

Online tools for new teaching concepts and new teaching conditions

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Abstract: *Technology is today engaging students from all levels of education in a ways that older generations thought of as the distant future. This paper provides a theoretical clarification of the concepts of e-learning and online learning, provides an overview of their application through all levels of education in Serbia, and presents the role of these systems in modern education. Also, the paper presents the most commonly used platforms and tools for e-learning with the recommendations of possible areas of their usage.*

Keywords: *e-learning, online learning, online tools for education, LMS*

1. INTRODUCTION

Young people and children grow up in a media environment, which is a significant challenge and (development) task for themselves, their parents and education system. The education system today has a very complex role to play: it has to develop basic knowledge from one subject area, but to teach students how to trace the role of that area in the world's development, to teach them how to interconnect with all the people that have similar area of interest and to do that using modern technology. Another world said, the education system has a role to teach young people how to become the citizens of the world in 21st century. This is a very demanding task because young people are growing with technology that can easily take all their attention in none desired direction and education system must find a way how to teach on interesting and inspirational way.

Information technologies, as a part of our lives, are constantly changing the way we live, work, think [12].

The development of the global network, as well as computer technology, have contributed to the creation of new ways of learning and the one among them is distance learning (distance learning, e-learning). Computer-assisted learning, distance learning, virtual and WEB classrooms are part of the terminology used to describe e-learning systems. It is not necessary to be online to talk about e-learning. Distance education does not necessarily imply the use of modern information and communication technologies (ICT), while this is the case with electronic education (and communication by mail is a form of distance

learning). E-learning is about the use of computers, the Internet, mobile devices for exchanging information.

E-learning is a convenient and most commonly used way to implement distance education, and can be used as a supplement to classical education. Distance education is a field of education that focuses on learning methods and technology in order to transfer knowledge through them, usually individually, to students who are not physically present in traditional educational institutions, such as school or classroom, or near teachers.

2. DISTANCE LEARNING, E-LEARNING AND ONLINE LEARNING

When talking about distance learning, the following terms are often used: Distance Learning, Distance Training, Distance Education, e-learning (E-Learning, e-Learning), Online Education, Virtual Instruction, Virtual Education, Virtual Classrooms, Electronic Classroom, Blended Learning, etc.

Understanding these terms as synonyms is not accidental. Common for all terms is that they assume a learning process in which the source of knowledge and the recipient are physically distant and in which their relationship is mediated by the use of ICT, and individually depict the nuance of options within the distance learning process.

E-learning can be defined as the process of transferring knowledge and skills electronically with the use of appropriate computer applications, i.e., dedicated programs, and learning environments. These applications and processes include learning via the web, computers, digital classrooms, and content is transmitted over the internet, intranet / extranet, audio and video tapes, satellite television.

The basic definition of e-learning is that... *the use of multimedia and the Internet to improve the quality of learning - by providing access to remote resources and services and by enabling distance communication and collaboration.*" (E-learning Strategy Task Force, [28]). E-learning is a kind of communication channel, a channel through which learning takes place, like face-to-face communication, like print or phone, like TV and audio -video system. ("E-learning's greatest hits," Clive Shepherd, [29]).

In the European Community, the e-learning Action Plan defines e-learning as "the use of new multimedia technology and the internet to demonstrate the quality of learning through easier access to aids and advice, as well as distance learning and collaboration."

Distance learning originated long before we first thought. Of course, not in the form in which we know and use it today, but it had the same role - to overcome physical distance for the sake of transmitting knowledge.

The pioneer of Distance Learning was Isaac Pitman, a shorthand teacher. He applied distance learning in his work with his students for the first time in 1840 in England. He sent assignments by mail to students, and they returned the works done to him, for the reviews. In 1858, the University of London decided that students could take exams without physical presence [22]. It was the first distance learning, primarily aimed for marginalized groups, such as women, who had limited access to educational content.

At the beginning of its development, distance learning was primarily based on using the postal system, providing the possibility of education to people who were prevented from attending classes in classical schools. Thus, the first stage of the development of distance learning was in fact correspondence learning.

Pioneer in institutionalizing this type of education was the University of South Africa, which introduced Correspondence Education courses before 1946. The largest Distance Education University in the UK, Open University, has existed since 1969. A similar one was opened in Germany in 1974, Fern Universität in Hagen.

Today, there are more than 90 institutions around the world, most often called Open University, in English or translated into local languages and modeled on the long-established Open University of England principles, which primarily emphasize the importance of distance learning [21].

Unlike correspondence education, where the interaction between students and teachers took place mostly in one direction (teacher - student), in the online environment there are several types of interaction. In the interaction are involved: students, online interactive communication system,

educational content (teaching materials), mentors /teachers. These interactions form the basis for the development of collaborative learning, which promotes learning in the online environment [11].

Information technology is an integrated part of higher education. Between 1970 and 2000, the demands of students and teachers for greater flexibility changed conditions in the learning and teaching process [14],[1].

Ratio between received and adopted knowledge is a question over all questions during whole education history. This is a very important issue and giving appropriate answer require deep analysis. In the relevant literature, numerous studies compare student achievements of traditional and online learning and teaching. Some research shows that online learners are better students while others suggest that there are no differences between study models [13].

But, in addition to the previous noted results from researches, it is important to take care about necessary knowledge and abilities associated with the performance of a specific job. Developed competencies also include adequate, moral behavior of an individual in a narrower and wider social context enriched by modern information and communication technology [21]. Information and communication, and especially Internet technology, nowadays have a strong influence on changing the economic structure of both the national and the world economy. Different information technologies and communication are closely related [10]. Receiving knowledge today deeply depend of teacher's/trainer's ICT skills. The implementation of education in the workplace is increasingly implemented with the help of information and communication technology for learning [3]. Today's teacher must be deeper involved in development of ICT. A quality teacher must master modern technology and must continuously work on himself.

On the other hand, books and textbooks used to be the main and most important source of knowledge, and today equally valuable content can be found in various sources of knowledge on the Internet. The content on the Internet is very comprehensive and available to everyone, so it is very important for users to know how to evaluate it and correctly choose sources of knowledge that have been checked [18].

3. TECHNOLOGIES FOR ONLINE LEARNING

Although we live in an advanced information age where the speed of the Internet and telecommunication networks (4G and 5G) are more than sufficient, many have found themselves unprepared by the great demand for online learning and teaching, created by the Covid19 pandemic. During the lockdown and virtual lectures, a large number of systems could not accept a large number

of users (students), blockages occurred. The system could not accept everyone turning on the video at the same time, chat messages were delayed, sound was blocked, etc. [8]. Some old questions surfaced us and the main is IT infrastructure.

Numerous new perspectives and opportunities are lighten up since 2020, within them and the usage of internet in educational process, as the internet, has already proven itself as an exceptional tool in science and education [8]. The application of ICT in education includes, among others, the individual learning and teaching, practice and revision, group learning and teaching, e-mail communication (student, teacher, parent), some pedagogical documentation, administrative work and much more [11].

Among most emphasized benefits from learning in online environment belongs increasing interactivity between participants, where we have interactions among [19]:

- Student/online interactive system,
- Student/educational content,
- Student/student,
- Student/mentor (teacher/trainer) [11].

The other most cited benefits are:

- more effective visualization of contents,
- better communication between students and mentors,
- effectiveness of time usage (there is no need to travel),
- easier revision of materials (teacher's and student's),
- one-to-one approach etc.

In this way of learning, part-time students are more motivated and they achieve better results than in live model of teaching [4]. This can be explained with the fact that in online learning they have specially defined terms for lectures that are adapted to their working time [9].

The structure of four areas of ICT usage that influence on digital literacy achievement is shown on Fig. 1 [17].

The main noted obstacles in online learnings evidenced in the literature are:

- high level of frustration,
- decline of satisfaction,
- frustration caused by technical problems,
- lower level of interaction with mentors,
- lot of emails and interactions on online platforms [7].

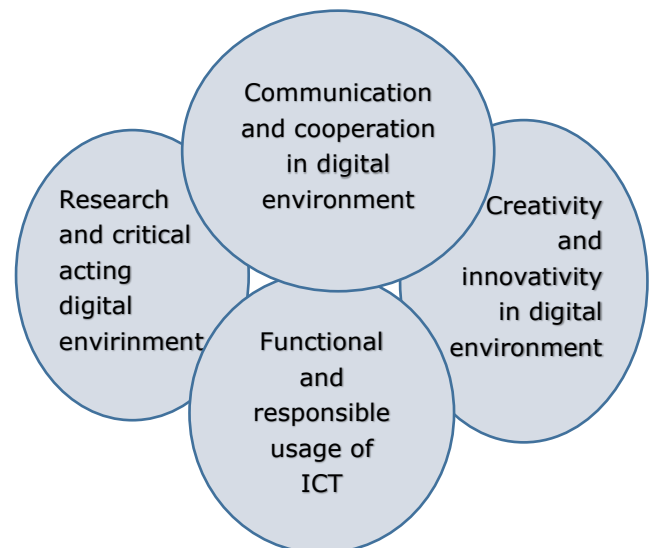


Figure 1. *The structure of cross-curricular topics in the use of information and communication technologies*

In all discussions about IT, it is important to think about all good and bad sides of IT usage, so the innovation direction in the area of IT could be lead in a proper way. It is very important to emphasize that all ecological dimensions must be taken into consideration when debating about IT and online learning [15].

4. THE MOST POPULAR SYSTEMS FOR ONLINE LEARNING

The role of all educational systems today is, to prepare young workers to become citizens and workers of the 21 century. Tools on the network like as: Zoom, Teams, Skype, Moodle, Google Hangouts etc. are well known among wider population. Most popular tools are Zoom and Microsoft Teams. Their main comparative characteristics are given in the table 1.

For education system the especially interesting are Learning Management Systems (LMS). LMS is a software system that is designed to contain in one place everything that teachers and students need for online learning [23]. This system of learning can be used independently or in combination with traditional way of learning (blended learning).

Most LMSs are web-based, to facilitate access to learning content and administration. They are used for training in industry (financial services), in educational institutions as support for classical lectures in classrooms or for offering courses to the general population.

Table 1: The comparison between Zoom and MT

| TOOL | Zoom | Microsoft Teams |
|------------------|--------------------------------|-----------------------------|
| Usage | Easy, free of charge | Complicated, free of charge |
| Message exchange | Yes | Yes |
| Audio/video call | Yes | Yes |
| Files exchange | Yes | Yes |
| Group call | Yes | Yes |
| Screen sharing | Yes | Yes |
| Data protection | Bad – in the development phase | Good |

LMSs are developed on different development platforms (Java/J2EE architecture, Microsoft.NET, PHP), and usually use a database at their "back" end. Some systems are commercial, do not have a free license or access to the source code is limited, while others are free, open source, and have a wider application.

Platforms for the creation and delivery of WWW program support for learning began to develop since 1996. All the necessary tools for implementing the "WWW class" are combined: creation and delivery of learning content, quizzes and tests, communication, student data recording. Platforms allow storing learning content, providing additional information needed for learning, and can give information to participant in various ways.

Functions are divided into two groups:

1. the administrative and
2. the teaching.

In most cases, they have two interfaces (based on roles in education processes):

1. author's - serves for teachers who generate content and
2. user's - for students.

The entrance to the platform is in the form of a portal.

The administrative functions of the LMS include all data records necessary for the functioning of the platform, which are not specifically related to the processes of knowledge transfer:

1. records of subjects and users of the platform (students, teachers),
2. user registration for courses (subjects),
3. creation of permissions and user groups,
4. reporting on class attendance, progress, status and learning results, i

5. support for the creation of teaching materials

The most important teaching functions of the LMS are:

- organization of learning content - in the form of lessons and modules,
- navigation – sequence of learning content in a specific order, visual aid (buttons of a standardized design),
- knowledge check - usually through tests and quizzes for (self) checking of students' knowledge,
- computer communication - allows students and teachers mutual communication that can be private and public, synchronous and asynchronous,
- authoring tools - not all parts offer a complete authoring environment, but they still have the ability to save learning content on the WWW server and link them, and create tests and discussions.

The advantages of LMS are:

1. represent more "economic" knowledge transfer,
2. teaching has been technologically improved, and materials and activities are more accessible to students,
3. it still supports the classical model of learning in a class or group,
4. students are grouped, they start learning at the same time,
5. periodically receive materials and all are expected to complete the tasks at the same time (within the class or planned implementation time),
6. can be used as a supplement to classroom teaching and in mixed model of e-education.

4.1 Moodle LMS

The most popular and mostly used LMS on Western Balkans is Moodle. Moodle is an acronym for Modular Object-Oriented Dynamic Learning Environment. The application is used for creating and maintaining online courses via the Internet and distance learning. There is a large number of users of the application (more than 150 thousand registered users) due to excellent documentation and support.

Moodle is an open source project in which users can view the source code, with the possibility of changing the application and adapting it to their own needs. Although it is protected, users are allowed to use, copy and modify the code, if they allow others to use the code under equal conditions, the original license and protection are not changed and the same license is applied to any other work that comes from Moodle. The application can be downloaded for free from the

official Moodle website. As a web-based platform, it allows access from any location in the world and only requires a device with internet access. The default interface enables compatibility with mobile devices, different web browsers and different operating systems. One of the advantages is the existence of the Moodle community (<https://moodle.org>) which serves for information, discussions and cooperation between Moodle users (administrators, lecturers, researchers, instructional designers and programmers).

The main Moodle features are [16]:

- the creation of a large number of courses,
- the course planning - schedule of activities, calendar,
- the management of users, user roles and user groups on the course,
- the work with already existing files and educational contents,
- checking knowledge and evaluating users,
- monitoring of user activities,
- the numerous tools for communication and collaboration between users,
- the application management - backups, statistics, logs,
- help for users.

Moodle allows constructive approach to learning, because:

- Moodle philosophy" is socially constructive - students learn best if they interact with the learning material, create new material with other students and have a dialogue with them,
- Moodle has interactive and static elements on the Moodle course.

Roles on the Moodle system represent levels of editorial rights, that is, each role has certain authorizations and restrictions on work (except for the administrator role). There are several roles: manager, course creator, lecturer, lecturer without editorial rights, participant and guest.

The Moodle platform has the possibility of applying different types of activities that can be used in its lessons in order to present the content to the students, where some type of activity and interaction is required from the students (e.g. communication, discussion, answering short questions, solving tests and/or tasks, submission of homework, selection, etc.). Activities can be graded and are displayed as items in the grade book. Each activity can be individually edited depending on the needs of the course and lesson [24], [25], [26], [27].

As for online professional practice, for some professions it is relatively easy to do, e.g. in computer science or social science. For some fields such as medicine, professional practice is feasible only with physical presence, so in those cases, professional practice can be carried out when the conditions are met or with the consent of students

to practice and face first-hand a situation like the current pandemic [23].

Beside Moodle, there are numerous LMS systems for e-learning and the most popular are: Google Classroom, Edmodo, BlackBoard, Canvas, Teams etc. The logos of some of them are given on Fig.2.

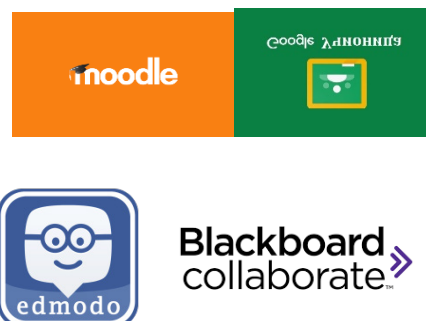


Figure 2. Mostly used LMS systems

4.2 Interesting tools for online learning

As a main education problem today most often communicated problem is dealing with kipping attention of students. In order to make teaching interesting, lot of online tools are available, such as:

- AnswerGarden – a tool for group online discussion or surveys; teachers can use this tool to get real-time responses from students to questions posed,
- Buncee - a content creation and presentation tool that helps students and teachers to visualize, communicate and interact with concepts and ideas in class,
- ClassKick - This app allows teachers to assign assignments to students so that both the teacher and other students can comment on the assignment,
- Crowdsignal - create online surveys, quizzes and questions quickly and easily. Students can respond using smartphones, tablets and computers, and information can be collected for reports,
- Edmodo – an interactive learning platform, where students and teachers can solve questions together,
- Expeditions – Google Expeditions is a learning app that allows teachers and students to go on over 1,000 tours in virtual reality and 100 in augmented reality. You can swim with sharks, visit outer space and more, all without leaving the classroom,
- Flipgrid - students can record 15 second to 5 minute video clips to respond to assigned topics; teachers and other students can leave comments,
- Google Forms - The Google Drive app allows you to create documents that

students can work on simultaneously using their smartphones, tablets and laptops,

- Kahoot - a game-based teacher-student exchange system, where teachers can create quizzes using online content,
- Micropoll - a tool for quickly creating surveys and analyzing responses. Surveys can also be posted on websites,
- Quizalize - a tool that allows teachers to easily create tests and homework for students. Teachers can see how students have done and identify areas that need improvement.
- Sparkpost - Adobe application that allows teachers to add graphics and visuals to flashcards,
- Visme - free software for creating infographics,
- Visme - free software for creating infographics,
- Zoho Survey - creating surveys that students can access and respond to via mobile devices. Teachers can see results in real time etc [27].

Teachers and trainers in the area of programming, can also use [28]:

- Petlja - material for teaching informatics and computing in primary and secondary schools in the field of programming on Serbian,
- Startit - a series of articles about programming in the Serbian language.
- FreeCodeCamp - a list of sites on the Internet for learning programming - everything is free, but it is in English.
- School of Code - a commercial programming school, with plenty of free online materials
- Web programming - a collection of articles for entering the world of web programming. Everything is localized in the Serbian language,
- Kampster - there are free of charge online programming courses, as well as a communication system with students. They also have a solution for schools - a distance learning platform.

For implementation some teaching methods in primary and secondary schools, like inverse classroom, Youtube channels can be used as a part of preparation for those type of lessons or for discussion sessions. Some of the suitable channels are:

- <https://www.youtube.com/education>
- <https://www.youtube.com/user/teachers>
- <https://www.youtube.com/user/BIEPBL>
- <https://www.youtube.com/user/DiscoveryEducation>
- SUPER SCIENCE - a series of video clips that provide answers to unusual questions, from

why the sky is blue to what virtual reality is. The narration is in the Serbian language, and the narrators are some of the famous people from Serbian culture and art who explain the phenomena in a sympathetic way.

As the main skills that are needed for the 21 century are: creativity, critical thinking, ability to observe, problem solving ability, ability to make decisions, it is recommended development of these skills from the early age. These skills can be acquired through specific approach to the tasks, which can be given through interesting media. Some online tools that can be used are:

- Peekaboo Kidz - video clips for young children, which provide answers to various questions such as: *Why? How?*,
- Art for Kids Hub - over a thousand drawing instructional clips and intended for younger ages.
- Crash Course - a channel that explains scientific phenomena in a humorous way. It covers a variety of topics, from historical facts to astrophysical quirks. It is intended for high school students, but with adaptations and with some more detailed analysis, it can, also, be used for higher grades of elementary school.
- AsapSCIENCE - a collection of animated clips dealing with answers to various scientific questions. Witty animation can be very interesting for lower school age children, even when the topics are very difficult to understand.
- It's AumSum Time - animations on various questions starting with: *What if...?* This is interesting for the students of lower grades of elementary school, such as: *What if we lived on Mars?*.
- National Geographic - a collection of video clips that accompany articles on the National Geographic website. Particularly interesting are the 360° video clips, such as the exploration of a coral reef where the viewer can control the image and travel along the seabed.
- Kurzgesagt - In a Nutshell - animated short video clips that provide answers to questions from various fields with the motto: *nothing is boring if told well*. They can be used for all grades.

For secondary school, in making lectures of physics and chemistry more interested, this two Youtube channels can be very helpful:

- The Organic Chemistry Tutor - a collection of video clips presenting instructions for solving problems in organic chemistry.
- Step-by-Step Science - explained concepts in physics, chemistry, mechanics, electronics and astronomy for middle school students

For academic level of teaching, this Youtube channels are very much used:

- MIT OpenCourseWare – recordings of lectures by professors who teach at MIT University. Various topics, such as bitcoin economy or stellar archaeology are some of the themes that are processed. It is intended for HE students, but in some adapted form it can be used also for students of vocational secondary schools.
- Educational Documentary - a large collection of feature-length documentaries produced by the BBC, National Geographic, History Channel, Discovery Channel, etc. – duration of session is 30 to 90 minutes.
- Philosophy Tube – a collection of video stories related to philosophy in a very modern and entertaining way. It deals with various topics, from Introduction to Hegel's philosophy to some contemporary ethical dilemmas [27].

5. CONCLUSION

With the traditional system of learning, students and adults eventually lose interest in the subject and perceive the material as an obligation. For many years, e-learning forms in Serbia have been understood as an additional type of learning, and not as an added value to the existing education system, learning or online learning. Loss of interest in learning is a prerequisite for early school leaving, which does not fit at all into the concept of lifelong learning, on which future social progress is based. In the conditions of life in which an individual suffers from a lack of time, one of the ways to satisfy the need for education, in the presence of lack of time, is certainly electronic or online education.

Regardless of the fact that the Kovidom-19 pandemic significantly accelerated the raising of digital skills of all participants in the educational process, it seems that the results in the implementation digital tools are still slightly improved. We can not neglect that the application of e-learning is still not properly noticeable, especially in rural schools and underdeveloped areas of the Republic of Serbia. So, in Serbian area, e-learning is still not developed with the same intensity as in European countries. Of course, there are areas in which the complete way of education can be transferred to the digital sphere (social sciences), while in others physical presence is mandatory (medicine, technical sciences), at least in the segment of exercises and practical teaching.

Like any innovation, e-learning is a concept that is better accepted by younger teachers. The reasons certainly lies in the fact that investments in educational IT infrastructure have been intensified only in recent years (especially because of Kovid-

19), and that younger staff in private life, in the largest percentage, use IT technologies intensively.

Further development of this area will certainly depend on the state's ability to invest in infrastructure and training of teaching staff, not only to acquire technical IT skills, but also training on creativity in the IT environment. Online learning, especially blended or hybrid learning requires space redesign and mastery of time management skills. This will play a crucial role in the realization of the concept of lifelong learning, which permeates all existing occupations today.

Good organization can take advantage of all the advantages of e-learning, and minimize the disadvantages (differences between users are lost, better personalization is achieved and the possibility of progress towards personal affinities and abilities is opened, so through a combined approach raises interest in teaching, experiencing electronic learning as something new and enjoyable, they create a competitive spirit, and learning outcomes become better).

The reformed education system, legislation and the development of scientific research projects are the main types of support for the implementation of e-learning in the modern education system. Development and growth of IT sector in Serbia in a last few years gives the encouragement for further investment in educational infrastructure.

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