The Role of Future Technology in Education

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Abstract

The current technology associated with modern computing has provided the instructors with many opportunities to collect, analyse, share and transfer information in a multimedia format.

There is no doubt that these features and opportunities have made contributions to education in general. However, the potential for utlising the technology more effectively for learning is far greater than electronic presentation, synchronous and asynchronous methods of communication.

This paper explores the use of innovative and technology aided teaching methods, which utilize different modes and senses for the purpose of learning enhancement. Based on the learning outcomes and preferences of a sample of internationally selected students, the paper attempts to recommend a basis for development of less language-dependent multimedia systems. The ultimate goal of more direct means of information transfer is investigated and discussed.

Keywords: multimedia, education, virtual reality, speech recognition

Introduction

Recent advances in Information Technology and its applications have certainly made an important contribution to our learning and information sharing. The Internet, in particular, has taken us to different heights in terms of information storage and communication.

If we compare the current computers with those 20/30 years ago, we would realise how much they have contributed to making life easier. For instance, we can collect data in multimedia format from various sources, analyse it and create multimedia presentations to be given to others. These presentations can be, at very low costs (or no costs to the user), sent to several people around the world. Despite all these features, one

can ask the question if the modern computing has indeed added any significant value to the traditional ways of information transfer.

We have all experienced changes of technology in education. Many of us may recall the "talk and chalk" era where the instructor copied his or her notes onto the blackboard and students copied these directly to their notepaper. The instructor used the same notes each year, in many cases one suspects the same notes he or she used as a student.

Now contrast this with a more recent innovation. The instructor projects Powerpoint slides onto a screen. The same slides he or she used the previous year, or years, or was it the same slides from his or her student days! Not likely perhaps, the slides were provided by the publishers of the textbook as an added incentive to choose that text.

But there is a dilemma. While students are transcribing from screen to paper, what should the instructor do? Talking while students are busy writing may be an irritation, as students cannot copy from two sources at once. This can also cause cognitive overload for students. Cognitive Load Theory suggests that when large amounts of information are presented at one time the learner can experience cognitive overload in working memory, as working memory has only a limited capacity. In effect the learner becomes overwhelmed with what is being presented, resulting in a loss of direction and focus (Lih-Juan, 1997). Hence, waiting while the students copy can mean long periods of silence, while the instructor ponders the value of what is happening.

Or give the students copies of the slides. But how – put them on a network so students can access them at leisure and then wonder if there is any added value in attending the lecture! Or give them out in the lecture, so that at least students have to attend to receive them! The instructor can then discuss the slides and give additional material verbally. The students can then have an activity of writing and at least receive personalised handouts which makes the instructor feel more creative!

Other impacts of technology are of course the use of the Internet, where the amount of material is so vast that the skills in searching are the prime activity. But what is the real learning experience? Searching, copying, pasting even apart from the plagiarism issue, is the learning experience. But is this all bad? – learning information is one aspect, learning how to find information is another, perhaps more enduring skill, that is almost guaranteed to outlast all other skills and also the information of the time.

As we know, over the recent years, many successful educational multimedia products have been developed and used for teaching and learning purposes at various levels. Unfortunately, it is not always clear what exactly the position of technology in education is. In other words, do the technology-aided means of learning actually enhance learning and add value to the conventional materials? How are they supposed to supersede or excel the learning effectiveness of the face-to-face (talk and chalk) methods of teaching?

This paper explores and presents some of the possibilities of the future technology in education. In particular, more natural ways and means of interaction with computers will be discussed.

Evolution of Information Transfer and Sharing

A very important achievement for human beings was the devising of the means of recording information so that it could be archived for future reference or transferred to others. Writing was a significant step in the right direction. The earliest form of writing dates back to about 8000 years ago. Symbolic and pictographic writings such as hieroglyphics were gradually replaced by alphabetic ones which were based on sounding out or pronouncing words.

The establishment of the universities can be traced back to the Middle Ages. Initially, these institutions were either ecclesiastical or had royal links. Some of the oldest universities in Europe include Oxford, Cambridge and Paris; these were established sometime in the 12th Century. Until the late 19th Century, women were not allowed to enter universities, and most of the medieval universities were developed to educate young men in law, religion and medicine.

Text-based learning was the main approach until the Second World War when the US military introduced audiovisual learning. Its main applications included the use of maps, graphs and recorded sound. When it became possible to incorporate sound and video features into computers, a new generation of audiovisual instruction was born. This was interactive multimedia-based teaching and learning.

Current Technologies and Educational Multimedia

We know that the trains of thought run in parallel in our mind. With the minds' eye, we visualise an image of an idea. This image may consist of a number of sub-images, which are linked to each other. Could we somehow, transfer the blueprint of an idea to a learner in an almost original format? If we could transfer our thoughts in a more direct manner to other sources or people without the use of intermediate conversions then a great deal of time and effort would be saved. Using new technologies, one day, we may be able to transfer large amounts of information (data), and the necessary mental and physical skills to another person directly too.

We can create the most sophisticated animations and multimedia in our thoughts as we can select different types of thought-based "audio" and "visual" effects as well as "actors". In other words, we have an unlimited amount of resources to choose from to design our thought-based multimedia system. One day, we will be able to utilise the technology to capture and store these animations and multimedia directly. Therefore, the technology will play a significant role in transferring our knowledge and ideas onto storage devices for future reference and other people's use.

At the present time, we do not have the technology for any direct interface and transfers between humans and machines. The existing computer technology is ideal for creating multimedia materials. Therefore, we should focus on feasible approaches such as effective use of visual and sound features to complement the teaching materials. Visual effects are very effective in conveying the underlying messages to the learners.

According to a recent survey, it was discovered that most (about 58%) of High School students in a particular region of Queensland, Australia have a preference for visual learning with regard to the topic of Statistics, see Figure 1. This survey was part of a formal research project funded by the Faculty of Business, in one of the Universities in Queensland in 2002. The study was conducted by surveying year-12 students of ten High Schools in and around Toowoomba in Queensland. Both public and private schools were included in the study. The sample comprised 133 randomly selected students.

This finding indicates that learning via multimedia, with interactive animations, appears to be an attractive approach in 'new times'. Although the focus of the study was on Statistics, there are likely to be many similarities and commonalities with other subjects which require data manipulation and model building.

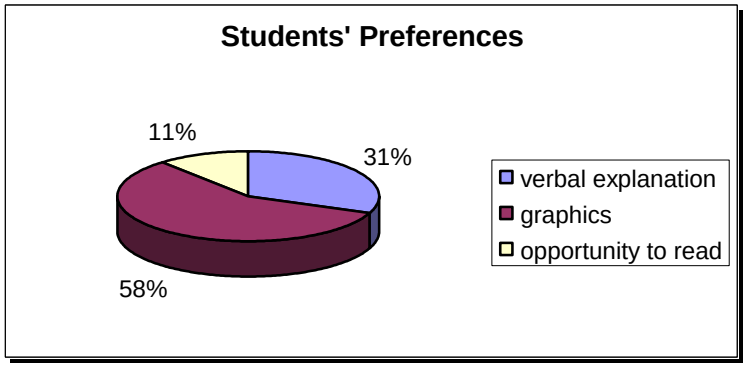

Figure 1 - Learning medium preferences of students

In another research project, a sample of 100 Business students from a University in Queensland, Australia and a University in Texas, USA were chosen to participate in a survey. The objective was to identify the learning effectiveness of a multimedia system called WEMLE on these users and determine the learners' learning style preferences. Web Enhanced Multimedia Learning Environment (WEMLE) has been developed by the author and his colleagues at one of the Universities in Queensland, – Australia, see http://www.usq.edu.au/course/material/MGT2102/). WEMLE utilises visual features in demonstrating and showing concepts and techniques of Project Management. The surveyed students were given the opportunity to use the system on their own and then complete the online survey questionnaire.

A very large proportion (88%) of the students who used the system indicated a favourable experience with the multimedia way of learning.

As an extension of the same project, 34 students at a Mexican in Mexico City, with very similar characteristics as the Australian and American (English-speaking background) students were also given the same opportunities to evaluate WEMLE for Project Management. According to the survey results, a vast majority (97%) of these students believed that visual features play a very important role in understanding the concepts. Although the native language of all of these students is Spanish, 41% of them have indicated a preference for having the multimedia materials in English rather than Spanish. These findings indicate that the use of visual effects would certainly assist with internationalisation of the language of education, see Figure 2.

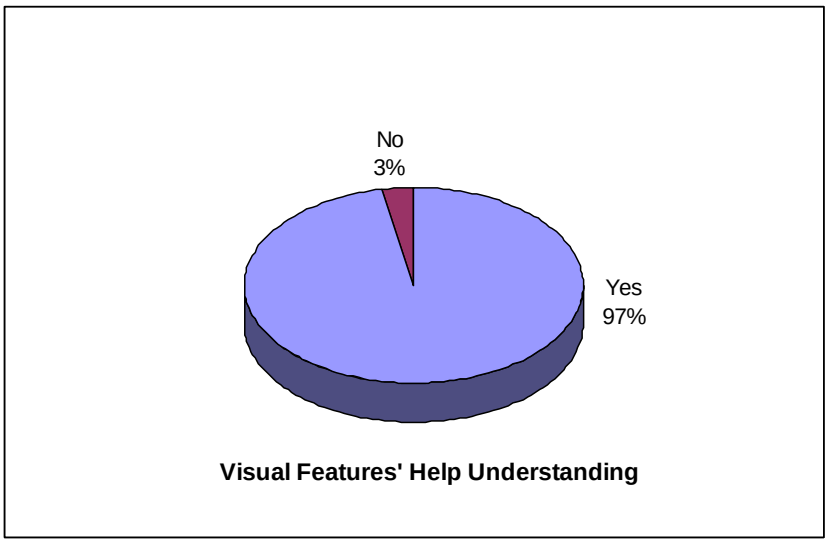

Figure 2 – The visual features' role with understanding the Project management

Hence, by incorporating appropriate visual features, educational multimedia materials can be developed in a generic language like English, and be available to students whose native tongue is another language. Although this is not quite like a direct transfer of ideas to others, it is a step in the right direction. Now, let us consider how the future technologies can create more direct means of knowledge transfer.

Future Possibilities and Conclusions

The technology is changing and new ideas are being introduced all the time. For instance, speech recognition will probably make a significant contribution in transforming the means of interaction with computers. It might have sounded far-fetched or a technological prediction if a few years ago, we had claimed that one-day we would be able to convert our language or dialect to any language or dialect via a machine. This is a reality now! *Ectaco* (2001) has developed a very compact machine (*Universal Translator*), which can understand spoken words in English and convert them to French, German or Spanish with perfect accents. Although the Speech Recognition technology has not progressed to achieve 100% accuracy in deciphering every word or phrase, it is intelligent enough not to be too fussy about the speaker's accent. Again, in addition to its valuable use in travelling, Universal Translator can be a good means of learning phrases.

Maybe, one day everyone can choose to talk to each other in their "mother tongue" without too much effort.

Other technologies such as virtual reality will allow the learners to be a part of the learning materials and play important role in the future multimedia systems. For instance, virtual reality has been utilized in practical areas such as 3-D modeling of human genes, physics experiments, surgical procedures and tours of terrestrial and celestial landscapes. For details see:

http://www.easypano.com/p_Virtual_Reality_software.html; and
http://www.iei.uiuc.edu/class.pages/rw2g/virtual.html .

The future technologies will enable us to interact with computers in a less formal manner. In other words, we will not have to sit in front of a computer, switch it on and then start typing and mouse-clicking. The main computer will be able to receive commands and requests remotely and produce output to various locations around us. The output will be in the form of holographic images and sound. The speech will be controlled by the user. Hence, the user can choose any language for input or output. The user will be able to interact with the output in a natural manner by touching, separating, lifting and moving parts. Hence, a true virtual reality situation will be created.

Future information technology products may also facilitate capturing, digitising, storing and transferring human thoughts as an independent medium directly to other sources. Imagine the ability of directly transferring an animation of a concept to a learner in a 'thought file'. After all, the language of thought is probably universal and is not based on a particular type of language. In a strictly natural way, we do not have to pronounce words in our thoughts to describe ideas. Our ideas can be "seen" in our thoughts. Perhaps these images are like Plato's Forms (*Plato's Republic*) or Aristotles' Essences (*De-Anima*).

In this way, most of the language-dependent barriers will be removed and we will achieve that ultimate level of internationalised information transfer and sharing.

Testing the Propositions and Recommendations for Future Research

In order to test the above prepositions, a comparative study involving two groups (say, A and B) of learners can be carried out. Both A and B groups members will be tested for the learning effectiveness and outcome. The topic and its content will be identical, but they will learn via different methods and facilities. Group A will be taught using conventional methods and the multimedia offered by the existing technology. Group B will be exposed to a richer multimedia environment provided by Virtual Reality (VR). In other words an almost real (virtual) presentation of the real objects will be presented to group B learners. Hence, the group B learners will be able to interact both mentally and physically with the learning materials.

We may choose a number of different topics for this study. As an example to demonstrate the concept, let us select learning a foreign language. Group A members

will have text and images provided in print and computer multimedia for this group. The auditory mode will also be available in the case of computer aided multimedia. So, group A learners will be able to learn a foreign word or phrase by seeing how it is written, how it sound sounds and what object or situation it refers to. For instance, if they wish to learn how to say "Where is the taxi station please" in Spanish, they can read the phrase and listen to its recording. Obviously they can repeat the phrase too if they wish. There is no doubt that this way of learning is far more effective than the old-fashioned text only approach. The research findings as presented earlier have shown preference for this kind (multimedia way) of learning.

Let us investigate how we can measure the effectiveness of the VR multimedia approach. The learners will be provided with VR goggles, gloves and shoes. The gloves and shoes can be in the form of micro-sensors placed in appropriate body parts for input/output and interaction purposes. After wearing and attaching the goggles and the sensors, the members of our VR multimedia group (B) will visualise, feel and hear themselves in front of the *Plaza de toros* in Madrid. They can physically (in a virtual manner) approach a virtual local and virtually ask by moving their hands and arms and their usual facial expression (smile, worried and desperate) *Dónde está la Stacion de taxis por favour?* The local pedestrian will smile back in recognition and encourage a foreigner trying to speak their language and point to the right corner. This scenario can be extended into a see, hear, touch and walk adventure too. Imagine entering a virtual shop and virtually touching and picking an object and asking *Cuánto cuesta* (How much)?

It is noteworthy to mention that the technology involved and required for the VR educational multimedia approach as described above is not an impossibility in an almost near-future. Although it is not possible to set up the above-mentioned experiment right now, it is reasonable to predict superior results as several senses will be utilised. We know that for thousands of years, human beings have acquired and processed information using a number of different senses. Hence, the use of different senses for information collection, analysis and remembering is something, which our brain can relate to very well.

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