Impact of Interactive Learning on Knowledge Retention

Mohamed Ibrahim and Osama Al-Shara

ADWC, Higher Colleges of Technology
PO Box 41012, Abu Dhabi, UAE
Mohamed.ibrahim@hct.ac.ae,
Osama.Alshara@hct.ac.ae

Abstract. There is amble evidence that supports true interactivity, both in the interface and in the presentation methodology, will further enhance learning and knowledge retention among students. The real challenge is how to implement it, measure and evaluate this outcome. This paper presents findings that look into the efficacy of the combination of virtual environments and interactive teaching techniques in enhancing learning and increasing the knowledge retention level of students.It is now widely accepted that the conventional way of lecturing students has certain limitations. E-learning and the use of ICT, interactive tools in the education field has proven to be effective in assisting the teaching and learning experience. It has been observed that the one way communication method of lecturing with limited or no opportunity for feedback from students and audiences in general has a major impact on their attention span and the retention level. There are issues related to the establishment and implementation of interactive learning tools as an aid for teaching and especially in continuous evaluation of students' achievements. We point out that it is not only the 'teaching' tasks that are impacted by the use of ICT but also current methods of evaluation including written examinations which have proven to be time consuming and inaccurate reflection of students' achievements. The introduction of interactive learning and evaluation has several advantages and this paper will give a convincing support to the fact that the advantages are more than the fact that it makes *the teaching and evaluation process easy, simple and rapid.* Educators should not fail to adapt and respond to the needs of 21st century bust and multi-tasking students for innovative learning methods, i.e. interactive learning. The role of education institutions and educators in the future will become demand–driven; to satisfy technically sophisticated student clients. The paper recommends that we should not ignore the use of interactive technology used as it should be, as a tool, to enhance sound pedagogical methods, however, we should also be able to measure its contribution in enhancing teaching and learning. It is pertinent to synthesize a framework that encompasses ways to compliment existing methods of teaching with interactive learning.

Keywords: interactivity, simulation, elearning, pedagogy.

1 Introduction

Teaching and learning in the post e-learning era has become more interesting and challenging. Educators are continuously challenged to deliver new and innovative ways to educate, and deliver higher quality content to achieve better outcomes. Keeping students motivated and interested in learning is a tremendous challenge for educators particularly when there are so many alternative methods to teach and learn. The digital era introduced an effective means to communicate, teach, and provide learning opportunities to all. Educators and students are at the forefront of this challenge, always looking for innovative ways to ensure deeper learning and greater retention of knowledge, and with ever shrinking budgets, at a lower cost.

There is an ongoing debate on the effects of ICT based teaching, i.e. e-learning on students' achievement. This paper looks into this issue focusing on knowledge retention and whether the students in the e-learning environment in general were as successful academically as students in more traditional classroom settings. The finding presented in the paper are based on the authors' experience in using innovative teaching methods i.e. Learning by Doing (LBD)[1] environment on the internet as a means of communication with students and utilising interactive learning tools. We observed that the students learn more and knowledge in greater if ICT based learning tools enable more interactivity rather than moving paper based content into an electronic format.

This paper takes an introductory look at interactive learning within the context of e-learning and how the digital technology can make an immediate impact on improving learning initiatives. It is intended for learning and technology decision makers and begins by describing the theory behind this new method of teaching and learning in section two, there is an ongoing debate on the effects of ICT based teaching, i.e. e-learning on students' achievement. This paper looks into this issue focusing on knowledge retention and whether the students in the e-learning environment in general were as successful academically as students in more traditional classroom settings. The finding presented in the paper are based on the authors' experience in using innovative teaching methods i.e. Learning by Doing (LBD) environment on the internet as a means of communication with students and utilising interactive learning tools. We observed that the students learn more and knowledge in greater if ICT based learning tools enable more interactivity rather than moving paper based content into an electronic format.

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[1] **Learning by Doing Environment (LBD) on the internet:** The LBD environment and the program design afforded a new paradigm for a successful online synchronous, real-time distance learning experience, conducive to the practice of identified skills and lasting knowledge a synchronous, online e-classroom available over the Internet and designed specifically for the experiential "learning-by-doing" pedagogy—uses a real-time, interactive HTML formatted text, image, and animation messaging system. The e-classroom, consisting of a main room and four breakout rooms for small e-group experiential e-activities and e-discussions, was password protected, monitored, and archived. Most students logged into the e-classroom from their homes. Text and image based lecture materials were posted to the e-classroom in real-time, and the "learning-by-doing" e-group activities offered, in this medium, facilitated learning through practice and discussions (Lobel, et al., 2002).

2   Theoretical Underpinnings

There is currently extensive literature on technologically delivered, mediated, monitored and valuated education systems. This overwhelming evidence supports this paper's proposition. More than a decade ago, over 30 studies have found that interactive technologies reduce learning time requirements by an average of 50 percent (Miller 1990).

A number of studies in recent years have demonstrated that information and communication technologies (ICT) has positive effects on the students' achievements, improvement of learning processes, development of educational skills, concentration, communication, met cognition, motivation and creativity (Monteith, 1998; Becta, 2001; Leask and Pachler, 1999, Barton, 1998; Hotle, 1998). However, some researches on the technology based learning indicate that there is no significant statistical difference in instructional effectiveness and exam scores (D'Alessandro et al,1993; Smeaton and Keogh 1999). In these studies, both student grades and test scores as measures of student achievement has been used (Hoyt, 1999). There are also many studies on the teaching with ICT in which methodologies are discussed (Driscoll, 1997; Shaw et al., 1997; Berge, 1999; Watson and Rossett, 1999; Price, 1996; Pool, Blanchard, and Hale, 19995; Whalen and Wright, 1999; Sherry, 1996).

With ICT based education, students interact with pre-produced sources for course replacing much of the traditional interaction between students and instructors. Emotional involvement, easy access to information, and a friendly chat contribute to learning pleasure and student motivation—which increases learning and knowledge retention. Teaching effectiveness is "demonstrated by students' learning of what has been taught" (Simonson, Schlosser and Hansen, 1998; Hoyt 1999). The core proposition of the paper is to further enhance the learning approach that uses ICT in order to "support", "enhance", and "extend" both the teaching and learning processes with serious interactive methods that grasp the students' imagination and transform the learning process into a natural extension of the students' daily activities.

Teaching and learning can be expanded in the sense that active learning ingredients can be and should included in the education content delivered to the students through the use of interactive learning objects, simulation applications, and virtual platforms that enable the students to practise and do experiments, solve problems as often as necessary to ensure abstract concepts are understood. Of course this is more important in the engineering, science and medical education environments where conducting experiment or performing surgical practice can be very expensive or in some cases unrealistic.

Technology is already used within instruction in the form of computer simulations, and at home as a means of interaction and self study. Considering the various aspects of teaching and learning with the help and the richness of available educational technology today, educators should utilize interactive systems based learning methodologies. This can be extended to the use of Learning Object which will use visual imagery and audio to vivify the learning and achieve interactivity in the true sense of the word—beyond mere mouse-clicks and multiplechoice questions. The penetration of technology in the education sector has reached a level that challenges the current teaching methods. Educators should be asking how to utilize these innovations, how to engage technology savvy learners? It is no longer acceptable that

the 'theory' happens in the learning product and the 'application' happens only in real life? There has to be new ways of merging the two, and this is the power on interactive learning. For example, a simulation enables the learner to practice in a failsafe environment before going into the real world with the added advantage of enabling the educators to monitor and evaluate the learner's progress. As in many other technical sectors, definitions are vogue in the online learning industry today. In summary the description given above closely associates with the constructivist view of learning, which emphasizes the need for individuals to create their own models of knowledge. Therefore simulations can be viewed as cognitive tools.

3 Significance

E-learning educators are increasingly challenged to develop courses which promote interaction and reflective thinking in a virtual learning environment. The potential of the interactive learning approach in supporting knowledge retention that will equip student with the necessary skills for a long term job opportunities as well as life long learning.

Interactive learning is one of many innovative solutions that present itself as imaginative and creative use of technology in the education sector. We consider as a fundamental paradigm shift in the opportunities provided by new these technologies such as the Internet and the World Wide Web, CD-ROM data bases, multimedia presentations, and other instructional uses of computers which require considerable reflection and debate as to whether and under which conditions; they will enhance the quality of learning and teaching. To what extent do the newer interactive technologies improve the quality of the overall learning of students studying completely online? In particular, we must accept that it is important to establish whether the technology can function as a tool for improved learning rather than simply operate as a medium for the delivery of content.

We highlight the significance and the need to revisit the use of simulation approaches and techniques in teaching and learning. Many researchers found a sufficient evidence to support this approach as a successful mechanism to enhance the teaching of for example medical or engineering related topics. They argue that some of the most interesting current interactive applications are simulations. In general, such programs provide a platform for highly interactive learning according to Lander (1999).

It is now widely recognized that the effectiveness of online learning tasks depends on the way they generate interaction. Interactivity is a necessary and fundamental mechanism for knowledge acquisition and may be the key to successful online learning. (Barker, 1994; Mesher, 1999). Lander highlights that the fuller uses of new information technologies cannot be realized without a paradigm change toward learner-centered, interactive, outcomes-oriented instruction. Such a shift requires new role definitions for both faculty (teachers) and students (learners). "It may also be noted that, through interaction, online learning tasks can be used to generate the 'variation' in experience identified by Bowden & Morton (1998) as critical in many forms of learning" (Lander, 1999)

It is important that we recognize the importance of developing new models for students to equip them for the dynamic environment in which they will need to be life-long learners in order to survive and thrive. The issue, however, is to address the appropriate use of the technology.

4   Changing Teaching Methods

Interactive learning involves more than a simple content resource; it will enhance the teaching and learning model. The students will be able interact with subject matter experts and each other, attend live classes, or become a member of a discussion group focused on an immediate learning need. The education sector has recognized this and using this method will involve accepting the need for teaching methods. The existing technology in today's education institutions enable the delivery of educational content, its storage, and repeated delivery, broadcasted, etc. as well as on demand access.

Because the technology utilized other advanced feature within the ICT arena, education content delivered using digital media, for example, can be indexed and easily updated, learners can discover relevant and current content for the tasks at hand or they can reuse at a later stage. Learning retention can be increased because auditory and visual learning preferences are easily accommodated through the use of interactive learning tools based on digital media presentations. The most effective learning outcomes will fulfill the requirements of both students and the educators who can easily track, monitor and evaluate the students' progress.

One example that demonstrated this capability is StoBLs™ , a methodology developed by Tata Interactive Systems (TIS)[2], global e-learning pioneer, this methodology uses stories as the instructional approach to deliver learning effectively. The StoBL object utilizes visual imagery and audio to bring learning content to life. The students become independent and this interactivity platform helps them make decisions that control the movement of the story, as it were. This teaching and learning methodology does combine many aspects of outstanding pedagogical principles, the following is a summary that in a nutshell provides the profound shift in thinking on how to deliver educational content in a way the enhances retention (www.tatinteracive.com).

> *Contextual:* A story with a context conveys emotions, triggers individual and group memories, and provides intuition and insights to events; this in turn enables appreciation and application of the learning points.
> Realistic: Stories are based on reality, or are converted to reality, making them, and therefore the learning derived from them, credible—and learners, receptive.
> *Unusual:* A story must be memorable—with an "a-ha" moment—promoting retention of the associated learning.
> Natural: The events in a story appear natural, not contrived, enabling easier learner acceptance.
> *Concrete:* Stories deal with specific people, things, and events, which learners can relate to.

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[2] www.tatainteractive.com

Human: There is a human angle in stories, even if they are not about human beings all the time, ensuring learner empathy and receptivity.
Easily Accepted: People lower their defenses to absorb a story instead of questioning it. The curiosity and readiness to be entertained translates into high acceptability and retention of the underlying concepts.
Discovery-oriented: Adults love to learn when they discover the learning themselves—which a story-based approach facilitates

The concept of simulations and interactive learning as an instructional technique has been in existence for a long time, especially in the form of games, models, and role-playing. What is not immediately obvious is how this method of teaching and learning enhance knowledge retentions? The US Air Force is one of the oldest and most prominent users of simulations for training pilots and flight crews, and they have been fairly successful in this. The use of simulations for learning has emerged from the need to provide hands-on practice. Besides, simulations promote higher order thinking skills, such as decision making, analytical reasoning, and problem solving[3].

What is of greater relevance in the education field is the need for high retention of small modules of e-learning information provided "just in time" in support of on-the-job activity is attributed its perceived higher relevance and "digestibility", as compared to lengthier, traditional, "just-in-case" training. The Research Institute of America found that, over time, the retention of knowledge from classroom lectures dissipates, with only 15% of such knowledge being retained three weeks after the course (Forbes 2000)

Students in this environment generally absorb the same instructional material in less time. By enabling them to navigate through material at their own pace, this minimizes the time that knowledgeable learners must spend in such training activity. And, for all learners, graphical presentation of material leads to faster comprehension. These two factors help to explain the results of several studies showing significant time saved per course[4], i.e. students requiring from 40% to 60% less time than the same material delivered in a traditional classroom setting or "reduced time to achieve given instructional objectives (30%) — or increased student skills and knowledge (30%) — depending on whether achievement or time was held constant."[5]

5   Interactive Learning Experience

Students interact with educational content similar to how they play games within a Web page whether the content can be located on a computer or a portable device. The students expects a quick and easy way of accessing and viewing content and so is the

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[3] A Military organization found an increase in ability of personnel to correctly diagnose and repair aircraft systems the "first time" by more than 80%. · ROI with Blended E-Learning, White Paper Report, http://www.mentergy.com/blended/roi.html, 2001.

[4] *Return on Investment and Multimedia Training*, Brandon-Hall, 1995.

[5] *SCORM, Version 1.1*, Advanced Distributed Learning Initiative, quoting J.D. Fletcher (2001), "Evidence for Learning from Technology-Assisted Instruction"; H.F. O'Neil Jr. and R. Perez, "Technology Applications in Education: A Learning View", Hillsdale, NJ, Lawrence Erlbaum Associates.

educator who can in 'real time' or at a later time monitor what the students are doing or have done. It is this instant-on or always-on interaction that makes the whole learning and teaching experience more enjoyable, measurable and revisable where necessary.

Supplementing conventional teaching with interactive e-learning can lead to savings in time, effort, and money. This is quickly emerging as an effective and efficient learning aid in the education industry which is the main reason for many educational institutions turning to this as a primary means of improving their students' learning experience.   The benefits may include:

- The access to visual imagery, which facilitates retention. Most people tend to remember 70 percent to 80 percent more of what they see than what they read. Live and on-demand scenarios bring the learning event closer to the participant.
- It enables learning institution to broaden it's by providing participants with greater and more flexible access to the educational content and other material, i.e. assessment and evaluation documentations.
- Instructional designers, implementers of education content delivery systems, can provide their expertise in a consistent way, reducing instructor and content variation and inaccuracy.

We need to keep in mind that interactive learning and simulation techniques used in teaching and learning are complimentary tools rather than replacement to all other teaching tools. The main advantage is the possibility that students can learn on their pace, concentrate on specific areas, etc. The baseball analogy demonstrates this point succinctly; consider a baseball player. He will practice his pitching separately. He will practice his batting separately. And he will practice his catching separately. Even within this, he will practice different aspects separately. The reason for this is not difficult to see. A baseball player needs to be good in all aspects of the game to be successful. Therefore, he needs to concentrate on all aspects separately. On match day, all these come together. "Practice in parts, play together"

In life, there are many concepts one learns and applies together. However, will it not help if one can practice the concepts separately? Will it not help if a learner can apply different concepts deeply so that the learner can understand the nuances of that concept? Interactive learning will allow learners to focus on specific areas of their learning teaks as often as necessary.

Flexibility and accessibility of the interactive learning environment offers learners a risk-free setting, enabling them to make mistakes and experiment with new ideas without risk, and allowing for reflection and review. We mentioned that interactive simulations make learning more interesting and engaging, resulting in increased retention. However, an area many neglect is the adaptability for complex concepts; Training on complex topics or processes is an area traditionally accepted to be challenging and difficult to handle, this has now managed in a successful manner with the help of interactive learning.

6   Conclusions and Recommendations

Increasing student retention and achievement is the focus and core function of all who are involved in the teaching and learning business. Research indicates increasing

interactions during class between faculty and students and among students increases their achievement in the class and retention. Interacting with faculty, and interacting with students, are both obvious ways students acquire knowledge. In fact, a student's interaction style is another dimension of that student's learning style. Interactive learning can occur both inside and outside the class making learning a part of the students' daily activities. The learner's ability to apply in real life what he/she has learnt is probably the best indicator of effective learning and this can be achieved systematically when interactive learning tools are given to learners.

At a different level, we have accepted the notion that "The half-life of knowledge is decreasing, It's a matter of maybe three years in most professions and is down to months in the information technology field. The time pressures are only accelerating."[6] This will reinforced our proposition to let the learner have access to interactive learning tools that can be updated easily as speed of knowledge progression increase.

Based on the literature reviewed and our own experience over the last few years, we came to the conclusion that the impact of interactive learning has been under-estimated and educators should revisit this valuable method of teaching and learning. There are areas that require further studies and deeper research in teaching methodologies and the inherent value of knowledge retention. We highlighted the need to reevaluate the fundamental notion that supports the validity of knowledge retention itself in a 'wired' and technologically advanced world. Should educators limit themselves to providing the necessary tools to facilitate learning and allow the learner to explore, gather, and apply the necessary knowledge when and where necessary? And transforming evaluation and assessment tools into a routine application, practicing, rehearsing and interacting constantly, not dissimilar to what pilot and athletes do before flights and races respectively.

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