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A CONCEPTUAL MODEL FOR OPEN U-LEARNING PLATFORM

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Abstract

Modern teaching methods applied in a university environment largely determine the quality and effectiveness of the educational process. The choice of a certain method and its application is left to the respective educational institution, which must make the right choice, according to the specifics of its educational programs and goals. In this paper a comparative review of modern e-learning, m-learning and u-learning methods is presented. Their main characteristic parameters are exposed. An open conceptual model for the u-learning platform is proposed. The model is focused on using inside and external, internet-based learning resources and is based on Artificial intelligence to offer the most proper learner-centered learning.

Keywords: Teaching methods; Educational process; Educational platform; E-learning; U-learning.

1. Introduction

The learning process has two main components: learning strategies and technologies used in learning. More and more new technologies are being incorporated into the learning process due to computers and the Internet: new writing technologies, new communication technologies, new visualization and storage technologies, etc. [1]. New learning paradigms are emerging as a result of technological developments. The paradigms of e-learning, m-learning and u-learning are of greatest interest from a technology perspective.

The paradigm for computer-based learning emerged as early as the middle of the 20th century. The concept of e-learning appeared at the end of the 20th century, provoked by the emergence of the Internet. Learning Management Systems (LMS) and virtual classrooms began to appear. The real boom in e-learning was at the beginning of the 21st century when many universities began to offer online courses.

The main characteristics of the e-learning are clearly described in [2]. It can be summarized that e-learning is aimed at offering anytime, anywhere learning content that enables learners to follow their own pace of learning, receive feedback and test the level of knowledge acquired, to communicate synchronously and asynchronously with teachers and other learners. LMS is used as a platform to implement e-learning. The learning materials are locked in the selected LMS and limited by the resources published in it. An LMS allows for some customization. It allows different learning paths to be followed, which are however limited by the resources of the portal used. Additional forms of interactivity can also be built into modern LMSs. In addition to the standard discussion boards, tools for voice-audio conference connections are easily embedded. It can be summarized that e-learning is aimed at offering anytime, anywhere learning content that

enables learners to follow their own pace of learning, receive feedback and test the level of knowledge acquired, to communicate synchronously and asynchronously with teachers and other learners. LMS is used as a platform to implement e-learning. The learning materials are locked in the selected LMS and limited by the resources published in it. An LMS allows for some customization. It allows different learning paths to be followed, which are however limited by the resources of the portal used [3].

The term mobile learning (m-learning) began to be used in the late 1990s with the appearance of the first mobile phones, but the real experiments began at the beginning of the 21st century with the appearance of more modern mobile devices, such as PDA devices (Personal Digital Assistants) and early smartphones. M-learning extends the possibilities of e-learning by having almost the same features as e-learning but allowing access from mobile devices. This improves access to learning resources. The use of mobile devices in m-learning leads to some problems. For example, smaller display sizes, limited capabilities of operating systems, variety of operating systems, memory limitation, and security threats [4].

Ubiquitous learning (u-learning) [5] began to be talked about at the beginning of the 21st century. U-learning can be defined as a learning environment that is supported by mobile and embedded computers and used for formal and informal learning. It provides learners with content and interaction anytime, anywhere, similar to mobile learning. But it is characterized by a high degree of personalization - the learning materials are in different formats (text, video, collaborative work, games, etc.) and are tailored to the current learning goals, interests and preferences of the learner, cognitive characteristics, learning history and current state of his competence in the field of study, the characteristics and peculiarities of the location, the technology used as a learning environment and the context of the situation in which the learning takes place [6]. We can highlight several significant features of u-learning:

- Inclusion of Social Media and User-Generated Content (YouTube, Wikipedia).
- The integration of artificial intelligence (AI) and machine learning (ML) algorithms into educational technology to build adaptive learning systems.
- Inclusion of Augmented Reality (AR) and Virtual Reality (VR). The advancements in AR and VR technologies opened up new possibilities for immersive and interactive learning experiences, allowing learners to be engaged with content in a more hands-on way.
- Internet of Things (IoT) and Smart Environments. The IoT brought about the concept of smart environments, where everyday objects and spaces are connected to the internet. This has the potential to create highly interactive and context-aware learning experiences.
- Gamification and Education Technologies Start-ups. The incorporation of gaming elements into educational experiences, as well as the proliferation of educational technology start-ups, brought new approaches to engaging learners and making education more interactive.

The purpose of this paper is to propose a conceptual model for open u-learning platform. The conceptual model represents the main components and the implementation requirements of the main tasks, faced by an open u-learning platform. The next part of the paper is organized as follows: in Section 2 we give a comparison between e-learning, m-learning and u-learning features. In Section 3 we present the most popular u-learning platforms. In Section 4 the proposed conceptual model for open u-learning platform is introduced. In Section 5 the conclusion statements and outline for further development of the work are discussed.

2. Comparison between u-learning, e-learning and m-learning

The most important parameters of current paradigms for digital learning are Accessibility, Flexibility, Collaboration, Interactivity, and Personalization. Table 1 represents the comparison of the three learning paradigms, with respect to these parameters.

Parameter	e-learning	m-learning	u-learning
Accessibility	At any time and from any place.	Anytime, anywhere and from different devices, including mobile.	Anytime, anywhere and from different devices, including mobile.
Flexibility	Pre-prepared content is available, which can be in different forms: text, video, and quizzes. The learner can determine his learning path within the proposed resources.	As with e-learning, but the content is adapted to the capabilities of mobile devices.	Resources from social networks, games, AR and VR, and IoT are added to the possibilities characteristic of m-learning. The learning path is formed using AI and ML.
Collaboration	Collaboration is often facilitated through online platforms and tools like:	To all e-learning collaboration tools are added discussion	Collaboration is like m-learning but can occur in a wide range of settings,

	discussion forums, group projects, virtual classrooms, and collaborative document editing.	boards, instant messaging, and video conferencing.	including physical locations, online spaces, and through various devices.
Interactivity	Is often facilitated through multimedia elements, quizzes, simulations, and other interactive activities. Learners engage with the content by clicking, typing, selecting options, and receiving immediate feedback.	Takes advantage of the touchscreens, sensors, and other features of mobile devices to provide interactive experiences. This can include gestures like swiping, tapping, and pinching to zoom, as well as utilizing the device's camera or microphone for activities like taking pictures, recording audio, or participating in video discussions.	It can take various forms, from virtual simulations to physical experiments, depending on the context.
Personalization	It is achieved by adaptive learning algorithms, learner profiles, and intelligent content recommendation systems. E-learning platforms may track learner progress and behaviour to provide customized content suggestions, adapt the difficulty of exercises, or offer targeted resources to address areas where a learner might be struggling.	Mobile apps can track user behaviour, preferences, and progress. It can use this data to deliver content that aligns with individual learning goals. Additionally, features like push notifications can be used to remind learners of upcoming assignments, assessments, or activities that are relevant to their specific learning journey.	Personalization in u-learning is about adapting learning experiences to fit the specific context and preferences of the learner at any given moment. For example, a u-learning system might adjust the content and format of a lesson based on whether the learner is using a laptop at home, a mobile device on the go, or participating in a hands-on activity at a physical location.

Table 1. Comparison between u-learning, e-learning and m-learning

3. U-learning platforms

U-learning is a learning paradigm and does not require a specialized learning platform. It can be implemented with more or less difficulty in any of the available LMS platforms. An implementation integrated into the Moodle platform is presented in [7].

In [8], the possibilities of popular LMS platforms such as Wikipedia, MOODLE, Web 2.0, Web 3.0 and Blackboard for the implementation of u-learning are discussed. It is understood that MOODLE, Web 2.0, Web 3.0, and Blackboard do not include social networks and do not provide the possibility of free access to educational resources, as well as the free possibility of creating them. Only Web 3.0 makes it possible to easily include social networks in the learning process.

In [9], the effects of implementing IoT in education are discussed and how u-learning that includes IoT can increase the quality of learning by enabling much more realistic experiences for students. It is argued that with the implementation of IoT, u-learning has the potential to replace traditional classroom learning.

Various methods have been developed to measure the success of information systems used for training, which could be used to evaluate the effectiveness of the system after it has been built. Models for Measurement Success are presented in [10]. They have focused on the performance of the following characteristics of u-learning - 1) context-awareness, 2) interactivity, 3) personalization, and 4) flexibility.

In [11], a model for U-Learning in higher education is presented, taking into account the two aspects of learning: pedagogical and technological. A U-CLX model is presented to measure the effectiveness of U-Learning in four dimensions: time, place, environment and context.

In [12] it is pointed out that the main factors for the effectiveness of digital training are 1) university level factors; 2) teacher level factors; 3) student level factors.

4. A conceptual model for open u-learning platform

We propose a conceptual scheme for building an open platform for ubiquitous learning. At the highest level, the platform includes 4 modules: Participant Profile, Learning Content Source Profile, Own Resources and Management Module (Fig. 1).

In the Participant Profile module, information is stored about all participants registered in the system, who at one moment have the role of learners, at another - the role of content authors, and at others - participants in joint projects. The Participant Profile module has 3 nested modules.

- The first nested module contains static data about the participant - personal data, contact data, and account.
- The second nested module contains dynamic information that is regularly updated by the participants (topics of interest, topics on which he works, preferences for the format of the offered training materials, participation in collaborative work groups, a collection of acquired certificates, etc.)
- The third nested module contains dynamic information acquired by an analysis engine (based on processing statistical data and application of artificial intelligence). This information is updated based on the participant's activity and includes information about preferred sources of information, a comparison with the profiles of other participants, and suggestions for inclusion in various discussion groups, groups working on a joint project, etc.

The second module (Own Resources) includes four nested modules:

- e-learning platform with its own training resources;
- blogs of participants on topics of their choice;
- groups of interest;
- joint projects on which groups of participants work;
- a module with AI that makes rating evaluations of learning resources, published blogs, topics of joint projects, determining their adequacy, level of knowledge offered and their association with different fields of knowledge.

The third module (Profile of Learning Content Sources) aims to create a database of information sources and their characteristics to more quickly and adequately offer these resources to participants.

The fourth module controls the operation of the system. Its task is to coordinate the work of the first three modules and make the connections between them.

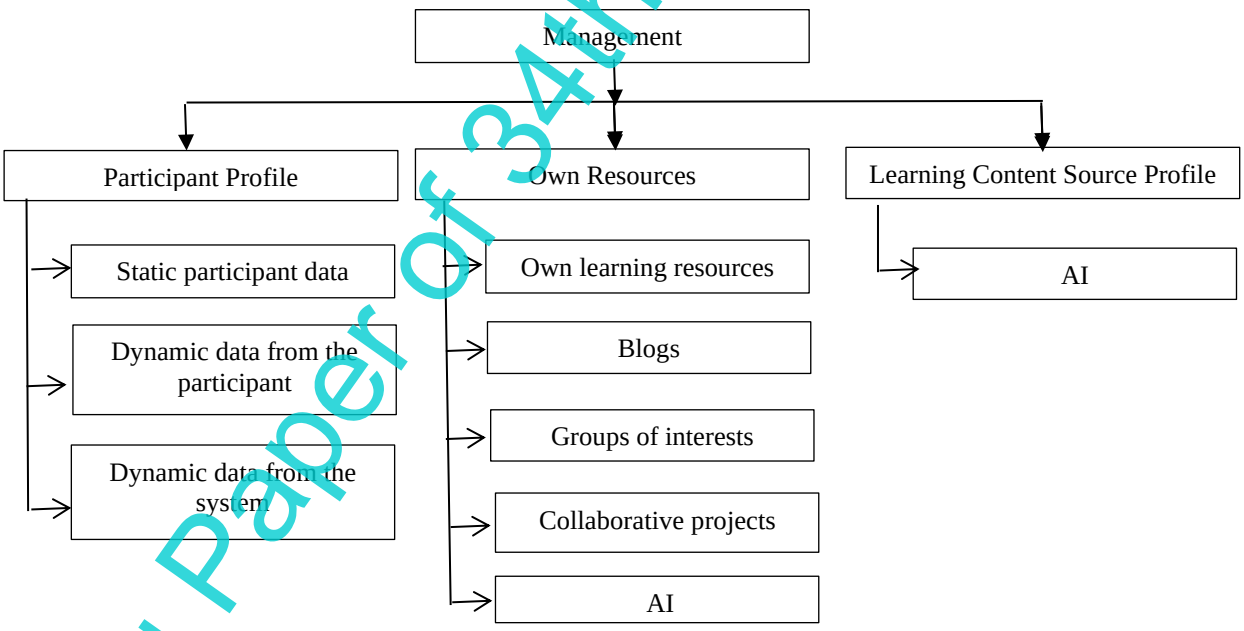

Fig. 1. The diagram of conceptual model for ubiquitous learning open platform

5. Conclusion

The advantages of the proposed conceptual model for open ubiquitous learning avoids some serious problems related to the learning process and its adaptation to the needs of the learner. Factors such as university level, teacher level, and student level can successfully be ignored.

- The level of the university is not decisive. Learning resources are searched all over the Internet, evaluated and offered according to the needs of the specific student. Thus, they are neither very difficult nor very easy to learn but are at a level corresponding to the preparation of the particular student.
- The level of the teacher is not decisive. Retrieved resources are evaluated by instructor and course rating, and resources with low ratings are not recommended.
- The level of the student is also not a factor. The suggested materials are tailored to his level. If the student starts a course and finds that his level is not adequate, he is not obliged to finish it but can choose another course on the same topic.

The disadvantages of the proposed model can be summarized in the following points:

- Great search and analysis complexity. There is no single standard for describing the courses offered (level of complexity, included components, resources, etc.) and for their rating.
- Accessibility issues to closed learning systems that may contain quality courses. This can be avoided by developing protocols for information exchange.
- The validity and recognition of certificates issued by one educational institution in another educational institution.

By implementing this model in the educational process, students and external learners will have access to the best and suitable for their learning style open resources for acquiring knowledge and improving their qualifications. They will be able to create their own resources with original content or with links to other resources. We believe that in this way the learning process will be better adapted to the needs of each learner, learning outcomes will be improved and new branches of science will be rapidly incorporated.

The implementation of this model requires the efforts of a team of programmers and AI specialists. For the future, we will focus on creating the backbone of the platform, creating learner profiles, discovering and providing open resources depending on that profile. We plan to involve the students from the University of Telecommunication and Post, Sofia, to test the functionalities.

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