Types, Technologies and Trends in E-learning

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Abstract. The article outlines the existing e-learning systems and kinds of learning approaches. Different types of learning require different technologies and platforms for their implementation. E-learning standards have to be applied to ensure that educational courses are developed and can be used seamlessly in a variety of software programs, platforms, and devices. The problems and directions for the development of education through digital transformation are discussed.

1. Introduction

In recent decades, teaching in general has undergone dramatic changes – from the standard classroom environment and training, led by teachers and instructors, to modern learning opportunities through gamification, artificial intelligence, mixed and virtual reality. Wide penetration of e-learning is a new reality. E-learning itself is also developing rapidly and currently numerous areas and technologies continue to develop as many new trends are observed.

Technology remains the leading keyword when it comes to e-learning. Whether teaching children, adults or developing corporate training courses, taking advantage of the advanced opportunities offered by new technologies is a must. On the other hand, many users are not ready to accept all new changes immediately [6], as this would mean a complete overhaul of their learning management systems and websites.

In the paper types and standards for modern learning platforms are considered. The technologies for provision of a variety of ways for access to formal and non-formal education are analyzed.

2. LMS and LCMS

2.1 Learning management system

Regardless of the directions and trends in e-learning, it is based on two types of systems – Learning Management System (LMS) and Learning Content Management System (LCMS).

LMS are software applications for management, administration, documentation, tracking and generation of reports for training programs, classes, online events and more. The main features of such a system include:

- Providing access to educational content;

- Assigning formal learning activities and courses to pre-defined groups;

- Compatibility with SCORM, AICC and xAPI;

- Event and registration management;

- Tracking of completed courses and reporting of learning outcomes.

2.2. Learning content management system

LCMS in turn, are electronic environments that perform the function of a learning repository – for storage, management and maintenance of the learning content itself. The purpose of these systems is to serve the management of educational content, and often for its development. This type of system distinguishes the physical content from the way the learner presents it. The main features of such a system include:

- Built-in content repository (the central database in which the learning content is stored and managed);

- Automated application for creating and shaping educational content, as well as for collaboration;

- Tools for creating templates, as well as individual learning objects and combining them in different modules and courses;

- Interface for dynamic provision of learning

content – this part of the system deals with the personalization of the content that is provided to the respective learner. It must be in accordance with the user's results in the entrance examination or with the tasks the user has set for himself. The system maintains records of user performance and progress during all activities, links to appropriate sources of information and various types of user feedback assessments;

- Flexible content publishing (ILT, eLearning, HTML5, AICC, SCORM, mobile);
- Tag content with metadata to maintain personalization based on role, product, level, region, etc.;
- Translation and localization support.

In overall, the trend is to focus on the content and the individual user, in order to provide not only new knowledge and skills, but also positive experiences. In other words, e-learning solutions are up to date when they aim to meet the needs of learners, put the person at the center of the process and offer the most appropriate learning opportunities.

3. Learning types

Different types of learning require different technologies and platforms for their implementation.

3.1. Microlearning

Although micro-learning is not a new or emerging trend, it is becoming more and more relevant. This is one of the preferred ways of learning, as it allows the content to be divided into smaller pieces and facilitates the assimilation of information by the learner. Since in micro-learning the learning content consists of smaller modules, it is easier to complete them and the material – learned on the go. The main emphasis here is on creating meaningful content, which is actually useful for the learner because simply breaking small pieces is not effective enough. It is necessary to know the needs of students and to choose the most appropriate format for them.

3.2. Blended learning

Blended learning combines the strengths of both traditional and e-learning to offer the best for consumers. To make learning more effective, blended learning offers an educational program that combines face-to-face meetings and online lessons. It is a good approach to use in educational institutions, as it offers more freedom and diversity to students and makes the learning environment more diverse and interesting.

3.3. Mixed reality

Another interesting trend, which also combines two forms, is the emerging Mixed Reality (MR). It combines Augmented Reality (AR) [2] and Virtual Reality (VR) [3] to present the learner with a unique tool for experimenting and acquiring new knowledge and skills. Many educational institutions have already adopted AR and MR [4, 5] as a way of teaching pupils and students in various subjects, including science and mathematics. It allows viewing and modifying the content, as well as experimenting in a way that is difficult to achieve for other available technologies, which increases interest and leads to better results.

For its part, Virtual Reality is often used to teach safety-related procedures. It allows the learner to be part of a potentially dangerous situation such as fire, earthquake, etc., enabling the learner to learn from his mistakes. The combination of AR and VR will provide more opportunities for learners to develop their skills in a safe learning environment.

3.4. Gamification

Gamification is one of the fastest growing areas of e-learning, which uses game elements in non-game situations to improve user engagement during training and their subsequent evaluation. In practice, this type of learning uses characteristics of the game (such as goals, rules, elements of entertainment, feedback, rewards), which are applied to solve a real problem and to measure user behavior.

It is believed that with the methods it uses, gamification can compensate for the shortcomings of other e-learning methods by engaging attention and increasing the concentration of learners over a longer period of time.

3.5. Online mentoring programs

Online mentoring programs are becoming increasingly popular. Combining live meetings or live video links with e-learning, they are a great way to provide personalized experience and first-hand knowledge in a specific field. Learners can benefit from live meetings with experts on the subject, watch pre-recorded videos and attend webinars to gain knowledge and receive the support they need to succeed. A mentoring program can be set up in educational institutions or in any organization that tries to provide students with the best opportunities for development.

3.6. Mobile learning

Mobile learning is a stage in the development of e-learning. Both types of training have similar characteristics. One of the things that distinguishes mobile

learning from e-learning is the use of mobile technologies – mobile devices and wireless communication technologies. In this way, the learner can learn from any place and at any time, and this allows full utilization of the learner's time [7]. The technological specifics of mobile devices – screen size, resolution, battery life, as well as those related to the development of a mobile application, require the individual learning units to be short, clear and specially designed for a mobile device. Awareness of the limitations of the user interface is also important to meet the needs of users without being burdened with unnecessary complexity.

4. E-learning standards

Guidelines for designing and developing content, platforming it, and ensuring interoperability with different devices can be found in the E-Learning Standards – a set of general rules that apply to content and software development of learning management systems.

There are two main types of e-learning standards (*figure 1*). Course design standards refer to various aspects of course design and development, and technical standards refer to the placement of courses in LMS or other types of portals.

Using standards to design educational content before developing a course helps developers clearly define the goal, strategies, and choose content, interactivity, assessment methods, and feedback methods. Bloom's taxonomy is a good guide for developing a logical framework for learning content and ensuring consistency between learning objectives, activities and assessments.

Graphic design standards apply to the graphical user interface (GUI) and navigation elements. It itself must be intuitive and user-friendly to be successful. The purpose of design standards is to ensure consistency and uniformity in different learning units.

Media standards ensure consistency and compatibility between the media elements used in a course in terms of the presentation of screen content – screen size, text elements, graphics, animation, audio and video.

It is always good practice to compile writing guidelines and style guides for course developers. These writing standards act as a guide for the use of language, punctuation, bulleted lists, abbreviations, acronyms, and other elements of text. For example, you might recommend using an active voice instead of a passive voice and simple, direct language, rather than academic, abstract language.

Assessment standards, which must be in line with the objectives of the course, determine how learners' understanding will be assessed after completing the course. Bloom's taxonomy or Kirkpatrick's four levels of assessment provide some guidelines for assessment.

The technical standards relate to the interoperability and portability of e-learning courses across devices, browsers and platforms. The most commonly used technical standards are SCORM, AICC and WCAG.

The ultimate goal is to ensure that educational courses are developed and can be used seamlessly in a variety of software programs, platforms, and devices.
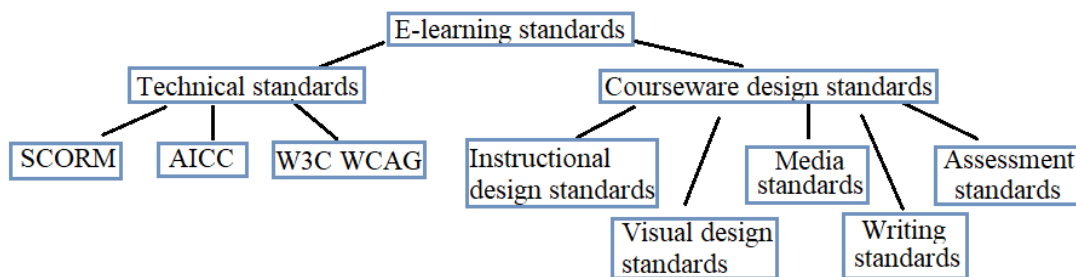

Figure 1. Two main types of e-learning standards

5. Personalized learning

The concept of personalized learning is not new to education. Personalized learning provides a unique, highly focused learning path for each student. Individual attention on the part of the teacher is not possible in traditional

educational models with a large number of students.

Personalized learning is a strategy that good teachers can implement. Without good teachers and a good strategy, even a great product designed for personalized learning applications has limited value.

Used in isolation, any customized learning solution can be of little use (and can waste resources and time). However, when practices are integrated and aligned with institutional policies and planning for student, teacher or staff development, the potential benefits of personalized learning can even be successfully scaled to the benefit of a large number of learners.

But for tangible results to be achieved, personalized learning must use IT systems and tools to tailor learning content based on strengths, weaknesses and the pace of learning. Technology, including data analysis, is at the heart of personalized learning, which builds a "profile" of each student and makes continuous adjustments to learning pathways based on learner outcomes.

In addition to educational technologies, the overall approach to personalized learning can be designed to include many other complementary educational approaches [1]. For example, in an attempt to create a more comprehensive approach to learning, some institutions are implementing 21st century classroom redesign, competency-based education, the "inverted classroom" and other learner-centered approaches.

6. Adaptive learning

One of the many possible approaches to personalized, highly focused learning for a large number of learners is Adaptive Learning. It requires the use of various technological systems and tools.

Adaptive learning systems use a non-linear, data-based approach to the delivery of learning material. They dynamically adapt to learners' actions and levels of effectiveness, providing the types of content in the appropriate sequence that individual learners need at specific points in time to make progress. These systems use algorithms, grades, student feedback, and corrections to provide new learning material to learners, both for those who have achieved and for those who have not achieved the appropriate level of mastery.

Knowledge and technologies from various fields are used for the realization of adaptive training – including computer sciences, artificial intelligence, psychometry, education, psychology, etc.

Adaptive learning is partly driven by the realization that personalized learning cannot be achieved on a large scale through traditional, non-adaptive approaches alone. Adaptive learning systems seek to transform the learner from a passive recipient of information to an active participant in the educational process. Adaptive systems find a place both in the field of education and in business training. The reason for this is that it allows each user to skip the content they are already familiar with and focus on new skills. In this way, the difficulty and pace of the course can be adjusted in real time to match the speed of learning. Adaptive learning must be combined with effective assessment and analysis to measure its effectiveness. The number of platforms offering adaptive learning is growing and technological advances are facilitating the process. The main advantages of adaptive learning include a better learning experience, regulation of learning speed and data collection for learners, which can be analyzed in order to improve learning. This is an approach that has not yet reached its full potential.

The general approach to building a platform for sharing online educational resources in LMS and LCMS can be described by several main steps, shown in the following diagram (*figure 2*).
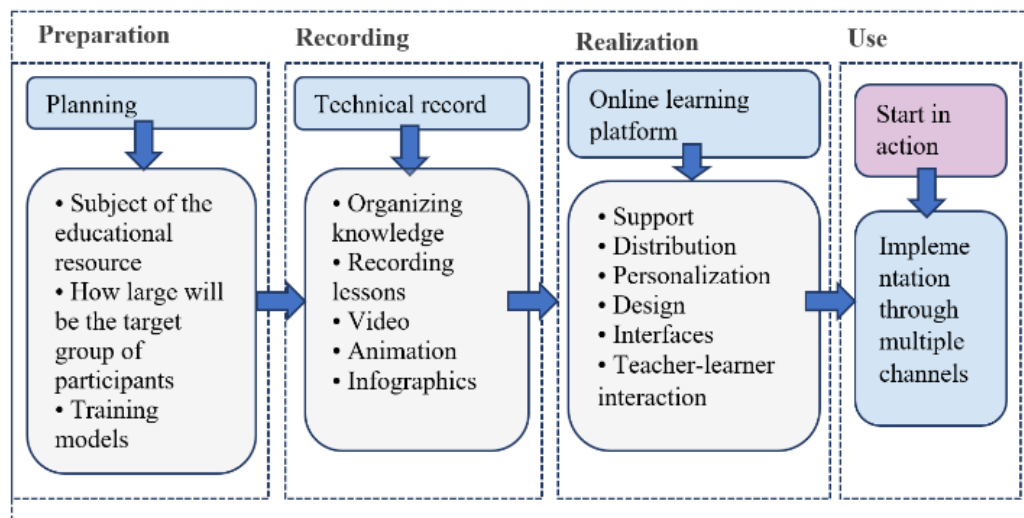

Figure 2. The general approach to building a platform for sharing online educational resources

Conclusion

In conclusion, it can be said that there is a tendency for modern trends and technologies in e-learning to be updated and upgraded in order to offer better training and get visible results.

Acknowledgements

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