

Educational multimedia

S. Dervan¹, C. McCosker¹, B. MacDaniel, and C O’Nuallain

¹ Digital Enterprise Research Institute, National University of Ireland, Galway, IDA Business Park, Lower Dangan, Galway, Ireland.

“Tell me and I forget. Show me and I remember. Involve me and I understand.” This ancient proverb epitomises the concept on which multimedia education is founded i.e. learning is enhanced by stimulating multiple senses simultaneously. Research has revealed that humans have widely varying learning styles which are not catered for by conventional instruction [1]. As well as providing an effective form of training, using multimedia technology in education has many other benefits; learning is self-paced, information is easier to access, independent discovery-oriented learning is encouraged and learning becomes more engaging. In this paper we discuss the prototype eLearning system we developed based on several key principles of modern learning theory. The interactive music education programme we created was designed for 9-12 year olds and its content conformed to the Irish primary school music curriculum.

Keywords multimedia; learning theory; multiple intelligences; multimodal interaction

1. Introduction

Our current education system dates back to the Industrial Revolution. During this time the system was designed to meet the demands of a mass production economy, producing students that were trained by rote to ultimately work in a production line. However as the economy changed, the education system was not flexible enough to change to meet these new demands for highly trained, motivated, confident students. The education system today is still deeply rooted in its origins and has not changed with the latest research into learning techniques. Modern learning theory such as Accelerated Learning is guided by more than a decade of psychological research on the inner workings of the human brain [1]. We have learned that humans have several forms of intelligence instead of a single static IQ and individual learning styles are largely dependent on this diversity. A learner’s dominant sensory system, i.e. visual, auditory or kinaesthetic, also plays a major role in determining their natural learning style. If the teaching style employed closely matches this preferred style, learning becomes more natural and thereby easier so consequently results improve and learning time is reduced [1]. Multimedia technologies can be used to forge stimulating, interactive learning environments and are essential in the creation of eLearning systems which support multiple learning styles as they present a wide range of graphical, textual and aural sources. Studies focused on the effectiveness of this type of education have proven that multimedia learning resources can enhance motivation, attention, comprehension and recall. In this paper we outline the shortcomings of the education system, reveal new learning techniques and propose eLearning as a viable solution to an underfunded and under resourced education system that still teaches students using outdated techniques. We present a practical example of an eLearning program, InterNote, that incorporated practical, interactive learning along with the latest research into new learning techniques.

2. Modern learning theory

Despite society’s awareness of the importance of education there has been less progress made in this vital area than in any other area of human endeavour for the last two millennia. Secondary education in particular still employs concentration, repetition and learning by rote as its principal educational tools and higher education remains dependent on the archaic toolset of lectures, laboratories, papers and exams [3]. A major failing of today’s educational system is its preoccupation with “what to learn” and ignorance of the more pertinent issue of “how to learn”. In the last decade psychologists have been investigat-

ing how the brain really works and have discovered effective techniques through which facts can be rapidly and deeply fixed in memory. Powerful encoding and visualisation techniques have shown to enable the creation lasting memory and improve recall. Dual encoding, for example, has proven to be an extremely effective learning tool; the simplest and most common form of which involves presenting the information both textually and visually.

Conventional teaching only involves the left side of the brain whereas we now know that “whole brain” learning is a far more effective way to learn. The better connected the two halves of the brain, the greater the potential of the brain for learning and creativity. Sperry¹ et al. conducted research which proved that when people develop a particular mental skill, it produces a positive improvement in all areas of mental activity, including those that lie dormant [1]. This disproves common misconceptions such as the popular belief that painters and musicians (right brain people) must inevitably be poor at mathematics. Leonardo da Vinci is probably the best example in history of the genius that can be liberated when left and right brain activities are fully combined. He was the most accomplished artist, mathematician, inventor, engineer and scientist of his day in at least half a dozen different fields, and he could write simultaneously with his left and right hand.

2.1 Accelerated Learning

"Accelerated Learning" is an umbrella term which encompasses many different techniques, methodologies and approaches to teaching and learning. These techniques are designed to stimulate the human senses, engage the learner and cater for varying learning styles. Research has shown that rhythm and rhyme are powerful mnemonics and can be used to great effect as learning tools when presenting information. Where possible, music is incorporated as it stabilises mental, physical and emotional rhythms to attain a state of deep concentration and focus in which large amounts of content information can be processed and learned [7]. Music is also used to create powerful emotional associations with the material which improves encoding. Marketers and advertisers have been aware of and utilising emotive techniques for a long time. This is why it is so easy to remember advertisements, pop songs or jingles but arduous to remember a list of historic dates. Information is better remembered when it is presented in a way that either focuses increased attention, or is arousing to one or more senses or emotions [1].

Stress and fear are the greatest enemies of learning as they reduce much needed energy and cause distraction from the task at hand. Accelerated Learning teaches the student how to achieve a pleasantly relaxed, yet receptive state of mind and utilises music to promote relaxation. Baroque music in particular is effective as it has very specific beats and patterns that automatically relax and synchronize our minds and our bodies. The learner themselves puts in no more conscious effort than normal during the lesson because they are more relaxed. Proponents of the method claim that Accelerated Learning enables anyone to learn anything more quickly and easily, enhances thinking skills and even increases IQ [1, 2, 8].

2.2 Multiple intelligences and learning styles

Modern educational theories such as Accelerated Learning take into consideration that humans process and gather information differently. Theorists now believe we have several different variable forms of intelligence, mathematical/logical, linguistic, intra-personal or reflective visual/spatial, musical, body/physical, interpersonal, and naturalistic, each of which provides a potential pathway to learning. The challenge that educators face is how to deliver learning materials to people with varying modes of learning i.e. intelligences. In most academic subjects linguistic and mathematical intelligence are largely emphasised by the media through which we learn, i.e. lectures and logically formatted books and courses. Since these two intelligences form the basis for IQ tests, these tests are only good predictors of school success because that is the way children are taught [1, 2].

Using teaching techniques that match the individuals preferred learning style makes learning a more natural experience. If learning becomes natural, then it becomes easier, faster, fun and more successful.

¹ Nobel Prize winning psychobiologist who demonstrated that the left and right brain hemispheres are specialized in different tasks

Educational Researcher Bernice McCarthy identified four distinct types of learner in her book "*The 4-Mat System*" [4];

1. The "Innovative" learner who is imaginative and relates new information to her or his own experiences.
2. The "Common Sense" learner who wants realistic examples relevant to real life.
3. The "Dynamic" learner who wants to learn by actual involvement and specific experiences.
4. The "Analytical" learner who wants to see the principles and concepts behind the subject.

The first three learner types are all natural right brain learners who will prefer a visual and kinesthetic approach. The only natural left brain learners are the analytical learners, who find it comfortable to be verbal and logical and have an auditory presentation of information. And yet our education system is focused solely on this minority of left brain learners and most teachers instruct for left brain assimilation. No wonder conventional learning incubates so much stress and anxiety. One of the driving concepts behind the Accelerated Learning technique is that when the way you are taught closely matches your style of learning, results improve significantly and learning time is greatly reduced [2, 8].

3. Technology in education

E-learning has changed and improved drastically since its humble beginnings as computer-based training using standalone videodisc/CD-ROM training courses but as yet has still not realised its potential as an educational innovation. In the beginning this slow uptake could be blamed on the technological restrictions of the time. Initially courseware was custom built utilizing cutting edge technology and innovative ideas but the resulting courses were very expensive, dreadfully slow, labour intensive to develop and monolithic [5]. Now however the available technologies are much more sophisticated; bandwidth expands continually and the exponential growth in the speed and capacity of computers and peripheral devices is unrelenting. In addition to the improved capabilities, the technologies required for the delivery of eLearning content are now attainable for the average user, e.g. PC, mobile devices, internet connection. The introduction of network and web based learning management systems near the end of the millennium radically changed the face of e-learning. Unlike their predecessors these systems had administrative and data reporting capabilities and were also the first to introduce the concept of online collaboration between learners and instructors. Since their inception LMS have provided the technological platform and data-management backbone of most other eLearning systems [5].

Although eLearning provides a good solution to the problem of introducing new learning and teaching techniques to an under-funded education system, it requires both the knowledge of a proficient developer to create a program that satisfies some basic usability tests, and a sound pedagogical base. Our research showed us that many eLearning packages did not incorporate up to date learning techniques into their programs nor followed any school curriculum. Few showed any innovation and simply rehashed the same worn-out ideas. For example the vast majority of programmes we reviewed used animal themes. Some companies even released sub-standard eLearning programs with poor usability designs that even failed to get the educational content across. The release of such programs reduced teachers' faith in eLearning programs, resulting in the creation of an accredited list of eLearning programs in Ireland to help choose quality programs. The creation of this list shows a commitment to introducing standards to the eLearning sector and facilitating the integration of quality eLearning programs into the education system. If eLearning is to be integrated into the education system it must meet certain baseline standards.

3.1 Multimedia technology

Multimedia technology serves as one of the primary advantages e-learning has over traditional classroom based learning and has already been applied successfully in various computerised learning environments from child education games to corporate training exercises. Multimedia instruction uses mo-

tion, voice and music, text, graphics, video and still images, to enhance learning by stimulating multiple sensory organs simultaneously. When combined, these tools enable the elegant explanation and enhanced comprehension of learning objects. Studies focused on the effectiveness of multimedia education have proven that multi-medial learning resources are often more effective than text-only resources, particularly when the learner is introduced to completely new material. When utilised properly in conjunction with text-based information, images have been proven to enhance motivation, attention, comprehension and recall. Studies have concurred that people retain only 20% of what they see but they remember as much as 80% of what they see, hear, and do simultaneously [6].

Multimedia technologies offer high-tech support for a range of visual, textual and aural sources, which complement the Accelerated Learning method. Using a variety of media to present information caters for more learning styles. Sight, sound, interaction and having fun during learning will help your brain retain more information and we know that games create a positive psychological impact. This is why games are becoming more and more popular in educational settings. Multimedia technology can maximise the potential of the learner's intelligences and improve their quality of learning, e.g. hands-on interactivity enhances the kinaesthetic intelligence; logical/mathematical intelligences can be maximized through problem-solving. No matter what one's intelligence multimedia presentations trigger visualization strategies such as mental imagery, which is crucial to many kinds of problem solving and improves retention.

4. The InterNote program

The InterNote program we developed in 2006 was designed as an interactive educational software prototype for children, which would help develop their music literacy skills in a fun and engaging environment. The prototype program contained four separate sections each containing an interactive tutorial and a game based on a particular topic. All topics were chosen from the Irish primary school music curriculum for our target age group. Designed to cater for different learning styles, the program was equipped with a virtual learning tutor which helps the student through the program. The student could also physically interact with the program using the mouse, keyboard or MIDI keyboard. The MIDI keyboard was an important part of this program, allowing the student to practice their keyboard skills, a necessary requirement of the music curriculum.

4.1. Program Structure

The program was designed with a flexible dual structure so the learner could follow a predefined sequence or adopt discovery-based approach. In selection mode the child can choose to enter any of the tutorials or games on a topic they want to learn about. Story mode is designed with incremental stages so games act as reinforcement for the topic the child learned about in the previous tutorial. These two modes appeal both to the logical, structured learner and the more creative, inquisitive learner.

The tutorials and games were designed to comply with Accelerated Learning principles, the use of voiceovers, animation, music and interaction all appeal to the senses and involve the student in learning. Tutorials consisted of slide by slide information along with clickable items and animated text and images. After the tutorial was completed the student was given a small game as a reward which also tested their knowledge of previous tutorial, thus reinforcing the content. We randomised game answers to ensure the child understood the material and not learning the answers by rote. As previous discussed playing games creates a positive psychological impact while still getting the information across; this type of learning environment ensures you are more relaxed and engaged while learning.

4.2 Program Implementation & Testing

A review of competitor programmes enabled us to learn from their mistakes. We fully researched teaching techniques, met with teachers and music teachers, used content which supported or supplemented Irish music curriculum, and carried out surveys in schools to determine the current usage of ICT in Irish

primary schools. The survey revealed that there was large demand for this type of programme and that the required technological infrastructure was already in place. Multiple authoring environments including Flash, Director and SWiSH were used to develop InterNote which allowed us to create a fully interactive, enjoyable program. Director extended the programs usability by allowing us to communicate with the MIDI keyboard and PC devices using its Xtra's capability. This level of interaction and involvement was only achievable through the use of these powerful multimedia tools which allowed us to present students with different ways of viewing a subject.

The InterNote program was also tested on our target group of primary school children (9 – 12 year olds) and the observed results were intriguing. Children with absolutely no experience with sheet music, they were able to understand the beat values and the notation at the end of the half-hour trial. To our surprise the school did not have music classes and the children were not taught the relatively difficult task of understanding sheet music, therefore the only education they received was through the program, which held their attention and got the educational content across.

5. Conclusions

It has become apparent that our system of education is in need of an overhaul. Modern teaching techniques have proven demonstrable advantages over the current archaic methods. However, implementing these techniques in our existing education system would be both costly and time consuming. The most efficient way to introduce these new learning techniques is through eLearning. This is the ideal tool with which teachers can reach students of all learning styles. Through the research conducted during the development of our prototype system we learned that the technological requirements for such systems are already in place in most Irish schools and homes. A collaborative effort involving both the IT and education sectors is required to smooth the transition. Educators need to be involved in the production of eLearning tools and content and the systems designers and developers must be more aware of and sensitive to the end-users needs. In the past e-learning solutions were developed with almost a complete disregard for the quality of the end-users learning experience which is one of the reasons for so many past failures. Future eLearning facilities must be adaptive to the specific learner's requirements rather than operating as mere content repositories. This type of technology has the potential to leapfrog our education system from the industrial revolution to the 21st century. In the creation of the InterNote prototype we concluded that creating an eLearning program that incorporates effective learning techniques and still adheres to the curriculum is possible and can be done for an acceptably low cost.

ACKNOWLEDGEMENT: This material is based upon works supported by Enterprise Ireland under Grant No. *ILP/05/203*

References

- [1] C. Rose, *Accelerated Learning*, Bantam Dell Publishing Group, New York (1998).
- [2] *What is Accelerated Learning*. Accelerated Learning Systems Limited. Retrieved September 20th, 2006. <http://www.acceleratedlearning.com/>
- [3] K. Egitim, *Accelerated Learning*, (2005) Retrieved October 2nd, 2006. <http://www.kirmizidanismanlik.com.tr>
- [4] B. McCarthy, *The 4-Mat System: Teaching to Learning Styles Through Right/Left Mode Techniques*. EXCEL, Incorporated, Barrington, Illinois, (1987).
- [5] Cross, J. And Hamilton, I., 2002. Beyond eLearning. *State of the eLearning Industry*. California, USA. pp. 1-21
- [6] *Enhancing Multiple Intelligences Through Multimedia*. Retrieved August 2006 from the "Encyclopedia of Educational Technology". <http://coe.sdsu.edu/eet/Articles/mimultimedia/index.htm>
- [7] C. Brewer, *Music and Learning: Sever ways to use music in the classroom*, Zephyr Press, Tucson, AZ (1995).
- [8] Retrieved August 2006 from the "Accelerated Learning Institute". <http://www.accelerated-learning.com/>