ONLINE LEARNING PLATFORMS AND THEIR USE FROM THE PERSPECTIVE OF UNIVERSITY STUDENTS

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Abstract: Due to the pandemic situation, many educational institutions are forced to supplement traditional teaching with online activities. The choice of appropriate technical tools, whether in the form of LMS (e.g. Moodle) or communication platforms with the possibility of sharing learning materials (e.g. MS Teams), is largely up to the choice of the respective educational institution. The latter often faces a difficult choice, as the range of such applications and systems on the market is wide and it is not easy to find the most suitable tool to suit all needs. Apart from the technological aspects of each platform, which are described and compared in the paper, the attitudes and opinions of the learners who use these online tools and platforms play an important role. Thus, the present study is also concerned with the attitudes of university students towards online learning as one of the modern forms of education in their undergraduate studies and presents the course and some selected results of a research investigation conducted between 20018 and 2022, where the main objective was to determine the preferences and opinions of students on the form, organization and individual tools or elements of online education. Thus, the present study is a contribution to the discussion on the possibilities and limits of using online education in undergraduate or lifelong learning built on the use of modern information and communication technologies.

Keywords: e-learning, online education, online learning activities, online learning environments

1 Introduction

The continuous development of information and communication technologies has opened up new possibilities for their use in education. Indeed, these technologies can increase the accessibility of education and also offer new means of learning (Zounek, 2009, Klement et al., 2012 and others). Today's pupils and students, for whom the use of digital technologies is a normal part of everyday life, require the integration of these technologies into their learning. There are even views that knowledge and use of digital technologies is considered one of the core competences, similar to reading, writing and numeracy (Cerny, 2019; Ferrari, 2012; and others). Thus, it is undeniable that modern digital technologies cannot be ignored and it is necessary to use their potential also in pedagogical practice. One of the ways in which information technology can be incorporated into the educational process is e-learning. There are a number of definitions of e-learning, which have been developed at different times and often differ significantly due to the continuous dynamic development of e-learning itself and the related information and communication technologies (cf. Korviny, 2005; Kopecký, 2006; Průcha, 2009; Zounek, Sudický, 2012 and others). For this reason, in the following, we will conceptualize e-learning as a process that has several basic components, which we will therefore approach.

The first component of e-learning is the learning content itself, which is represented by comprehensive training courses (e-courses) that can be quite extensive. At a lower level of comprehensiveness, the learning content can also consist of individual learning modules that can be combined to form learning courses. E-courses are usually composed of hypertexts with the subject matter being explained, supplemented by static and dynamic graphics, multimedia content, diagrams used to facilitate the explanation of the problem in the form of graphical communication (Friedmann, 2001).

Another important component is the distribution of education. This is carried out in the case of e- learning and through online in the form of the Internet or intranet, or by means of data carriers (in the case of off-line form of education). Both in the on-line and off-line form of the course, web standards (XHTML, XML, etc.), security standards and e-course standards used to communicate with the educational system are used for the environment (Barešová, 2011).

The last element of the educational process is educational management. Learning management can be defined as the process that ensures the management of e-courses and students, including the monitoring of their learning outcomes. This process is provided by the educational institution and is mainly managed by learning managers. It provides them with a comprehensive overview of the success of individual learners or study groups and evaluates e-courses. In this way, the effectiveness of the courses and the quality of the individual course modules can be accurately monitored. An indicator is the success rate of students in the post-module tests and in the final course test. On the basis of this information, some modules can be modified or removed from the course altogether and replaced by other modules. Usually there is also a possibility of communication with the human resource management system, which in this way receives accurate information about the success rate of individual students and their abilities (Barešová, 2011).

E-learning, if it is to be a truly effective tool for distance learning, must rely on an appropriate technological base, which in this case is provided by LMS or platforms enabling online learning activities. In the next part of the paper we will therefore deal with these systems and describe in more detail their functions in the educational process and their relation to the individual components of distance learning implemented in the form of e-learning.

2 LMS and online learning platforms and their characteristics

An LMS or online learning platform is a prerequisite for a truly effective e-learning process. The term LMS can be defined as "*Learning Management System - which translates to learning management system*" (Nobilisová, 2010). LMS or online learning platform represents a virtual "learning" environment, which contains tutorials, tests, study instructions, practice plans or discussion forums (Klement, Dostál, 2018).

LMS or online learning platforms are classified as online applications. It is an environment provided through web browsers (browsers), which is created for the purpose of managing educational content, its distribution and control of the educational process. In doing so, it is very often a modular system that allows for customization of use based on the individual ideas of its operator (Eger, 2020). The most widely used modules of LMS and online learning platforms include:

- presentation and creation of educational content,
- tests and surveys,
- file management,
- administration of users and groups (often associated with the school environment as "student", "teacher", "tutor", etc.),
- tasks and calendar,
- communications,
- blogs, articles and up-to-date information.

It should be noted that different sources may differ in this area as well, as the names or concepts of individual modules of LMS or online educational platforms vary according to individual manufacturers and from the perspective of the use of these applications, we can then observe different criteria for the applicability of modules. Some manufacturers of LMS or online learning platforms focus more on the learning process, while others focus mainly on the management of educational content. An important factor influencing the modular arrangement is the circumstance in which area the LMS or online learning platform

is deployed, whether in regional education or in public administration or large educational institutions or enterprises, and what requirements are therefore placed on the system in this respect.

3 LMS and other platforms for the implementation of online learning activities

In view of the poor situation that has arisen in the context of pandemic restrictions, which has affected not only everyday life but also education, many educational institutions have to supplement traditional teaching with online activities. For such teaching to be meaningful, it is not enough to simply assign homework via social networking sites, but a comprehensive technical means must be incorporated into teaching to supplement or replace online learning activities. The choice of the appropriate technical means, whether in the form of an LMS (e.g. Moodle) or online platforms with the possibility of sharing learning materials (e.g. MS Teams), is largely up to the choice of the respective educational institution. The latter is often faced with a difficult choice, as the market offer of such applications and systems is wide and it is not easy to find the most suitable tool to suit all needs.

The most commonly used platforms include the already mentioned LMS Moodle, but also several other products that fully or partially replace its functionality. The implementation of a full-fledged LMS is usually very time-consuming and costly, which is why many smaller educational institutions choose alternative online educational platforms such as MS Teams, EduPage or Google Classroom. It is possible to encounter the approach that online learning activities do not cover the entire portfolio of educational activities of the school, but focus only on selected subjects or activities.

For this reason, in the following sections we describe the main characteristics and features of selected technical solutions currently available on the Czech market. We will also try to compare them and define the main benefits or negatives of each platform in order to facilitate the orientation of future users.

3.1 LMS Moodle

The acronym MOODLE (Modular Object-Oriented Dynamic Learning Environment) suggests that it is a system made up of individual modules, allowing the appropriate design of courses and the entire management of education according to the needs of the institution (see https://docs.moodle.org/311/en/Main_page). The system is bound by the GNU open license, allowing free use. The individual learning courses, which are created directly in the Moodle environment, are catalogued and sorted into hierarchical categories, allowing potential candidates easy orientation and consistent access to course offerings, enrolment and completion.

LMS Moodle can be connected to the existing information systems of the organization, both in the form of batch update scripts and direct user authentication, over existing databases of HR systems. The design of the system can be adapted to the organisation's existing web presence. The concept of uploading and downloading files in Moodle is extended to include repositories and portfolios. Users can upload and download necessary data from repositories (repositories) in the Internet (cloud) space and are not bound to their computer. Of course, access to Moodle is also from a mobile application in addition to the computer.

3.2 EduPage

In addition to the LMS functions, the EduPage platform also includes a school-wide agenda, such as the school register, attendance and class register, timetable, lunch payments and more. The versatility of this platform somewhat reduces the clarity of some of the elements and possible search for information (see https://help.edupage.org/).

In terms of working with the tasks and the curriculum, the content is structured into cards that relate to a specific learning unit and its curriculum. Communication on EduPage uses messages and a bulletin board. It is sometimes difficult to find older posts in the messages because they are archived and need to be opened months later. When a news item is posted on the bulletin board, a message is automatically generated to all affected users. The interactive lessons module is useful for distance learning. It consists of a presentation that can be supplemented by questions. Logged-in users can answer them during the lesson and can be evaluated after the lesson. EduPage allows students to work and evaluate in groups within the class.

When it comes to integrating EduPage with other applications, the use of MS Teams is suggested. It is possible to insert a URL link to an online lesson in Zoom or MS Teams. When the user clicks on the link, they are automatically connected to the video conference. EduPage also offers a mobile phone app that makes the entire agenda accessible.

3.3 Microsoft Teams

Teams is not primarily an e-learning but a communication platform. Its potential in distance learning is primarily in face-to-face teaching via videoconferencing. It is possible to set up regularly recurring meetings in the calendar that correspond to classes and subjects in the schedule. Sharing of materials, assignments and testing are features accessible in the individual channels associated with these meetings (see https://docs.microsoft.com/en-us/microsoftteams/).

In terms of presenting the curriculum, it is based on PowerPoint presentations or MS Office file sharing, but also allows sharing of notes in OneNote (can be used as a whiteboard in class). The external app makes screen sharing available, but this slows down the transfer. Some users point out that MS Teams adjusts to the transfer speed of the weakest connection in the group, which can lead to degradation in transfer quality. The board that is available only allows raster graphics and without an electronic pen its use is questionable. Task evaluation and testing is done by linking MS Teams with other applications such as Excel and Forms. The linking is automatic but may be somewhat confusing for the teacher.

3.4 Microsoft Teams

Unlike the above platforms, GeoGebra Classroom is more of a one-off activity, but has a wide potential in teaching subjects where the use of mathematical apparatus is essential. GeoGebra can be used for calculations, algebraic equation solving, statistics and working with tables, plotting and displaying in space. All its modules are interactive and allow automatic evaluation using simple scripts (https://wiki.geogebra.org/en/Main_Page).

GeoGebra Classroom is interesting in that the teacher can monitor in real time the performance of the tasks on the previews of all learners, or open an individual applet and test if it works correctly, but does not affect the work of others. GeoGebra is an open-source platform and the materials created on it are freely shared. There are a number of excellent tools for teaching maths, physics and chemistry on geogebra.org. A major drawback of GeoGebra Classroom is the way you log in to the class using a URL link or password. This is because there is no way to verify the identity of the learners, so in theory they can have someone else work for them.

4 Comparison of selected platforms

In this section, we will try to compare the different platforms described above for the implementation of online learning activities and define their main characteristics in terms of their potential applicability for individual learning activities. This comparison will be made in terms of content structuring, possibility of user involvement, structure of learning material, type of tasks and tests, communication possibilities and other related aspects.

The resulting comparison of the different platforms can be seen in Table 1 below, which shows the main features of the selected characteristics.

Table 1: Comparison of selected LMS and other e-learning tools.

	Moodle	EduPage	MS Teams	GeoGebra
content breakdown	odds - format: • thematic • Chronological • Discussion	the basic unit is determined by the lesson in the timetable	feeds	one hour
users	enrolled only; division into courses and groups	enrolled only; grouping	enrolled only; channel splitting, possibility of splitting into groups when meeting	using the URL link and password, it is not possible to verify the identity of students in the class
teaching materials	• website or online book • multimedia files • videoconferencing (plugin) • external activities (LTI, SCORM) • lecture (tree zoning, interactive) • downloads • URL links	• arrangement according to the curriculum: • variable content cards including multimedia • interactive lessons in the form of presentations and questions • downloads • URL links	• videoconferencing • downloads • URL links • external activities	• interactive applications
tasks	• text or file • individual and group • entering comments • special input types from plugins	• file or text • Comment	• file or text • detailed breakdown of feedback • Comment	• tasks in the application • questions • Comment
tests	• Interactive or without hints • random selection of questions • use of random variables • use of algebra and formulas (plugins)	• training and evaluation • possibility of variants	• in an external application, e.g. MS Forms or Google Classroom	• the possibility to use tasks for evaluation
other content	• Discussion • dictionaries (activity) • wiki-site • workshops • surveys and more	• bulletin board • survey	• sharing work and results via the teacher's screen	• sharing work and results via the teacher's screen
communications	• chat • News • discussions and news	• chat • News • bulletin boards	• chat • the channel acts as a bulletin board	•
overviews	• course fulfilment • overview of activity logs • Calendar	• overview of task performance	• statistics using external applications	• previews of pupils' work • response statistics
note	the course has an adjustable ending (it does not have to end, it does not have to be evaluated, etc.)	the curriculum is valid for the school year; it contains other agendas: attendance, class register, timetable, etc.	automatic linking of applications for individual purposes	one lesson; Lots of ready-made resources; links to Google Classroom

The above comparison of platforms for the implementation of online learning activities is certainly not exhaustive, as it omits some important technical and financial aspects of implementation.

5 Conditions of the research investigation and description of the method

The main objective of the research was to collect and evaluate the opinions and attitudes of students towards learning supported by online learning platforms. This main objective was achieved through the use of individual sub-sections, which were designed to collect students' opinions and attitudes towards the online form of learning as a whole, but also towards individual parts. The individual sub-sections of the research were formalised into questions which formed the basis of a structured anonymous questionnaire (Foddy, 1994) which students completed according to the instructions provided.

Verification of the stated research assumptions was carried out using the static non-parametric Pearson chi-square method, which was used to determine the dependence of the results on some significant characteristic of the group of respondents, such as gender or age (Greenwood, Nikulin, 2006). Basic descriptive statistics and their visualization using tables were used to determine the power of each group of respondents who answered in the same way. Statistica 14 statistical system was used for the calculation (Nisbet, 2019).

6 Formulation of the main research assumptions and description of the research sample

On the basis of previous personal experience and studying the results of research or surveys conducted in this area, whether domestic or foreign, we have come to the conclusion that the area of online education implemented using online platforms has significant specifics compared to the classical concept, which allow to increase the efficiency of the entire educational process. This is especially the area of psychomotor competences, where information and communication technologies, represented by multimedia extensions or simulations or even virtual reality, allow the creation of such tools, the replacement of which by static elements of the structure of electronic learning support would be very difficult.

The above-mentioned facts led us to formulate research assumptions that would respect the modernization trends in the field of ICT-supported education. We started from the following research assumptions:

- Students are satisfied with online education in the form of, as they are comfortable with a fully electronic learning environment in the form of online learning platforms and this interest is long term.
- Students prefer multimedia elements with an interactive character and this interest is stable.

The research sample (Creswell, 2008) to test the above research assumptions, consisted of a total of 501 first year university students who had completed part of their studies online. The research sample was selected to ensure a proportional representation of males and females, matching the structure of students in other forms of study. An overview of the structure of the research sample can be seen in Table 2 below.

Table 2: Structure of the research sample

Gender	Number of respondents in each year	Total number	Total number in %	Satisfaction with the implementation of online learning in %
Girls	2019 - 40 2020 - 39 2021 - 46 2022 - 56 2023 – 39	220	44 %	94 %
Boys	2019 - 53 2020 - 63 2021 - 59 2022 - 48 2023 - 58	281	56 %	

The students had the opportunity to express their opinions and attitudes towards the online teaching using electronic teaching materials. The research questionnaire contained a total of 9 questions, which students answered anonymously.

7 Selected results of a research survey on students' views and attitudes towards online education

The main fact investigated in this part of the research was the students' satisfaction with the arrangement of learning implemented using online learning platforms, where the main form of learning is not full-time teaching, but self-directed

learning (Kluge, Riley, 2018) using suitably prepared electronic learning materials embedded in online learning platforms. A research assumption was established: *students are satisfied with an online learning arrangement in which electronic learning materials are the primary facilitator of learning content and the online learning platform provides the communication, evaluation and management aspects of the learning experience*. This assumption was verified by analyzing the data collected in the questionnaire survey. In addition to the aggregate opinion on the issue, we observed the long-term trend in this area and also analyzed whether or not the students' opinions are dependent on their gender. Table 3 and contingency table 4 present the results of this validation.

After analyzing the obtained results, it can be concluded that *students are satisfied with the organization of online learning if electronic learning materials are the main mediator of educational content and the online learning platform provides communication, evaluation and management aspects of the study*, as a total of 94.2% of respondents answered this question positively and only 5.8% of respondents answered negatively. Furthermore, it can be concluded that *student satisfaction with the online learning arrangement is continuous* and the results are consistent across the years when the research was conducted. The highest observed dissatisfaction of students with the arrangement of online teaching was in 2020 and was 7.8% of respondents, on the other hand, the highest level of student satisfaction with the arrangement of e-learning teaching was in 2019 and was 95.7%. However, both of these observed values are only slightly deviated from the overall observed results (for the dissatisfied respondents it is by 2% and for the satisfied respondents it is even by only 1.5%), and therefore it can be said that the observed results in each year do not differ significantly from each other, and therefore *the trend of development in this area of students' opinions and attitudes is stable and shows neither growth nor decline*. This fact is illustrated in Table 3.

Table 3: Students' satisfaction with the online learning arrangement expressed in percentages

Student satisfaction with the teaching arrangements online as a percentage						
year	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
dissatisfied in %	4.3	7.8	5.7	5.8	5.2	**5.8**
satisfied in %	95.7	92.2	94.3	94.2	94.8	**94.2**

We supported the objectivity of the results by conducting a further analysis to see if this result was dependent on the gender of the respondents. This was verified using a chi-square test and the results are presented in contingency table 4.

Table 4: Satisfaction with the arrangement of online learning by girls vs. boys

Contingency table, cell frequency > 10 is in italics Pearson chi-square: 4.1202, degrees of freedom: 1, significance = 0.0424			
Gender of respondents	**I am not satisfied**	**I am satisfied**	**Line sums**
Girls	*18*	*202*	220
Boys	*11*	*270*	281
All groups	**29**	**472**	**501**

Since the calculated significance value is 0.04, as shown in Table 4, we can say that *the frequencies of individual responses of boys and girls in terms of their opinions on satisfaction with the arrangement of online teaching are different, and* therefore this evaluation is partly dependent on the gender of the respondents. The obtained result can be interpreted in such a way that the frequency of dissatisfied girls is higher than the frequency of dissatisfied boys.

8 Selected results of a research survey on students' opinions and attitudes towards the content and structure of e-learning materials

Another of the assertions tested in the presented research investigation was the research assumption *that the most preferred element of structure in learning implemented through electronic learning materials is the dynamic element in the form of interactive learning animation*. With this question we responded to the fact that the classical concept of evaluation of electronic learning materials does not take into account some modern trends in the implementation of online learning using its more modern components, such as e-twinnig or virtual reality. These educational strategies, which are mainly based on achieving psychomotor and affective learning goals, are nowadays becoming a major concern for both students and authors or tutors (Lowenthal and Wilson, 2009). Thus, overall, students could choose one of the three options offered: a static element in the form of text, a static element in the form of visual information (images) and a dynamic element in the form of interactive visual information (simulations and animations).

According to the results obtained, the dynamic element in the form of an interactive learning simulation or animation was the best element of the structure of the e-learning material and only in second place was the static element in the form of "written" text, which is a surprising finding, but in line with the research assumption. Overall, then, 43.5% of respondents preferred a dynamic element in the form of interactive simulations or animations as the most appropriate element of the structure, followed by 34% of respondents preferring a static element in the form of text and 22% of respondents preferring a static element in the form of images. Therefore, it can be said that *dynamic elements in the form of interactive learning simulations or animations are the most preferred elements in the structure of e-learning materials, followed by static elements in the form of texts and images.*

On the basis of Table 5, expressing the percentage of students' opinions on the issue under study in each year of the research survey, it can be stated that *the trend of development in this area of students' opinions and attitudes is stable and shows neither growth nor decline*.

Table 5: Students' opinions on the most suitable element of the structure of the e-learning material expressed in percentages

Students' opinions on the most suitable element of the structure of the e-learning material expressed in percentage						
year	**2019**	**2020**	**2021**	**2022**	**2023**	**diam.**
static text information in %	36.6	30.4	37.1	30.8	39.2	**34.7**
static image information in %	25.8	23.5	21.0	19.2	19.6	**21.8**
dynamic image information in %	37.6	46.1	41.9	50.0	41.2	**43.5**

In view of possible differences in the perceptions of boys and girls, we subjected this partial result to a further analysis, namely: *whether there are differences in evaluation between boys and girls*. We verified this claim on the above sample of 501 respondents using a chi-square test. Statistica 14 was used for the calculation and the results are shown in Table 6.

Table 6: Students' opinions on the most appropriate element of the structure of the e-learning material - girls vs. boys

Contingency table, cell frequency > 10 is in italics Pearson chi-square: 0.9986, degrees of freedom: 2, significance = 0.6067				
Gender of respondents	**preferred element-text**	**preferred element - pictures**	**preferred element - animation**	**Line sums**
Girls	72	47	101	220
Boys	102	62	117	281
All groups	**174**	**109**	**218**	**501**

Since the calculated significance value is 0.61 as shown in Table 6, based on this value, we can conclude that *the frequencies of the individual responses of boys and girls in terms of their views on the preferred presentation element of the curriculum in teaching implemented using electronic teaching materials are the same, and* therefore this evaluation is independent of the gender of the respondents.

9 Discussion of the results achieved

The idea of a completely natural use of ICT, including e-learning tools and on-line platforms, by today's generation of students, is more or less taken as a fact, based on two major arguments. The first one stems from the fact that today's adolescents and even infants deal with and manage the computer technology with a rather striking spontaneity. The second argument is based on the statistics demonstrating the level of dependence of the use of ICT on age, showing that unlike older generations; nearly all adolescents use the Internet and mobile phones (Lowenthal, Wilson, 2009). It is around these arguments that Don Tapscott American (1998) built his essays claiming that the power model of the family was disturbed, because, unlike the past, children were taking over the teaching role and educated their parents with respect to the orientation in the digital environment. His concepts of N-GEN and that of the digital generation were soon followed by other concepts, i.e. digital natives (Prensky, 2009), homo-zappiens (Veen, Vrakking, 2006), digitally birth (Palfrey, Glasser, 2008) and others. "Digital natives are used to receiving information very quickly. They like doing more activities at a time (i.e. multitasking). They prefer the image processing over the processing of the text. They prefer a random access to information (i.e. hypertext) and they like best working in a networked environment (online). They expect immediate praise and frequent evaluation of their work". (Prensky, 2009). The ideas of Prensky and Tapscott were quite influential at the time and have later become subject to several attempts, more or less successful, by various researchers, to refute them (Bennett, 2017).

Within the framework of such a rapidly evolving field as this one undoubtedly is, it is almost impossible to keep sufficient distance, necessary for the achievement of an ´unbiased assessment`, which itself is a prerequisite for a professional discussion supported by facts. It is thus necessary to perceive the above stated findings rather as stimuli for further discussion, resulting in a more responsible and balanced approach to the needs of thr students whose studies are, though only partly, implemented through e-learning. Although they actually might not be the digital natives and current problems associated with school systems and the results of their action might have their origin elsewhere, the fact cannot be denied. It is therefore necessary to monitor this area constantly, to regularly analyze and evaluate the attitudes of the students involved in this form of education and to keep trying on searching for the best ways to meet their expectations.

10 Conclusion

It is an undeniable fact that e-learning is becoming more and more widespread in Czech education. Although it plays an important role primarily in distance and combined forms of study at universities, it is also increasingly used in primary and secondary schools. This is to some extent due not only to the current pandemic constraints, but also to the desire of schools to supplement their offer of educational activities. Here, of course, it is not possible to fully replace traditional teaching, but it can become a suitable complement to it. Increasingly, teachers at these school levels are thus learning to recognise the advantages of e-learning, which enable them to improve and innovate their teaching. On the other hand, it is important to realise that educational technology alone will not personally improve teaching. It always depends on the specific situation and on individual teachers how they approach these technologies.

There are many platforms on the market that offer the possibility of sharing learning materials, and the choice of the most suitable one is often at the discretion of the respective educational institution. The latter is often faced with a difficult choice, as the market offer of these applications and systems is wide and it is not easy to find the most suitable tool to suit all needs. For this reason, this overview study was also created to present the main characteristics of the selected platforms for the implementation of online educational activities. We believe that an overall comparison of these selected platforms can help in the selection and implementation of a specific tool.

Although the above stated results cannot be regarded as significant, they indicate trends that should be taken into consideration by up-to-date education making use of electronic teaching materials texts and on-line platforms. The attitudes of the students could provide us with a guideline helping to find the optimal way towards satisfied, educated and professionally prepared tertiary education graduates and graduates of lifelong learning programmes. The investigation research conducted shed some light on some of the preferences and attitudes of the students related to this field, which can be regarded as long-term. It can therefore help all those who want to design e-learning tools to meet the needs of their students or pupils the best way possible.

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