A Multi-sense Approach to Information Reception and Knowledge Creation in Learning

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ABSTRACT

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.

The process of converting the information into knowledge, referencing and utilizing it, is carried out within the personal mind-based multimedia system of the human brain. The human mind can create the most sophisticated animations and multimedia as it can select different types of thought-based "audio" and "visual" effects as well as "actors". In other words, the human mind has access to an unlimited amount of resources for designing the thought-based multimedia systems. Unfortunately, we are not able to transfer the information and knowledge in our mind directly to other people and sources. This may become possible in the future.

This paper explores the use of innovative and technology aided teaching methods, which utilize different modes and senses for the purpose of learning enhancement. Finally, it compares the learning outcomes and preferences of a sample of internationally selected students using a multimedia system, which attempts to cross the communication barriers in learning.

Keywords: multi-sense, multimedia, learning style preferences, learning by association

INTRODUCTION

We know that the trains of thought run in parallel in our mind. With the mind's eye we visualise an image of an idea. This image may consist of a number of

sub-images, which are linked to each other. If we could somehow, transfer these images to another person in their original format then a great deal of time and effort would be saved. Unfortunately we cannot transfer our thoughts directly to other sources or people without the use of intermediate conversions.   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.

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.

At the present time, we do not have the technology for any direct interface and transfers of ideas between humans and machines and we rely very heavily on the use of text for information transfer and storage. One day, it will be possible to create the most sophisticated animations and multimedia in our thought; and then utilise the technology to capture and store them 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.

The use of different senses for information collection, analysis and remembering is something which our brain can relate to very well. It should be emphasised that images and sounds do not always have to be actual; they can also be virtual. Virtual images and sounds can be "seen" and "heard" in our mind. Perhaps the virtual-visual feature of our mind is the most active part in creating thoughts. When Aristotle said that without images thinking is not possible, he was probably referring to virtual images created in the human mind. We can, with the mind's eye, visualise images of ideas.

The use of the early graphical-based writing is also a demonstration of the early human beings close association with images for information transfer and recording purposes.   The use of images and symbols in this fashion led to development of hieroglyphics.

The symbolic writing gradually evolved into the alphabetic representation of the various phonemes used in the language and for centuries language (spoken and written words) has been the most popular method of communication. It has been demonstrated by many writers and poets over the centuries that text (language) based information can also create and paint the most vivid images of events, actions and situations in our mid.

MULTIMEDIA AND EDUCATION

There is no doubt that a dedicated, skilled and knowledgeable teacher who uses speech, drawings, text, and possesses patience and willingness to repeat and interact with students is perhaps the ideal learning facilitator. This form of learning is probably the most effective type of "multimedia" learning too. It is rather hard to beat this kind of face-to-face learning. In addition to having visual, aural, text and other types of learning style preferences, in a face-to-face situation we can even utilise body language to reinforce the styles. Looking at the audience (learners) and reading their facial expressions to assess whether they fully understand is only possible in a traditional way of teaching.

So, if we can use the study/lecture notes and teach a subject in a face-to-face manner, then why do we need to simulate that process by creating computer based multimedia? The purpose is to simulate (not necessarily emulate) the classroom environment and make it available for those who are unable to attend lectures and tutorials (any face-to-face session) due to distance or enrolment mode. They can then have the opportunity of re-creating the classroom situation to suit their preferences.

Multimedia presentation of teaching materials can provide additional assistance for the learners in terms of creating the necessary images and sounds during their learning. It will also enable them to have more control in the learning process.

A less language-dependent approach in teaching/learning materials may allow us to cross the language barriers and make a significant contribution towards internationalisation of learning. For instance, we may compromise and encourage the use of more non-text based materials in the form of concept maps and animations.

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. 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. The medium of body language however is probably less likely to be a part of any near-future computer based multimedia system. Who knows, in a not too distant future, we may be able to achieve that too.

Designing Effective Computer-based Multimedia

Based on a survey conducted on high school students in the Darling Downs region of Queensland, Australia (Nooriafshar, 2003) it was confirmed that a significant proportion of the students had a preference for visuals (graphics, images and diagrams), see Figure 1 below.
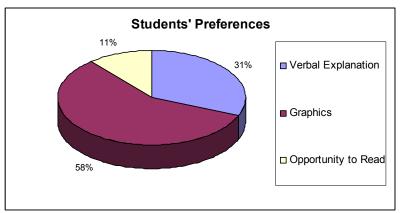
Students' Preferences

- Verbal Explanation — 31%
- Graphics — 58%
- Opportunity to Read — 11%

Figure 1 – High School Students' learning style preferences

In addition to catering for different learning style preferences such as visual, aural and text, teaching materials, regardless of the medium or mode, should also be based on established learning concepts and principles. For instance, encouraging the learner to build on what they already know is an effective teaching approach. This may be carried out by providing the learner with a reference point or base and then guide them to expand their knowledge. The analogy would be similar to giving the student the skeleton and then helping them to put the flesh on it.

A very interesting approach has been put forward by the well-known language teacher Michel Thomas. He adopts a less formal but very effective approach, which places an emphasis on understanding rather than memorizing. With this method, the learners do not need to take any notes, read from a book or even do any homework. Michel Thomas encourages the learners to construct their own learning material based on what they already know, see Thomas (2000). The same or similar approach may be applied to a variety of discipline areas.

Learning by association is another effective teaching and learning method. As suggested by Gruneberg (1994), the Learning by Association approach has been in existence since the ancient times. The ancient Greeks regarded this method an efficient way of learning and remembering. Concepts and information can be

linked to images or other easily remembered situations. These prompters are just memory handles which help the learner to remember and recall. These features should, when appropriate, be incorporated into an educational multimedia material.

When designing multimedia materials, we should also consider the fact that different senses invoke different parts of the brain. For example, the right-brain is the creative part and the left-brain is more sequential. So, balancing the process of information reception using different senses will allow us to use the full set of brain. Although we may lable ourselves as having a preference for either text, visual or aural, we use all of them. Text based information may not appear to represent images and sounds, but it can create the most vivid visuals in our mind. After all, writing originates from the mind-based images, sounds and actions. This has been demonstrated by writers and poets for centuries. As mentioned earlier the text-based information should be able to create the most effective and sophisticated virtual multimedia in our mind.

Therefore we do not have to convert every piece of information into real multimedia (images and sounds). Firstly, we have to pay attention to cognitive loading. As suggested by Lih-Juan (1997) the use of more than two modes can cause cognitive loading in the learners. 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).

Web Enhanced Multimedia Learning Environment (WEMLE) for Project Management is based on the simulation of the way project management is taught within an undergraduate course at the University of Southern Queensland (USQ). It incorporates established educational concepts and the latest in web-based multimedia design. WEMLE has been developed by the author and his colleagues at the University of Southern Queensland (USQ – Australia), see http://www.usq.edu.au/course/material/MGT2102/

In order to avoid or at least minimise cognitive overload, teaching materials are presented in a sequential and step-by-step manner in WEMLE. WEMLE achieves this by firstly, scaffolding the learning and secondly, by giving more control of the presentation to the learner. By breaking down a presentation into a number of learner controlled, stepwise segments, rather than being one continuous presentation, learners can understand a larger number of different

concepts (Schnotz, 2002). An appropriate analogy would be the way Dynamic Programming approaches solving reasonably complex problems by breaking them down to a number of sub-problems, solving these smaller problems and then finally putting the sub-solutions together to produce the main solution, see Nooriafshar (2002). However it should be re-emphasised that a multimedia presentation containing too many imbedded controls, also discussed above, might limit the effectiveness and efficiency of the learning event, actively retarding assimilation (Lai, 2001). The next section presents the findings of how WEMLE was used as an instrument to determine students' preferences for learning in a multi-sense manner.

TESTING A MULTI-SENSE LEARNING METHOD FOR USERS' LEARNING OUTCOMES

A sample of 100 Business students from the University of Southern Queensland (USQ - Australia) and the University of Texas in Arlington (UTA - USA) were chosen to participate in the survey. The objective was to identify the learning effectiveness of the same system (WEMLE) on these users (learners) and determine the learners' learning style preferences. These students were given the opportunity to use the system on their own and then complete the online survey questionnaire.

A very large proportion of the students who used the system indicated a favourable experience with the multimedia way of learning. See Figure 2.
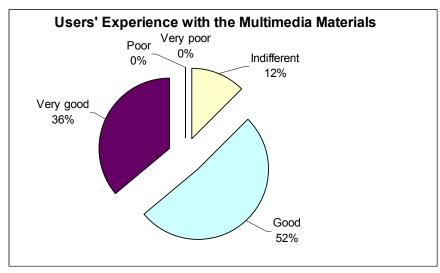

Figure 2 – Users' Experience with the multimedia teaching materials

When the data was further analysed it was found out that the preference for learning by using different senses was certainly high amongst the users.

Figure 3 illustrates the students' learning modal preference with regard to the WEMLE multimedia system. Visual features and interaction with the system appear to be most popular amongst the users. Almost every user who favoured the system's interactive tools suggested that ease of understanding was the reason. A very high level of preference for all types of modes clearly indicates that there is a desire for using a number of senses in educational multimedia. It should be mentioned that giving choices for enabling/disabling media features to users is important. In addition to minimizing the cognitive loading problem, the ability to choose gives the student a feeling of being in control.
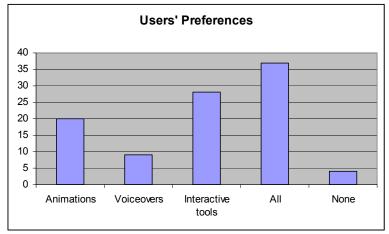
Figure 3 – Users' learning style preference

Figure 4 indicates that students found the multimedia materials less time-consuming compared with the text-based materials. As shown in Figure 5, the majority (over 80%) of students have reported either very positive or positive influence on their understanding by the multimedia materials.
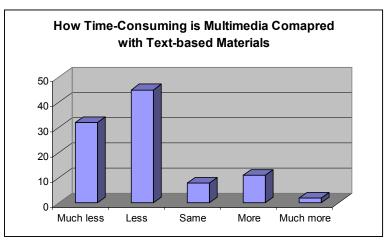
Figure 4 – Comparison of the time spent on multimedia with the text-based materials
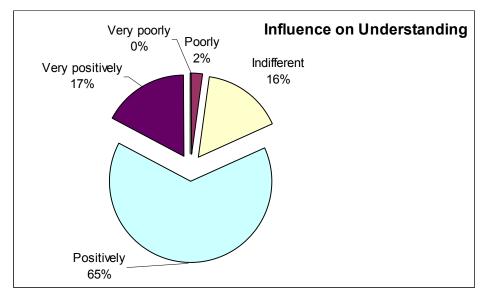

Figure 5 – The way that multimedia influenced the users' understanding

It is noteworthy to mention that closer analysis has indicated that around 82% of the students who regarded the multimedia way of learning highly effective (ranking of 10 on a 1-to-10 score) had indicated that they had a great deal of experience with computers and the Internet related technologies. About 73% of the same students have also indicated their very high level of enjoyment in using multimedia materials. This finding would probably suggest that a belief and active interest in the technologies associated with modern computing are certainly contributory factors in successful use of the multimedia educational products. As was mentioned earlier, human beings' preference for knowledge acquisition and processing has its roots very deeply established in the use of a number of senses. Therefore, computer based multimedia products can play a

very important role in providing the additional assistance for achieving the multi-sense approach to learning.

CONCLUSIONS

The use of multimedia for learning was found to be a very effective method according to the students who participated in the study. The majority of the students who regarded multimedia an effective method of learning also had a very active interest in the use of computers and the Internet related technologies. The study found that students, who enjoy using computers and related technologies, also enjoy and benefit from a multimedia learning environment.

This demonstrates that a background and an exposure to modern technologies would certainly help students in the use of educational multimedia products. It is reasonable to predict that this will not be a problem or an issue in a few years time as the latest generations of students have been growing up with computers and computer technology related products around them.

It can be concluded that the majority of the learners represented by the samples of this study (selected from the Australian and American universities) have a preference for utilising a number of different senses for knowledge acquisition (visual, aural and text). This finding is compatible with the human beings' well established desire and preference for information collection, processing and storage using several senses.

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