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E-Learning for Professional Development – An Integrated Approach

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ABSTRACT

One of the major problems faced by professionals today is the problem of knowledge decay. In the provision of professional service, the problem of knowledge decay can lead to customer dissatisfaction, damage reputation and even human lives. Therefore, the problem of knowledge decay in the professional service provision service has been studied in various research. This article reviews the problem of knowledge decay and how e-learning can be used to minimise its effects. It will review the use of different types of e-learning for professional to acquire and retain their knowledge. These types of e-learning include Learning Management Systems, Massive Open Online Courses, Student Response Systems and Augmented Reality. Finally, it will suggest the integration of the various types of e-learning with the HRMIS (Human Resources Management Information System) of an organisation to enhance its competitive capability by aligning the professional development needs of its employees and the service delivery requirements of its customers.

KEYWORDS: Learning Management Systems, Massive Open Online Courses, Student Response Systems, Augmented Reality, HRMIS, Competitive Capability

1 INTRODUCTION

One of the major problems faced by professionals today is the problem of knowledge decay. It has been found that a person can forget more than 90% of the information in just a month's time (Haag & Berking, 2015). The effect of knowledge decay on a learner can be classified as uninformed paralysis, misinformed mistakes and doubt hesitation (Kim, 2015). In the provision of professional service, the problem of knowledge decay can lead to customer dissatisfaction, damage reputation and even human lives. Therefore, the problem of knowledge decay in the professional service provision service has been studied in various research (Botezatu, Hult, Tessma, & Fors, 2010; Fontenot, 2015; Patocka et al., 2015). E-learning has been found to be an effective way to counter the effect of knowledge decay. The purpose of this article is to review the different aspects of e-Learning that can help countering the effect of knowledge decay.

The American Society for Training and Development defines e-learning as, "*anything delivered, enabled, or mediated by electronic technology for the explicit purpose of learning*" (Kirk, 2002, p. 4). The market size of the global eLearning was estimated to be US$107 billion in 2015. Although e-learning can be part of a structured course, such as a subject for one semester delivered by a university, more and more learners are using e-learning to study at their own pace. In the busy urban environment, many professionals do not have time to attend formal courses, but prefer to learn at their own pace in order to gain the knowledge and skills for better career development. Therefore, within the overall global e-Learning market, the segment of self-paced e-Learning market grew at a compound annual growth rate of 9% to reach US$50 billion in 2015 (Pappas, 2015). This article reviews some recent types of e-learning that have been becoming more and more popular among learners and education institutions. These are Learning Management Systems (LMS), Massive Open Online Courses (MOOC), Augmented Reality (AR) and Student Response Systems (SRS). Each of these systems has its own role in the provision learning services. An illustration of the pervasiveness of such e-learning technologies against the immediacy of collective feedback is provided in Figure 1.

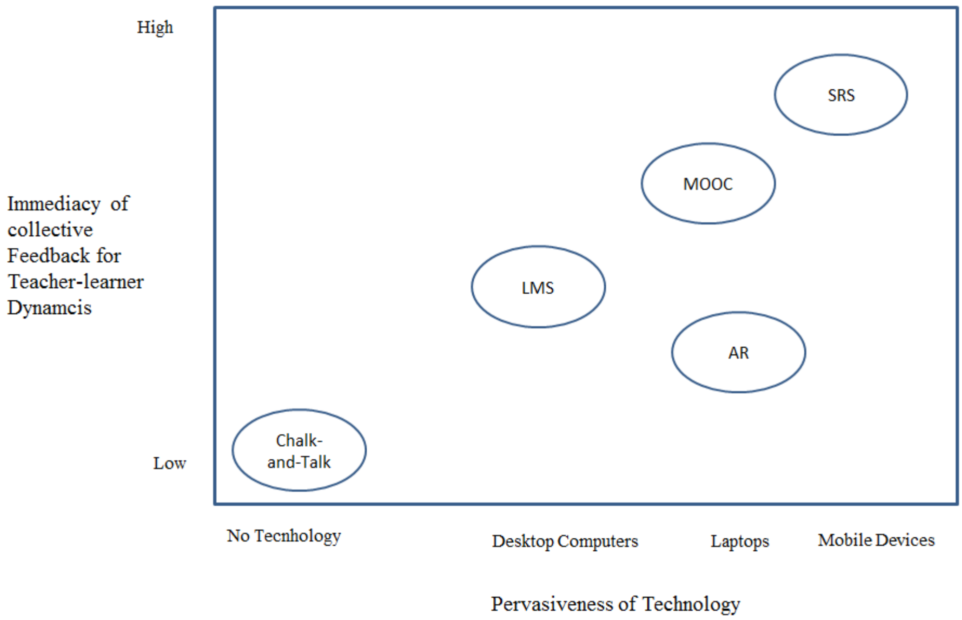

Figure 1: The Pervasiveness of Technology versus Immediacy of Collective Feedback for Teacher-learner Dynamics

2 Learning Management System (LMS)

To learners, a learning management system (LMS) allows them to access course materials, complete online activities such as quizzes, submit assignments. To teachers, an LMS is a platform for them to upload their teaching materials, access and grade the assignments, and generate reports about progress of the learners in various subjects (Cerezo, Sánchez-Santillán, Paule-Ruiz, & Núñez, 2016). The LMS market is estimated to worth about US$4 billion in 2015 and over $7 billion in 2018. In fact, the growing trend of using LMS has been described as "exponential"(Cerezo et al., 2016). There are various LMS platforms developed, including Blackboard, Moodle, Edmodo, Schoology, Canvas, Haiku, Piazza, Desire2Learn and Sakai (Bentz, 2014). A recent report has shown the educational sector occupies only about 21% of the entire LMS market. The other sectors that also use the LMS include technology, manufacturing, real-estate, consulting and healthcare, software development companies, non-profit organizations and governmental institutions (Eileen, 2015). For example, when a software development company needs to develop an application for a client using a particular programming language, it can use its LMS to find out the programmers who have good performances in courses related to that programming language.

Although the LMS provides a convenient way for teachers to "manage" teaching materials, it is not effective in collecting real-time student feedback. It is difficult for teachers to monitor the progress of the students. The LMS can only provide data about students' learning activities after the class has ended and when the students take the initiative to use the LMS. Therefore, while the LMS provides an effective e-learning platform for the management of teaching materials, it is necessary to have another e-learning method that help the teacher get real-time data for monitoring progress of the learners and make adjustments in teaching as soon as possible. (Cerezo et al., 2016).

3 Massive Open Online Courses (MOOC)

MOOCs is defined as "online courses open to all who have access to an internet connection and are self-motivated in learning anywhere and anytime in the world" (Israel, 2015, p. 103). MOOCs are open in the sense that not only that they do not require the participants to have acquired any specific academic credentials, but also no tuitions fees are charged. The MOOC courses contain online materials in the form of text, graphics, audio and video file. These contents are delivered to the learner using the Internet in urban areas, and via satellite links in remote areas. Therefore, the MOOC is an e-learning method that is open to any learner with an internet connection, and it can be taken anywhere and anytime. It is a kind of informal learning that enables learners to achieve their own learning objectives at their own pace. Highly motivated learners can successfully achieve their learning objectives through this kind of informal learning. Approximately 8% of companies are currently using MOOCs, while another 7% are beginning to experiment with MOOCs. It is estimated that by 2017, 28% of the companies could have experimented deploying MOOCs. In 2015, more than 350 companies have used MOOC to seek the most suitable candidates among the learners in courses that are relevant to job vacancies. Google also enrolled 80,000 of its employees in MOOCs course related to HTML5 (Pappas, 2015).

Despite their convenience and diversity, the Babson Survey Research group found that the online enrollment growth rate in 2013 was only 6.1 percent, which is the lowest growth rate since 2002.

There are two main issues associated with MOOCs. Firstly, the engagement rate and completion rate in MOOC courses are both low. The University of Pennsylvania Graduate School of Education studied the activity of one million users of MOOC. It was found that among all those registered for a MOOC course, only half of the students actually did not watch the videos of the required lectures. The same survey showed that only four percent successful finished the course they registered for (Bentz, 2014). Another survey also showed that the typical completion rate is less than 10% of total enrollment (Israel, 2015). Secondly, the qualifications acquired through MOOCs may not be accepted by employers or education institutions. Some education institutions offer degree programs through MOOC. For example, the Georgia Institute of Technology offered an online Master's Degree in Computer Science on Udacity, which is a MOOC-service provider. The learners who finish the online program will receive the same degree as the on-campus, instructor-led degree. The cost for finishing the online degree is only 20% of the on-campus degree. However, this kind of arrangement has created the concern that "the credentials for MOOC completion will cause confusion about higher education degrees" (Bentz, 2014, p. 146).

4 Mobile Learning

Mobile learning is a form of e-learning. Mobile learning can be defined as "a ubiquitous learning activity supported by the appropriate mobile technology and pedagogical approach" (Lin, Chen, Zheng, & Tang, 2014, p. 341) However, this definition downplays the role of mobile devices in the classroom, when in fact, many successful mobile learning systems are implemented inside the classroom. Another definition is as simple as "the use of portable devices with Internet connection capability in education contexts" (Kinash, Brand, & Mathew, 2012, p. 639). However, such definition ignores that mobile learning requires a change in pedagogical approach. In this article, Park, Nam, and Cha (2012)'s definition - "any educational provision where the sole or dominant technologies are handheld or palmtop devices" will be adapted. Mobile Learning Market. The global market worth for mobile learning products and services reached US$5.3 billion in 2012. The market for mobile learning is expected to grow at a steady compound annual growth rate of nearly 19%. It is estimated that such global market worth will reach US$12.2 billion by 2017 (Pappas, 2015).

There is empirical evidence to show that students today are competent in using smart mobile phones, and are more responsive in completing learning tasks when compared with the traditional methods. Thornton and Houser (2005) found that, based on a survey on a Japanese university campus, students sent an average of 200 email messages per week from their mobile phones, but they only made an average of 7 voice calls. Further, these messages contained an average of seventy 70 English words each, despite the ergonomic issues associated with mobile phones. Thornton and Houser (2005) found that the majority of learners in an English as a Foreign Language (EFL) subject responded immediately to practice exercises what were sent to them as text messages. These learners usually read the messages and responded during their commute or during other types of spare time. Thornton and Houser (2005) conducted another experiment in which they distributed exercises to one group of students via a series of cellular phone messages, and then distributed printed handouts of the same exercises to another group of students. The final scores showed that the mobile learners did better on examinations.

5 Student Response Systems (SRS)

The student response systems can make use of mobile phones, and therefore a form of mobile learning. However, they can also use proprietary hardware and software. Figure 2 shows the relationship between e-learning, mobile learning and student response systems.

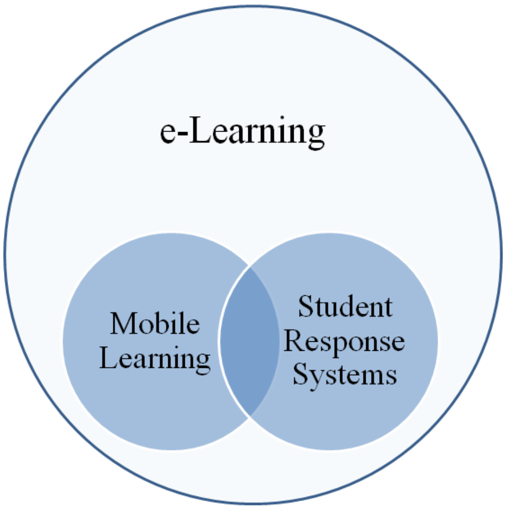

Figure 2: Relationship between e-Learning, Mobile learning and Students Response Systems

To achieve effective and efficient learning, student engagement is essential. However, it is not easy to achieve student engagement in the classroom (Micheletto, 2011; Wang, Shen, Novak, & Pan, 2009). In a classroom where the majority of the students are Chinese, for instance, the lack of student engagement is often an obstacle to achieving the learning outcomes (Wang et al., 2009). As digital technology continues to improve and become more economically viable to schools, many researches have been done to exploit digital technologies to increase the student engagement (Hwang, Wu, Tseng, & Huang, 2011; Jungsun & Kizildag, 2011; Liu & Chen, 2015). Recently, many researches have focused on the use of SRS (Student Response Systems) in which the teacher can gather and summarise answers from students inside the classroom immediately (Carnaghan, Edmonds, Lechner, & Olds, 2011; McLoone, Villing, & O'Keeffe, 2015; Monk, Campbell, & Smala, 2013; Valle & Douglass, 2014).

5.1 Clicker-based System Response Systems

In a typical SRS, students are given small, portable devices called "Clickers" (Lindquist et al., 2007). A typical clicker is show in Figure 3.

Figure 3: A typical clicker used in a Student Response Systems. Source: Turning Technologies (2015).

The clickers have numeric keys, on which students can choose their answers to the questions posted by the teacher. Then the student answers are summarised and shown on the projector screen in real-time. The mechanism of the clicker-based SRS is shown in Figure 4. The main advantage of an SRS is that it allows the teacher to quickly get find out how well each student understands a subject immediately. This is because students would no longer be overly hesitant about answering questions as the whole class can only see the statistics of the different answers, but not who give the answers. Therefore the SRS is especially useful in creating a more engaging environment in a large lecture hall. Without the use of the SRS, the collection of individual responses for immediate feedback would be infeasible. Many studies revealed that SRS are effective increasing student engaging and active learning (Cain, Black, & Rohr, 2009; Lindquist et al., 2007; Monk et al., 2013; Park, Nam, & Cha, 2012; Şad & Göktaş, 2014).

However, clickers are limited to making choices in the form of numbers, and students are not willing to use them if they have to pay for the clickers. Due to the widespread use of mobile phones in an urban environment like Hong Kong, and the availability of free WIFI access on campus, and commercially available polling software, the mobile phone has become a viable alternative to proprietary SRS using “clickers”. However, there is still little research about the use of mobile phones by students as an SRS device.

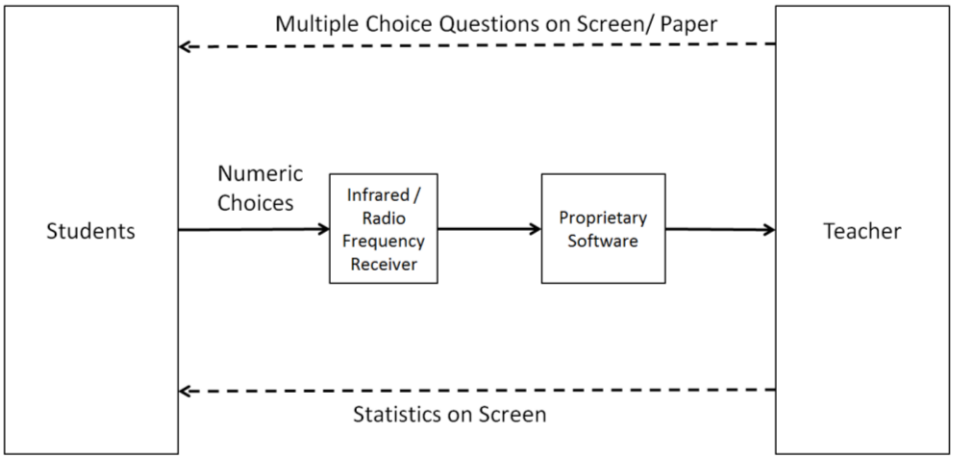

Figure 4: The mechanism of the clicker-based SRS.

5.2 Mobile phone-based SRS

Compared with the clicker, the mobile phone is an attractive alternative because of its small size and high penetration rate among students. Research has found that over 99% of students own a mobile phone (Burns & Lohenry, 2010; Gikas & Grant, 2013; Liu & Chen, 2015; Shon & Smith, 2011). Therefore, the mobile phones can be an effective substitute for clickers, laptops or even computers in the lab. The mechanism of the mobile phone-based SRS is shown in Figure 5. With reference to Figure 4 and Figure 5, it demonstrates that the clicker-based SRS requires the installation of a receiver in the classroom, while the mobile phone-based SRS uses the Internet as the connection medium. This means the teacher has more flexibility because the polling website can be switched when better features are required. The other advantages of the mobile phone over the clicker devices are summarised in Table 1.

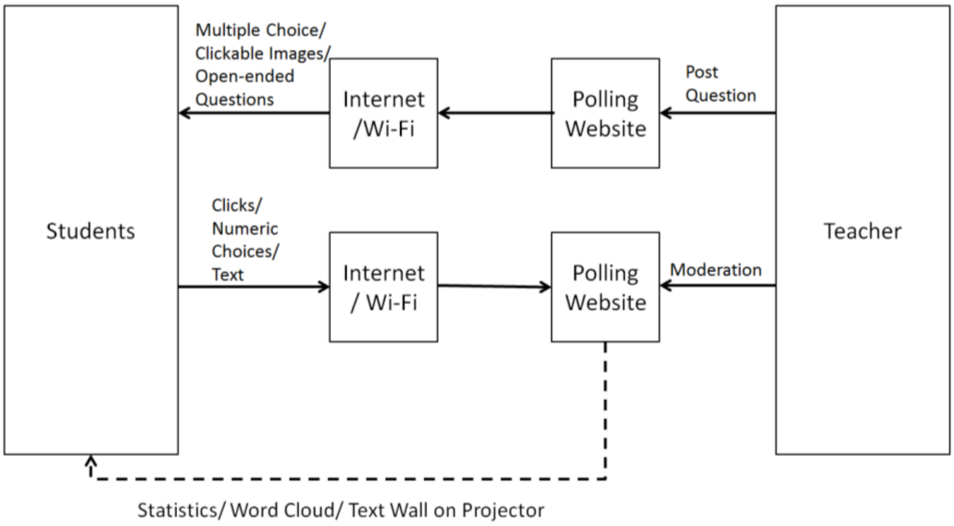

Figure 5: The mechanism of the mobile phone-based SRS.

Table 1 Comparison between the Clicker and Mobile phone

	Clicker	Mobile Phone
Networking Technology	Infrared, Radio Frequency	Cellular Network, WIFI
Cost	Hardware, Software, Maintenance	Subscription to polling software
Functionality	Numeric Choices	Numeric Choices, Text messages, Clicking Images, Upload Photos
Portability	Limited to the classroom	Can be used inside and outside the classroom
Anonymity	Not easy to achieve	Can be achieved easily
Convenience	Small size, easy to carry, light weight	Small size, easy to carry, light weight

When compared with clickers, mobile phones are less expensive to operate. Some schools require their students to purchase clickers, or pay a deposit which will be returned at the end of the term. This complicates the adoption process with additional costs and efforts. Since clickers has no other use other than provide answers in the classroom, students may forget to bring them to class (Withey, 2010). When students forget to bring them or if the clicker malfunctions, there is nothing they can do about it. If the teacher has to distribute the clickers in class, they have to carry a bulky box. On the other hand, most students already have mobile phones. Furthermore, mobile phones incur no extra charge when they used in connection with WIFI.

Mobile phones have more functionalities than clickers. Clickers are typically limited to numeric inputs using a small keypad. Therefore, they are normally limited to doing simple multiple choice questions. Although text can be entered by press the numeric keys repeatedly in a short time, the awkwardness of text entry encourages students to provide a minimal answer. For example, using “n” instead of “and”; or provide no explanations to answer at all (Lindquist et al., 2007). Some more sophisticated, although more expensive clickers allow text entry (Lindquist et al., 2007). On the other hand, mobile phones allow students to can enter text very efficiently on a virtual keyboard. Thus the students are more responsive to open-ended questions. Some polling software allows users to click directly on graphics as answer to questions. This reduces the possibility of error in selecting a choice when choosing a number that represents part of a graphic. Mobile phones are small enough to be used in the classroom without adversely affecting notes taking and peer discussions (Lindquist et al., 2007).

Clickers are often issued to students by the school. Because each clicker has a unique code which is included in the signal that it sends out, the students might worry that the school can track their answers. This prohibits them to reveal their true opinions or behaviours in certain questions (Caldwell, 2007). When the answers to some questions that are strictly confidential, such as those related to unethical behaviour, special measures must be taken to let the students have the assurance that their answers are indeed anonymous (Gikas & Grant, 2013). For example, the teacher would have to let students choose their clickers randomly from a set of clickers. On the other hand, mobile phones are owned by the students. The teacher can choose not to require students to log in before answering questions. Thus, anonymity is ensured efficiently.

5.3 Clickable Images in Mobile Phones-based SRS

Because the mobile phone has graphics display and touch screen, the teacher can use it as part of the SRS to achieve multi-modal learning. One of the models for multi-modal learning was the VARK model (Fleming, 2001). VARK is an acronym, which represents four learning modes - visual (V), aural (A), read/write (R), and kinaesthetic (K). The visual learning mode refers to learning by looking at images, graphics, and videos. It involves the use of symbolic tools such as arrows, flowcharts, graphs, models, and hierarchies. The aural learning mode refers to learning by listening to words delivered by teachers. It involves discussions, seminars and listening to mp3 recordings of lecturers. The read/write mode refers to learning by reading printed texts to gain information and taking notes. It involves lecture notes, handouts, and text books. The kinaesthetic mode refers to learning through hands on experience, practical application, use of models, and real life experience. Typically kinaesthetic students are passive in the classroom setting. A student learns most effectively and efficiently when the teaching is delivered in the modes that match the student's preferred learning modes (Fleming, 2001).

When the learning process involves only one of the four modes, the process is unimodal. If more than one modes are involves in the learning, the process is multimodal. There is strong evidence to indicate that multiple modalities in the teaching process are necessary to effectively cater to student learning preferences. To support the visual learning mode, the teacher can push questions in the form of images to the screens of student's mobile phones. In medical education, the images for the questions can be parts of the human body, medical equipment or diagrams of viruses or bacteria. These images can be created by the teacher to suit a particular topic in health education. The teacher can also use the mouse to mark boxes where students can click to indicate their choice of answers. For example, in Figure 6, the teacher shows picture of a tooth on the mobile phones of students in an SRS and ask them to click on the image on parts that are affected by a particular kind of decay.

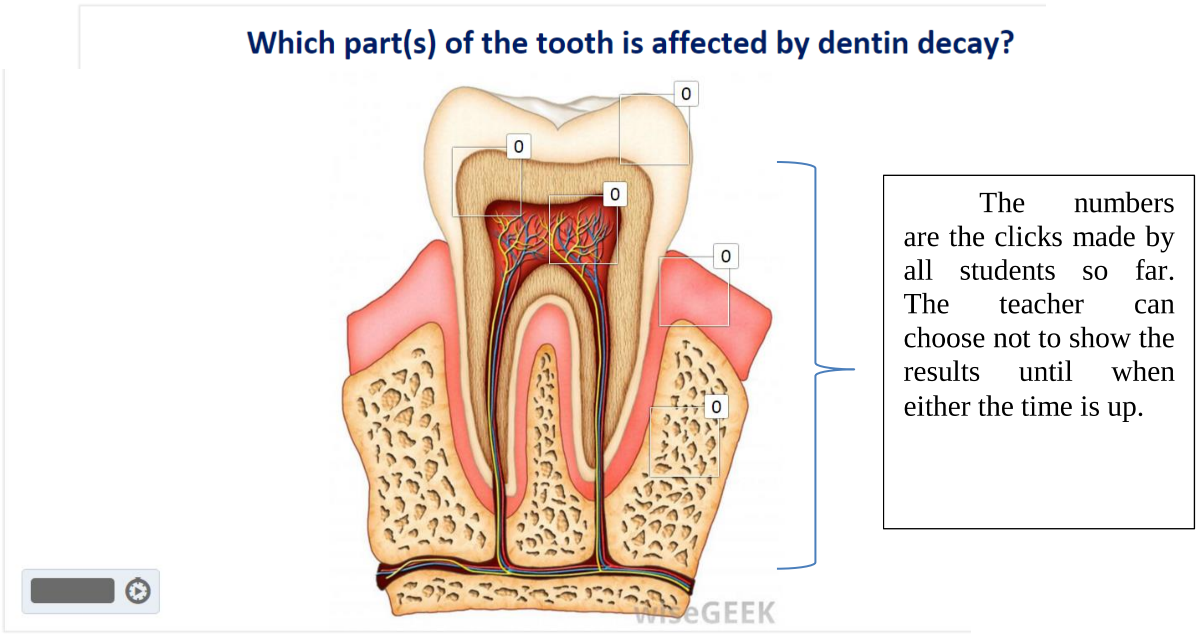

Figure 6: An example of a question in the form of a clickable image. The numbers at the corner of each box indicate how many students have clicked inside that box.

The teacher can choose to use a timer so that students cannot continue to click after a pre-set time. The teacher can also choose not to show the results until when either the time is up or most of the students have finished clicking on the image. This option of withholding the results encourages students to think independently instead of choosing giving an answer that is given by most of the other students.

6 Augmented Reality (AR)

One important direction of mobile-learning is Augmented Reality (AR). In a very restricted sense, AR can be defined as "*a form of virtual reality where the participant's head-mounted display is transparent, allowing a clear view of the real world*" (Wu, Lee, Chang, & Liang, 2013, p. 3). In a broader sense, AR can be implemented in an affordable and effective manner using varied technologies, such as desktop computers, handheld devices, head-mounted displays (Wu et al., 2013). Martín Gutiérrez and Meneses Fernández (2014, p. 24) defined augmented reality as 'an environment that includes both virtual reality and real-world elements'. For instance, an AR user might wear a headset, through which, he or she can see the real world, as well as computer-generated images projected on top of that world.' While this definition states clearly the key components in an AR system, it did not attach any meaning to "realities". To indicate how AR is important to learners, Solak and Cakir (2015, p. 52), defined AR as "a situation in which a real world context is dynamically overlaid with coherent location or context sensitive virtual information".

To illustrate, the Hong Kong Polytechnic University has set up special study areas in which AR markers are posted on walls. Students who have the matching application on their mobile phones can learn at their own pace simply by pointing at the markers and get videos, pictures or additional information. A typical AR system consists of a trigger image, an AR mobile application, and the content associated with the trigger image. When the user scans the trigger image with the AR mobile application, the content associated with the trigger image will be overlaid on top of the real-time view of the trigger image. For example, AR has been employed by companies like Boeing and BMW to train their engineers (Martín Gutiérrez & Meneses Fernández, 2014).

L-Elira is a book in in mechanical engineering that incorporated AR technology. It allows students to visualise engineering components in three-dimensions. The book contains photorealistic images and a marker, which allows visualization of an object in three-dimensions through a computer application called BuildAR installed on a notebook computer with a webcam. As the student tilts and turns the marker in the book, the objects, such as screws, shafts, axles, gears, belt wheel, sprockets, pulleys, couplings, and bearings are shown from different points of view (Martín Gutiérrez & Meneses Fernández, 2014). Figure 7 shows a photorealistc image of a bearing in three-dimension when the marker in a book is viewed through the BuildAR application.

Figure 7: A 3D image of a bearing viewed through the BuildAR application.

Source: Martín Gutiérrez and Meneses Fernández (2014).

There are software tools available on the Internet for teachers to learn and create AR applications without the need to learn computer programming. One such software tool is Aurasma. The website of Aurasma not only enables teachers to create their AR applications, called Auras, it also allows teachers to choose Auras designed by other users.

7 Virtual Patients for Medical Students

To support the kinaesthetic mode, McLean, Brazil, and Johnson (2014) employed a company to develop a mobile application which they called a “virtual patient”. The virtual patient application successfully replaced the paper-based case study approach that was used previously and resulted in higher student engagement and better student perception. In that study, medical students formed groups of size from six to seven. Each group were given an iPad and assigned to a ‘‘clinical team’’ which met twice a week to conduct ‘‘ward rounds’’ with a few other groups. As shown in Figure 8, the iPad shows a video of the current status of the patient (played by actors) and the vitals of the patient.

Figure 8: The iPad shows the video of the patient, the tasks available to the medical students and the vitals of the patient.

The discussion sessions of the groups were guided by a clinical facilitator (mostly generalists) to discuss their deliberations in terms of what they understood to be going on with the patients and also how they might manage the patients. Every two weeks, the patient's data such as imaging, laboratory reports, vital signs, doctors' notes, referral letters, etc. were uploaded. Each group had to perform tasks such as *writing* discharge notes and ordering investigations. Each group had to ‘‘manage’’ several patients each week, requiring them to prioritise patients in terms of their treatments. McLean et al. (2014) found this approach motivated the students better than the traditional paper-based problem-based learning (PBL). The planned to continue to employ the developer to further develop the virtual patient and expand the use of the virtual patient in more all phases of their university's curriculum.

8 Integration with HRMIS

While e-Learning can improve learning efficiency and prevent knowledge decay for the knowledge worker, organisations can also harvest the results of e-Learning by integrating its internal system with the various forms of e-Learning. Figure 9 describes such an integrated model which is suitable for an organisation whose main line of business is the delivery of professional services to its clients. Examples of such types of organisations are Software Development, Accounting and Engineering. In this integrated model. The individual learner can leverage on existings MOOCs for professional training and staff development. SRS can be used to turn every meeting room into an interactive training room for the development of industry specific skills or generic soft skills such as communication, team work or negotiation. Finally, organisations can integrate LMS with HRMIS to build and renew expert knowledge to enhance corporate competitive capability.

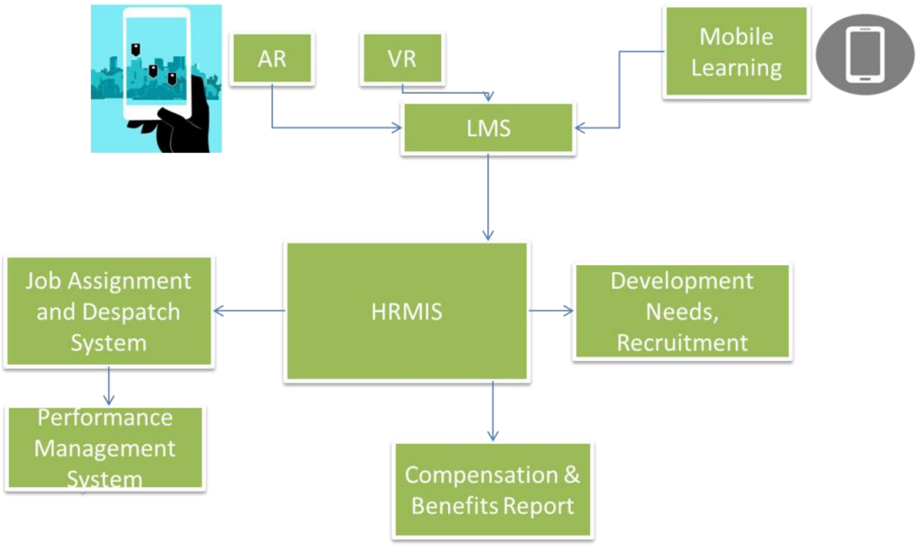

Figure 9: Proposed Integrated Model of E-Learning with HRMIS of An Organisation

CPCE Disclosure Authorized

9 Future Developments

In future, with more powerful mobile phones and tablets, and faster communication links, students will be able to learn using virtual reality (VR) to immerse themselves in settings that are difficult to create in real-life. For example, Ashley et al. (2014), used a software called SecondLife to simulate a real-world retail management experience for their students. In a virtual shopping mall, the students created retail stores, defined their target customer segments, merchandise assortment, store design and provided customer service. The screen shots from that experiment are shown in Figure 10. The same learning experience can be implemented on mobile devices in future for ubiquitous learning within an urban environment.

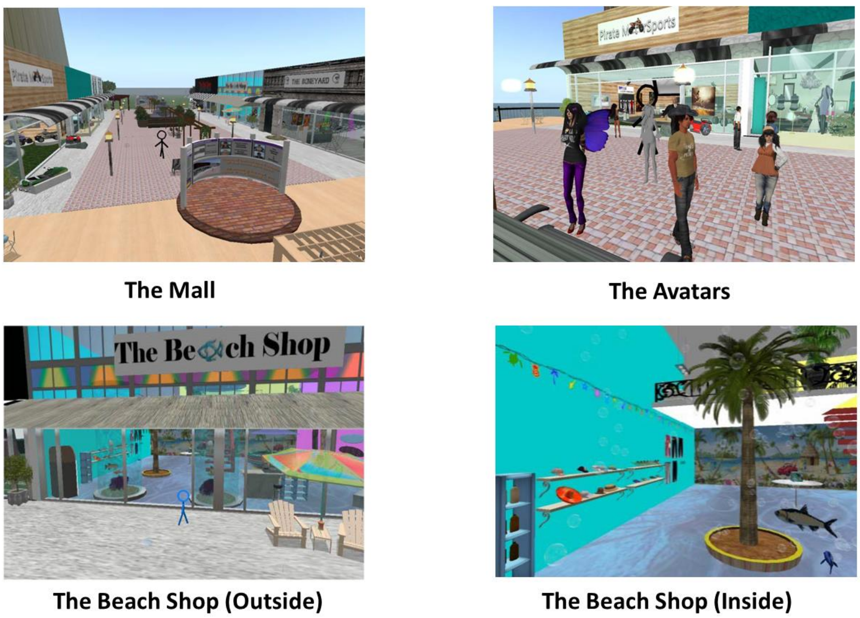

Figure 10: Screen shots of a Retail Management learning experiment.

Source: Ashley et al. (2014)

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