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TOWARDS SMART CLASSROOMS: EMERGING EDUCATIONAL TECHNOLOGIES

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ABSTRACT

Recent advances in computer technologies result in the development of E-Learning and Learning Management Systems. They provide mechanisms to organize course contents and training systems including interactions of trainers and trainees. Moreover, virtual reality systems emerge in the training and education systems to increase the trainee participation at the process and visualize the training subject. Increasing data transfer rates of the computer networks also made distant learning activities possible. Moreover, the economical solutions with the cloud computing technologies for the abovementioned systems come up. All these improvements lead the technology towards smart classrooms. It seems to alter the educational habits towards the flipped and the blended learning. In this study, general information about emerging educational technologies is given and a short evaluation with suggestions is presented.

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ÖZ

AKILLI SINIFLARA DOĞRU: YÜKSELEN EĞİTİM TEKNOLOJİLERİ

Bilgisayar teknolojilerindeki gelişmeler E-öğrenme ve Öğrenme Yönetim Sistemlerinin geliştirilmesine olanak sağlar. Eğitmen ve öğrenci etkileşimini de kapsayacak şekilde eğitim içeriklerinin ve sistemlerinin düzenlenmesi için gerekli altyapı, geliştirilen bu sistemler ile oluşturulur. Bunun da ötesinde sanal gerçeklik sistemlerinin eğitim ortamlarında yer almaya başlaması ile öğrencinin derse katılımı arttırılır ve eğitim konuları görsel olarak sunulabilir. Bilgisayar ağlarındaki artan veri aktarım hızları uzaktan eğitim faaliyetlerini mümkün hale getirir. Bulut bilişim teknolojileri ile de yukarıda bahsedilen eğitim faaliyetleri için hesaplı çözümler ortaya çıkar. Bütün bu gelişmeler teknolojiyi akıllı sınıflara doğru götürür. Bu da eğitim alışkanlıklarımızda ters-yüz edilmiş eğitim ve harmanlanmış eğitime doğru bir değişikliğe neden olur. Bu çalışmada, yeni ortaya çıkan eğitim teknolojileri hakkında genel bir bilgilendirme yapılmakta ve öneriler içeren kısa bir değerlendirme sunulmaktadır.

Anahtar Kelimeler: Öğrenme yönetim sistemleri, sanal gerçeklik, uzaktan eğitim, bulut bilişim, akıllı sınıflar, ters-yüz edilmiş eğitim, evde ders okulda ödev modeli, harmanlanmış eğitim.

Keywords: Learning management systems, virtual reality, distant learning, cloud computing, smart classrooms, flipped learning, blended learning.

1. INTRODUCTION

Recent advances in computer and networking technologies are changing current education and training philosophy, methods, and practices. Increasing computing speeds and advanced computer graphics technologies enabled virtual environments. Increasing internet speeds and storage areas together with the recent advances in cloud computing technologies, made the information available to everybody, from everywhere, at all times. As a resulting effect of the abovementioned technological advances, traditional training and education methodologies in which the trainer explains the subject in the classroom and the trainees make the exercises about the subject at home, start to leverage towards contemporary approaches like the trainees study the subject at home and the trainer make the exercises in the classroom with the trainees involvement. This new phenomenon at the training and education is called the "flipped learning" in which the in-class activities and the at home activities flip. With these advances, trainees start to get more involved and participate more actively at the training process. Thus, the quality of the learning process increases.

Learning Management Systems (LMS) and virtual environments constitute the main components of the contemporary education and training system. Advances at the internet technologies and the use of LMS systems together make the distant learning activities possible. Also, system setup and maintenance costs of the LMS and distant learning systems can be lowered with the use of cloud computing systems. All these technologies leverage the training environment towards smart classrooms. Also, training habits change to more interactive and practice oriented learning. One example is the flipped learning in which trainees have chance to do more practice on the training subject together with the trainer. Learning with the practice makes the training more permanent and useful for the trainees.

The rest of the study is organized as follows: In Section 2, emerging educational technologies, approaches, and tools including LMSs, the use of the virtual reality systems at the training environments, distant learning

technologies, cloud computing technologies and their usage for the LMSs, smart classrooms, flipped and blended learning are explained. Evaluation, conclusion and suggestions are presented in Section 3.

2. EMERGING EDUCATIONAL TECHNOLOGIES, APPROACHES, AND TOOLS

Improvements in educational technologies are enabling ubiquitous learning while increasing quality of education. These improvements cause an evolution from traditional classes to smart classes and traditional education to smart education. Technologies, approaches, and tools that provide this evolution can be list as LMS, smart classrooms, cloud computing, simulation technology, virtual reality/environments, augmented reality, e-books, mobile devices, interactive collaboration tools, gesture-based computing, distant learning, flipped learning, blended learning, game-based learning etc.[1] [2]. In this study, some of the most used ones from these technologies, approaches, and tools are covered.

Learning Management Systems

The life-cycle of the e-learning process is defined to have the following four phases; Learning design, learning production, learning deployment and learning assessment [3]. At the design phase, the targets and the requirements are specified. At the production phase, content is produced, assembled and packaged for distribution. At the deployment phase the trainees are collaborated. At the assessment phase, the learners and the process are evaluated. LMSs today are designed to support all these phases of the e-learning process.

An LMS can be defined as a software application to create, manage, and deliver online or offline electronic courses or training programs. It can support both on-campus and online education and training programs. There are commercial and open-source LMSs. Even social networking sites such as Facebook may be used as an LMS [4]. Some well-known commercial LMS software are Blackboard, Oracle ILearning, Edmodo, Successfactors,

Skillsoft, Schoology. Some of the popular open-source LMSs are Moodle, Sakai, Atutor, Eliademy, FormaLMS, Dokeos, ILIAS, Opigno, OLAT. LMSs available today are designed to have web based interface for the spread use of trainees and the trainers [5].

LMSs store and organize the educational material in a convenient and efficient manner. They provide means for the information sharing between the trainees and the trainer. Besides that, they also provide a platform for several educational activities like academic discussion, forums, online exams, grading, homework and exercise submission, attendance monitoring. Managing all the above mentioned educational activities centrally using an LMS improves the training quality [6]. In example, for the laboratory sessions of a course, the trainer doesn't need to evaluate all the trainees' activities during the limited laboratory hours. Instead the trainer can focus on the trainees' activities and the trainees can submit their resulting work using the LMS at the end of the laboratory session. And the evaluation of the work can be done by the trainer after the laboratory session.

LMSs are sometimes confused with Course Management Systems (CMS). There is a main difference between these two types of systems. While CMSs mainly feature the creation of course and training content, LMSs focus on the management of training and education programs. However, there are LMSs that include course management system functionality as well.

LMSs are not only used by schools or universities but also by many corporations and companies. LMSs are becoming an important part of enterprise management systems. There are many features provided with these systems. However, a basic LMS should be able to [7];

- centralize and automate administration,
- use self-service and self-guided services,
- assemble and deliver learning content rapidly,
- consolidate training initiatives on a scalable web-based platform,
- support portability and standards,

- personalize content and enable knowledge reuse.

According to a 2009 survey, the most valuable features of an LMS are [7];

- Reporting (52.8%),
- Compliance tracking (46.5%),
- Assessment and testing (42.5%),
- Learner-centered (39.4%),
- Content management (29.9%),
- Course Catalogue (28.3%),
- Authoring (19.7%),
- Manager approval (19.7%),
- Certification (18.9%),
- Standards (18.1%),
- Analytics (17.3%),
- Collaboration tool integration (15%),
- Security (14.2%),
- ERP/CRM integration (8.7%).

Furthermore, especially for corporate use, LMS should be able to integrate with the enterprise management system or other enterprise systems such as human resource management systems.

2.2.Virtual Environments

Virtual environments make use of the recent computer technologies to visualize the training subject. With these visualizations, the training gets more permanent for the trainee [8]. Virtual environments not only visualize the trained subject but also provide means for the trainees' active participation. With the use of virtual reality, the educational costs decrease. In example, pilot training can be done with a simulator instead of flying a real plane. The cost of using simulator is much more less than the cost of flying a real plane. In addition to that trainee can fly with a simulator as long as he/she wants and whenever he/she wants. Maintenance training can also be done much more easily with the use of virtual environments in

which the artificial training scenarios can be set up. The trainer's task is to decide whether to use the virtual reality in the training or not. A model to decide the use of virtual reality in a training course is explained in detail in [9]. In addition, to be given online is an important feature and advantage of virtual training courses [10].

2.3. Distant Learning

Recent advances in internet technologies, and increasing data transfer speeds made the distant learning possible. Asynchronous distant learning activities, in which the trainees and the trainer don't need to synchronize tightly, make the trainee download the training material and study the well prepared offline learning material like e-books, interactive e-books, and other training documents. Synchronous distant learning activities make the trainees and the trainer to meet actively in virtual classroom environment. Synchronous distant learning needs time synchronization between the trainees and the trainer in order for them to meet online at the same time. Synchronous distant learning activities provide independence of the locality of the training. In other words trainees and the trainer don't need to gather at the same physical location for the training. However, they can meet online inside a virtual classroom [11] and discuss on the training subject as if they meet in a real physical classroom. Trainers can choose from a variety of synchronous technologies including the slide presentation, audio and video conferencing, application sharing, and shared whiteboard [12]. Asynchronous distant learning activities provide independence of both locality and timing of the training. Trainees can learn every time, everywhere, whenever they want and when they are ready. However, asynchronous distant learning lacks the active real time interaction among the trainees and the trainer. The missing interaction can be enhanced with the synchronous components [13]. Recording the synchronous training session between the trainer and the trainees and making these recordings, together with the other training material, available to the trainees asynchronously with the use of an LMS commonly applied trend at the distant learning activities. Hence, the asynchronous and the synchronous solutions are combined in distant learning [14] [15] [16]. E-learning

collaborative circles in which people learn in groups while producing an outcome like an e-book, report etc. is proposed as a distant learning methodology in [17].

2.4. Cloud Computing

Recent advances at the internet technologies, increasing data transfer speeds result with the emergence of the new paradigm called cloud computing. Powerful computer centers serve their services, like LMS service, to a wide range of customers. This effort reduces the repeated effort at different sites [18]. In example, for the calculus class, each trainer does not need to prepare his own training material. Prepared high quality training material can be served centrally and can be used by all the trainers all over the world. Moreover, LMS can be operated centrally by the professionals and several different subscriber companies, schools, and the training centers can use these LMS services from the cloud [19]. Since LMSs/distant learning systems usually require many hardware and software resources, system setup and maintenance costs of the LMSs/distant learning systems can be lowered with the use of cloud computing systems. A metric system has been developed in [20] for measuring the system implementation process and the long-term usage efficiency of cloud computing based LMS solutions.

2.5. Smart Classrooms

Emerging LMSs, use of virtual reality in classrooms and use of internet technologies make the smart classrooms possible [21]. In a smart classroom, a smart board connected to a computer is employed instead of a dummy white board or blackboard. The smart board makes reuse of the training material possible. Also, eases to going back and forth on the material is possible. Integrating the computer of the smart board with an LMS and connecting to the internet make the distant learning activities with the smart classrooms possible. In other words, the high-quality training materials can be used repeatedly by both the trainer who prepared them and the other trainers, who need them, all over the world. A trainer from very distant

place can connect to the classroom and carry on the training interactively with the trainees [22]. The training session can be saved to the computer and the session can be made available with the use of an LMS. The trainees that missed the session and that participated to the session however did not understand some parts of the session, can later watch the session to catch up. On the other hand virtual reality systems are used in the smart classrooms as well. These systems help visualize the training subject for easy understanding. For example, for the biology class, 3D visualization of the human body makes the training much more efficient.

2.6. Flipped and Blended Learning

Availability of LMSs and the use of internet technologies caused a shift at the training habits. At the traditional training methodologies, the trainer talks about the subject at the classroom and the trainees perform exercises at home. Emerging Flipped Learning approach reverses this habit. Trainees study the subject at home and the exercises performed at the classroom together with the trainer [23] [24] [25]. While getting the classroom environment more trainee-centered [26] [27] [28], flipped learning requires training material to be available for self-studying of the trainer before the class. Training videos, recorded class sessions, offline training materials, e-books, interactive e-books, virtual reality tools are the materials that can be used for this purpose.

On the other hand, while flipped learning has a clear-cut of what to do in the classroom and what to do at home, blended learning, in contrast, blends at home and in class activities of the trainee. In other words, it blends the face-to-face activities with the distributed online activities [29]. In this respect, flipped learning can be thought as a subset of the blended learning.

3. CONCLUSION

In this study, the impact of the recent progress at the computer and the networking technologies on the training and education systems is examined.

The trend shift, in the training and education systems, towards flipped and blended learning caused by these progresses is also presented.

LMSs, virtual reality systems, distant learning technologies, cloud computing technologies, smart classes, flipped learning and blended learning, with the other emerging technologies, approaches and tools, cause significant change in the traditional education. This change makes the education more trainee-centric and ubiquitous as well.

It seems that the smart classrooms which contain aforementioned technologies will become widespread and can make the training and education process independent from the time and the location.

It is a fact that the use of these abovementioned technologies, approaches and tools in the educational process, will significant contribute to the quality of education.

It is evaluated that some new studies related to the contribution of the emerging educational technologies to the education processes are needed and these studies will provide acceleration in the usage of emerging technologies in the field of education.

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