during interactive processes. This means that the retention rate is far better for the information that has been seen, heard, discussed upon, and spoken than the information given in lectures. This means that the interactive design of multimedia education will greatly benefit students in retaining knowledge during learning processes.

In fact, since the latter half of the 1980s when the Information Era had begun, advanced nations such as the U.S. do not only value tremendously the development of the multimedia education industry but have also been investing heavily in its research and application. According to a survey conducted by Hopkins University in 1990, computers were utilized by teachers for more than 1/3 of the subjects taught in high schools. 1/5 of teachers also frequently used computers to assist their teachings. Computer-assisted teaching is even more pervasive in primary schools.

Since the 1990s, the application of computer-assisted teaching is evidently turning toward internetization and intelligence. The technologies that were developing faster were the Internet and multimedia technologies, which are also developing toward the direction of multimedia education. This means that the educational industry focuses more and more on long-distance information gathering via the Internet and the application of multimedia on stimulating learning performance. In other words, the application of multimedia and network technologies will open up a new prospect in the educational industry, in which the following modes of application are already seen:

1. Formulation of encyclopedia-styled databases that allow students to freely learn or review material: Since the capacities of the services that store multimedia information are growing everyday, video and audio files for each subject can be combined together via hypertext organizations. When a student is interested in a certain topic, he or she will discover
endless treasures once he or she is willing to enter the relevant databases.

2. Producing excellent environments of situation-learning that enhance learning effectiveness by taking students to virtual worlds: The design of this kind of learning situation is much like how microscopes and telescopes help students observe tiny or remote objects – the things that could not be seen can be made to be seen. Virtual environment is one of the applied technologies, through which students can learn novel material in a virtual environment.

3. Designing multimedia Q&A questions to challenge the level of cognition in students: This design includes using the multimedia format to provide students with questions and assist them in understanding and thinking about answers. It is even more beneficial when an environment for open discussions or different opinions can be made possible by the Internet as this will stimulate students’ learning potential. For example, students from different countries can jointly come up with different considerations on the same topic via the Internet, which will enhance their learning effectiveness especially for competitions.

4. Developing the “Computer-Supported Collaborative Learning (CSCL)” model to help students achieve their learning goals through teamwork. This new learning model is developed based on “Computer-Supported Collaborative Work (CSCW),” and its purpose is for students to jointly achieve a learning objective by forming a small learning organization in which some use computer networks to conduct inquiries whereas others use computers to process information. This process contains both cooperative and competitive mechanisms that help students increase their learning performance.

The anticipated results of the design of the above multimedia educational application models includes the strengthening and stimulating of students’ desire for learning, increasing their learning effectiveness, and, more importantly, developing students’ problem-solving capacity through the mechanism of multimedia education. This capacity has to be better than the one acquired by attending lectures and reading books.

Application of the Virtual Studio

Among the new broadcasting technologies utilized in multimedia education, the virtual studio is the one that seems the most promising. The so-called “virtual studio” means that the scenes needed in a studio no longer have to be physically constructed by carpenters and art designers, but are constructed by computer graphics. Therefore, a virtual studio can be looked at as applying the technology of VR (virtual reality) in video productions.

VR basically means using computer graphics to simulate a realistic scene demanded by a TV program in which actors will perform. Rather than a real, physical set, this scene is merely an image stored in a computer, and actors perform in front of an empty blue screen as if they were performing in a real scene. In other words, VR becomes a virtual set in a production.

In order to create a composed image that feels like the real world, the integration of virtual set and actors depends heavily on visual realism. This requires high-end computer algorithms that masterfully integrate the virtual set created by computer graphics with the actors’ images recorded by the video cameras in a studio. This integration needs to meet geometrical consistency, motion consistency, and photometry consistency in order to create optimal visual effects (Yu, 1999).

Not only are physical sets replaced by virtual sets in a virtual studio, computer graphics can also be used to design different objects to place them on the screen. This is done by using computer graphics to draw images of objects and then “keyed” in predetermined positions. Actors respond to the objects as if they actually exist, and what the audience sees is a situation where the two are collocated.
Moreover, in order to achieve maximum realism in composed images created by the virtual studio, the 3D animation technology in the industry has been developed so effectively that it promises realistic 3D space. As a result, actors performing in a studio have to be even more careful with changes in the virtual set. The technologies used to address this issue include infrared scanners, which are installed on top of the virtual studio. Infrared sensors are also installed on cameras and actors so infrared scanners can trace their relative positions, and the data of adjustments between X, Y, and Z axis are sent to the computer. The computer then integrates the data with the established virtual set. What the audience sees on TV are actors moving in a virtual 3D set or maneuvering around virtual objects.

The applications of the virtual studio described above are already quite popular in recent TV productions as well as multimedia education. For example, the production of “Studio Classroom” already utilizes a virtual studio. What is being emphasized here is that using the technology of the virtual studio in multimedia education saves on immense costs of constructing a physical set but also allows easy swapping between different sets needed in multimedia education and reinforces educational effect. Education is about passing down knowledge, and it can involve a lot of temporal and spatial changes that often require more imagination. Traditional set construction often cannot meet such demand, but virtual studios can.

**Application of Animation and Motion Capture**

Other new broadcasting technologies that can be utilized in multimedia education are animation and motion capture. The traditional animations we see on TV are continual recordings of individual images in which the motions of characters are drawn by animators. Today, however, the realistic motions of animation characters are done by recording real human motions that are then integrated with computer generated characters.

Motion capture uses 20~30 “marks” that are attached onto a real person’s joints to record his or her motions. The motions captured are then converted into data that can be processed by computers and applied on different types of computer generated characters. This technology is one of the best ways to interpret human motions in today’s computer animation.

Through this technology, computer animators can easily view the data of the images of captured human motions from different angles and choose the most appropriate movements or postures that can be applied on different cartoon characters’ personified motions. More importantly, this allows computer animators to fully express their imaginations, the motions they wish to manifest, and their ideas.

Currently, the technology of motion capture is being pervasively applied in computer games and special effects in movies, in which the presentations of virtual characters (and animals or other fictional objects) are so realistic that they can touch people’s hearts. They can also perform with real humans and deliver outstanding realism. Many companies have already constructed databases for the data of motion capture such as walking, running, dancing, fighting, martial arts’ moves, and sports. The establishment of this kind of motion capture database has enriched the effects of video productions as well as saved time, manpower, and cost in production.

Traditional presentations of multimedia education are somewhat dull since they usually consist of professors or experts sitting carefully in front of cameras giving narrations or lectures. If motion capture can be utilized effectively, the content of lectures can be presented by cute cartoon characters or imagined objects through realistic computer animations. Doing so will especially benefit educational programs for children.

Since 1993, the publishing circles in Japan began selling magazines that came with CD-ROMs. The huge sales volume has attracted the attention from different circles. Why were CD-ROMs enclosed in the magazines? This was
done mainly to complement the aspects that could not be expressed by text. Images, especially color animations, certainly better facilitate readers’ understandings. This is similar to the idea that manuals factories provide to employees or consumers can facilitate better understanding if they have images beside just text.

Additionally, the data of realistic motions stored in computers can be provided to students for free adjustments. In other words, students can input different parameters and see how motions change with different parameters. Many computer games or sports games on the market allow users to independently set the characters’ characteristics, and users can see what kind of combinations work better for a given set of rules. This function also provides users with more space for self-actualization (www.dci.org.tw).

**Future Trends of Multimedia Education**

According to the Chinese scholar Ke Kang He (2001) who compiled the essays published in many education magazines worldwide and past “ED-Media (World Conference on Educational Multimedia and Hypermedia),” the trends in the applications of today’s’ multimedia education that deserve our special attention are:

1. Integration of multimedia and Internet communication.
2. Integration of multimedia and virtual reality.
3. Integration of multimedia and AI.
4. Integration of multimedia and the learning theory of Constructivism (He, 2001).

In terms of the integration of multimedia and Internet communication, the invention of browsers has already provided students with multimedia messages of graphs, images, sound, animations, and cartoons based on the format of hypertext, and drastically enhanced the function of using multimedia educational networks to look for dynamic information. This is a great improvement compared to the first-generation Internet browser that only allows one to view static pages.

In terms of the integration of multimedia and virtual reality, because VR is an interactive, artificial world that is jointly produced by technologies of multimedia and simulations, it creates in students realistic sensations that facilitate learning. Ke Kang He also pointed out that a latest system that creates a virtual situation composed by high-quality images taken using 360 degree panorama, called “QTVR (QuickTime Virtual Reality),” allows users of Windows or Macintosh to use a mouse and a keyboard to realistically experience a VR situation. This further expands the benefits of multimedia education for students.

The integration of multimedia and AI is based on the consideration that if the system of multimedia education lacks an inference mechanism and a model of identifying students’ abilities, students cannot learn in accordance with their aptitudes. Therefore, the key in actualizing a multimedia-assisted education system is establishing a multimedia system that meets the demand of educational purposes, and enabling intelligence in the multimedia educational system. The necessary tasks include: 1. Enable multimedia education system to be able to identify students’ knowledge level, learning capabilities, and cognitive characteristics. 2. Provide different students with appropriate educational content and methods. 3. Allow students to use natural languages to conduct “man-machine conversations” with computers (this is not yet achievable as of now).

In terms of the integration of multimedia and the learning theory of Constructivism, multimedia is very popular because it facilitates in the establishment of four major factors that are deemed necessary by the learning theory of Constructivism: situation, negotiation, conversation, and sense-making??. Because multimedia is the most effective tool in designing different types of situations, the result would be even more realistic if it is integrated with simulation
technology. For example, the interactive design of multimedia computers can effectively create the mechanisms for negotiation and conversation, which lead to the “sense-making” emphasized by the learning theory of Constructivism. This means that multimedia is able to provide an interactive learning environment with a friendly interface and realistic images, and this can encourage students’ desires to actively explore and discover. With the multiple sensational excitement caused by graphics, texts, sound, and images, the anticipated learning effect can certainly be achieved.

CONCLUSIONS

Besides its capacity of gathering and exchanging information with no boundaries or its effect on provoking people’s desire and performance of learning via sound and images, the main reason that people have great expectations for new broadcasting technology being utilized in multimedia education is because it can integrate and analyze different types of information. This also enables people to easily stay on top of the latest knowledge and skills with greatly increased learning effectiveness.

All in all, in an era that focuses on “knowledge economy,” the saying “knowledge is power” further demonstrates the importance of grasping the latest information. Compared to traditional teaching methods, the new broadcasting technologies utilized in multimedia education can better help students acquire new knowledge. Therefore, multimedia education is very likely to replace or even revolutionize traditional educational models and become the main method through which people pass on knowledge in the future. Thus, the development of multimedia education certainly deserves our special attention.

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