International Conference at the Brno University of Technology,
Faculty of Business and Management, September 16-17, 2021 Brno, Czech Republic
Perspectives of Business and Entrepreneurship Development: Digital Transformation for Business Model Innovation

Methods and resources for increasing the efficiency of distance learning in a university environment

Galin Milchev[a,*]

[a] *University of Forestry, Kliment Ohridski, blvd. №10, Sofia 1700, Bulgaria*

Abstract

Purpose of the article Alongside the traditions that universities had in the field of e-learning, the global situation caused by the pandemic necessitated the transition to a mixed, or at certain stages, complete distance learning. This identified both a need for a review of existing resources used so far as a side tool in this process, and the introduction and use of entirely new directions and environments to compensate for the lack of direct contact, which is of utmost importance for achieving the set objectives. The article examines the possibilities provided by different types of Learning management systems (LMS) – paid for and open source, their advantages and disadvantages, in the context of their combined use with synchronous communication applications. In addition, the consumer attitudes, expectations and satisfaction with the software tools for e-learning used during distance learning in combination with the respective LMS are considered and analyzed.

Methodology/methods Based on a preliminary study, a target group was determined, to constitute a representative sample including the main participants in the educational process of higher education - teachers and students. Through the use of quantitative methods, the results of the conducted research are analyzed, synthesized and summarized, on the basis of which the optimal possibilities for the combined use of LMS and synchronous applications for online communication are determined.

Scientific aim To create a framework to assist universities and higher education institutions in the processes of identifying opportunities and ways in which, through the use of the additional benefits provided by the various online tools and channels for online communication and sharing, alone or as ancillary tools along with the introduced Learning management systems, to further develop their concepts related to alternative forms of traditional in-person learning.

Findings Based on a literature review relating to the possibilities and directions of application of LMS in higher education, as well as the degree of use of their specialized tools, the main functions that are widely used in the educational process are identified. On this basis, the directions, in which their use, in combination with the tools of synchronous applications for real-time online communication, will bring maximum benefits in conducting a distance form of traditional activities and processes in a university environment, are identified.

Conclusions LMS with their development and improvement in recent years are increasingly used in academic fields. Their easy integration with the other systems at the institutions, the maintained information system for participants in the educational processes and rich instrumental make them a preferred tool used in the processes of blended, online or full distance learning. In order to reap the benefits of these new ways of conducting traditional activities, higher education institutions need to combine their use with the innovative solutions provided by e-learning software applications. This requires changes in the technological infrastructure needed to ensure the proper functioning of processes in order to maintain positive attitudes on the part of consumers. The integrated approach in the use of synchronous applications for online communication will provide improved resource allocation, personalized online learning, as well as the opportunity to introduce social learning into the overall strategy of the educational process.

Keywords: digitalization, LMS, e-learning, cloud services, innovation, globalization, distance education

JEL Classification: I21, I23

[*] Corresponding author. Tel.: +359 2 91907/340
E-mail address: gmilchev@ltu.bg.

Introduction

The last year has necessitated many changes in the way of conducting educational, scientific and practical activities related to student education and the teaching style of university professors. The transition to a distance form of teaching put all participants in this process in a position to look for effective and at the same time easy to introduce, understand and use tools and technologies. This global trend has also affected Bulgarian universities, where the e-learning tools used so far have established themselves as an integral part of the traditional learning process and in most of them, have become the basis for upgrading and moving to distance learning. In this aspect, those who had introduced in previous years systems for Learning management system / LMS /, regardless of its type and degree of staffing, were able to quickly and easily adapt to new conditions. The use of the additional capabilities provided by the various web tools and channels for online communication and sharing, alone or as ancillary tools along with the implemented systems, enabled universities to further develop their concepts related to alternative forms of traditional face-to-face learning. The variety of rapidly evolving applications for online communication, sharing and exchange of information in real time, brought forth issues related to choosing the most appropriate of them, and at the same time the most adaptable to the relevant content and material. In order to optimize the process of online learning it is necessary to use them in sync with the LMS implemented successfully so far to create personalized courses corresponding to the specific style of teaching, providing connectivity, commitment and motivation on an individual level for students and lastly, a place to track results. While e-learning software tools are based on access to selected digital libraries (including videos, e-books, and online tutorials) providing self-paced learning, LMS focuses on managing the learning process and storing and tracking learners' individual or collective progress. In this regard, the article examines and analyzes consumer attitudes, expectations and satisfaction with the e-learning software tools used during distance learning in combination with the respective LMS. For this purpose, a survey was conducted at two Bulgarian universities using different platform solutions - one with open source / Moodle / and a specialized commercial solution / Blackboard Learn /. The answers of the surveyed students and teachers, related to the quality of the conducted distance learning, are aimed at the successful integration and subsequent joint use of the LMS and the specific online applications in the newly formed model of education.

1 Learning management systems (LMS) & applications for synchronous communication

Like in many other fields and institutions, in recent years there has been an exponential trend in higher education in terms of technical innovation and solutions. This also refers to the introduction and use of LMS as a tool to support traditional learning, and in the global pandemic environment, as a foundation for its realization. Such a system can be seen as a platform to help teachers manage and organize educational materials online and conduct online courses, aiding in streamlining the learning process by providing a central place to access online materials and develop content. Unlike synchronous tools for online communication, they also make it possible to track students' progress on an individual or general level. For the most part, they also support additional utilities for conducting online communication through the use of magazines, wikis, blogs or discussions. There are two main types on the market: free / open source or paid for commercial solutions. Both options have advantages and disadvantages. The former require minimal to no initial acquisition costs, but can subsequently be expensive to implement and customize, require additional charges for functions other than the basics, and usually do not include support for feedback in the events of in-service problems. Premium offers, as an alternative, have higher upfront costs (compared to the free versions), but also usually include dedicated support staff and professional services. In recent years, this type of LMS has a tendency to introduce monthly user fees varying in a wide range depending on a certain number of users. Regardless of the type of solution used, the choice of each such system is determined by the main functions it offers, as well as by the specific need for additional functions useful in the learning process (Table 1).

Table 1 Main functionalities and additional features of LMS

Function	Description
Creating content	Allows educators to create content and use web-based tools to embed files from the web or their own files into lesson materials.
Content management	Allows teachers to share materials between courses and upload materials from the web or their own files.
Creating assessment	possibility to create new questions / assessments - including support for different types of questions, possibility for their random mixing, import of banks with questions to third parties,

	etc.
Assessment management	This may include automatic question updates and automatic and manual tagging.
Educational objects repository	Online library for sharing, storing, searching and managing learning objects (e.g. content, specific lessons, etc.)
Instruments for assessment and feedback	This may include the ability to take notes on student suggestions and create reports for students.
Course management	This may include course catalogs, course registration management, calendars, textbooks and virtual classrooms.
Tutor and student portals	Individual portals for students / instructors for access to study materials.
Colaboration tools	Opportunity to comment and share the LMS interface, through channels such as live chat, blog articles and discussion boards / topics.
Progress data and analysis	Ability to track students' progress against established standards such as identifying gaps in individual learning and setting personalized learning goals.
Additional capabilities	
Social media maintenance	Opportunity to integrate tools for social learning and tracking student engagement.
Mobile application	Allows students and instructors to connect to the LMS interface using a mobile application.
Aiding blended learning	Ability to record, share and evaluate events outside of training, such as seminars, workshops, demonstrations, etc.
Game tools	Use of techniques related to various games to increase user engagement - including things like badges, trophies, leaderboards or points.

Source: summarized by Internet sources and websites of the developers

Globally, the e-learning market is estimated at $ 190 billion by “Global Market Insights”, and its turnover is expected to exceed $ 300 billion by 2025. Table 2 shows some of the world's most widely used LMS.

Table 2 Open source/specialized commercial solution of LMS

Commercial LMS	
Blackboard	https://www.blackboard.com/
Schoology	https://www.schoology.com/
Brightspace	https://www.d2l.com/higher-education/
Canvas	https://www.instructure.com/en-gb/canvas
Free/Open Source LMS	
Moodle	https://moodle.org/
Sakai	https://www.sakailms.org/
WordPress Learning Management System Plugins	https://wordpress.org/plugins/learnpress/

Last year has highlighted the need for ways to conduct traditional face-to-face activities bringing together many participants through online communication channels. This trend also applies to a large extent to the field of higher education, where it was necessary to find alternatives for classroom teaching very quickly and in a short time. Along with their universal application, these synchronous applications have also found a place in purely administrative activities in the field of the educational process. These applications have a greater focus on the joint aspect of teaching, emphasizing the conduct of video conferencing, but with less ability to track and analyze the achieved learning outcomes, in contrast to the LMS. Table 3 shows some of the applications used in the implementation of video connectivity, as well as some of their main functions.

Table 3 Basic functionalities and features of the tools used for synchronous communication

Application	Main function
Zoom	Individual meetings - possibility to host unlimited individual meetings; Group video conferences - up to 500 participants (with the purchase of an additional package) and up to 100 participants lasting up to 40 minutes with the main package; Screen sharing - possibility to share with one user or with large groups; Recording of meetings or events.

Teams	Maintenance of teams and channels; Individual and group meetings - all team members can view and add to different conversations in the common channel and can invite other members to different conversations; Chat function; Storage of documents in SharePoint; Online video calls and screen sharing. Audio conferencing - a feature that allows anyone to join an online meeting by phone. Requires additional licensing. Full telephony. Requires additional licensing.
Google Meet	Unlimited number of meetings; Live inscriptions during meetings; Compatibility between different devices; Video and audio visualization screen; Adjustable screen layouts and settings; Controls for meeting hosts; Sharing the screen with the participants; Chat feature with participants.

These applications, used alone, can cover the administrative norms and requirements for conducting online teaching, providing convenient communication channels, but in view of a sustainable development and introduction of well-provided distance learning, it is necessary to consider them and analyze the possibilities for their integration into LMS and complement their current application and use.

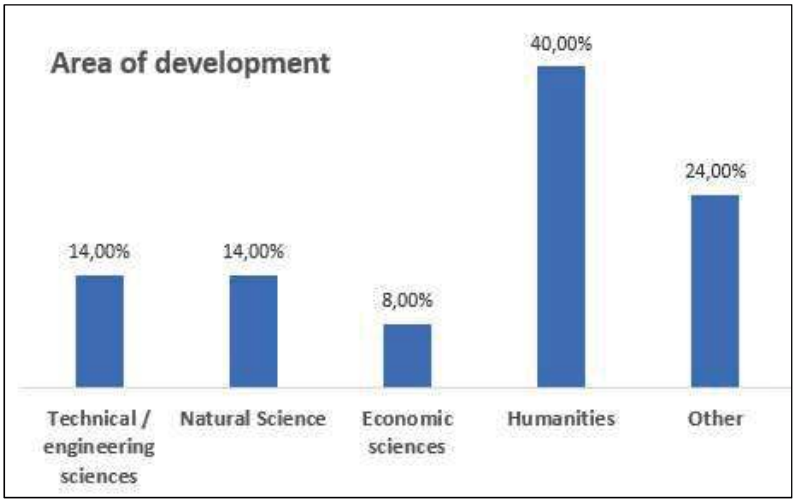
2 Analysis of LMS applications in higher education

In an increasingly complex and globalized world, creative abilities, diverse thinking, skills in various fields and adaptability tend to be valued more than specialized knowledge (Mladenova and Brezin, 2014). To meet these needs, modern Learning management systems need to provide young people with the skills and motivation to turn learning into a lifelong activity. In order to achieve this, they need to be properly structured in terms of the interactions used in the directions of learner-content, learner-teacher, learner-learner and learner-interface. The global trend of their increasing use in academic institutions, as a part of their system for managing education and improving teaching, is due to not only the benefits they contribute to this process but also the dramatic improvement of information and communication technologies (ICT). This improvement allows for many academic institutions to easily use some of the new ICT-related features, such as high-definition video streaming, video conferencing and virtual classrooms (Abdulaziz et al., 2019), which contributes to the improved distribution of e-learning concepts. LMS can also be applied in guidelines related to the facilitated active participation and cooperation of learners in problem solving and knowledge production, which is key for success in the transformed models of online learning and teaching (Phillips, McNaught and Kennedy, 2012). The main goal of LMS is to centralize and simplify the administration and management of teaching and learning through e-learning, by means of a simplified interface designed for students and teachers and the relevant administration panel to cover the entire process of distance learning. This supports the planning of learning processes, allows for collaboration through the exchange of knowledge and information (Lopes, 2011). LMS have a leading role in the reorganization process of the education sector related to the preparation of materials by teachers in the most effective way and in the shortest possible time on the one hand, and on the other hand the requirement for students to remove the concept of time and space to promote of self-learning. In this regard, LMS is at the forefront of the latest technological advances, enabling academic institutions to provide the maximum level and quality of education with a minimum level of investment (Nadire, 2015) or being used as a tool in identifying the needs for acquiring work expertise in research projects and networks (Dragozova and Milchev, 2018). Their use is appropriate in processes aimed at assessing the degree of mastery of material from individual courses of disciplines, which on the one hand is to identify the underperforming and best performing students, and on the other hand to assess the quality of presentation and teaching of the material (Pavlenko, Barykin, Nemeshaev and Bezverhny, 2020). Knowledge testing to assess the quality of teaching and the achieved results can be used as an indicator of the need for necessary changes in the curriculum and for deriving conclusions related to the organization of training in general. These learning management systems, consisting of toolkits and partial software applications, are able to simulate a real teaching and learning environment that allows learners to learn at anytime from anywhere and at an individual pace (Poulova, Simonova and Manenova, 2015), as they can be used to support both cognitive processes and aspects of psychological education. Based on their use, teachers' attitudes to adopt other technological and pedagogical innovations can be analyzed (Rhode, Richter, Gowen, Miller and Wills, 2017). By analyzing system logs and executing database queries, it is possible to track and identify the most commonly used functions and the change in their use over time, thus improving their role in higher education and online learning. LMS, in line with the ever-changing times when the Internet is increasingly used in the daily activities of participants in the educational process, can be used and considered as an online system or student portal to meet their academic needs (Adzharuddin and Ling , 2013), and where they can confidently seek and receive information about their courses, as well as ensure the accuracy and reliability of the information. Based on the tracking of six main elements relevant to the learning processes in the academic environment, namely student, lecturer, course, technology,

system design and environmental dimension (Kabassi et al., 2016), LMS can be successfully used not only as an additional tool to help students study further, watch missed lectures, etc., but in addition, have the potential to become a mainstream environment in blended or distance learning. LMS provide an opportunity to customize the learning processes in order to meet both the teaching requirements and the needs of students. These advanced systems help address the typical challenges associated with education, while creating sustainable learning programs and improving related outcomes. In Bulgaria, most universities have some form of e-learning, thanks to the previous programming period under an operational program aimed at their development and modernization. The guidelines and challenges for their advanced use in the modern process of conducting the main activities in higher education, are in the good understanding and knowledge of their functions and capabilities for integration of new technologies and applications for online communication.

3 Analysis connected to increasing the efficiency of distance learning in a university environment

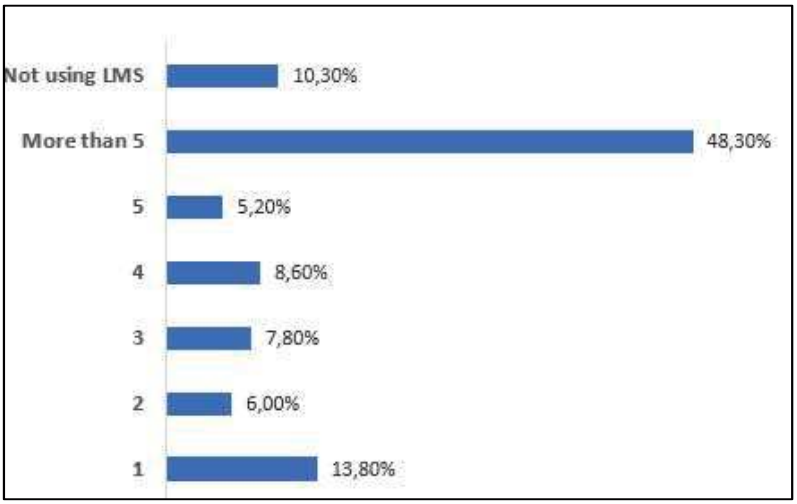
Based on the transition to distance learning in the last year, a survey was conducted among teachers and students from two major Bulgarian universities using both versions of the LMS - "BlackBoard Learn+" system integrated at the first university and "Moodle" used by the second. The developed and approbated survey aimed to identify key points in the use of the respective LMS and ways to integrate it with the tools and applications for online communication. The aim is to establish the level of preparation for use of the system, its reception by the participants in the process, to identify problems in its use, as well as the preferences for combining with other applications used during the distance learning. The survey covered students and teachers - possible users of the services of the individual systems. The profile orientation of the participants is shown in Figure 1.



Source: own work

Figure 1 Profile of survey participants by area of profiling

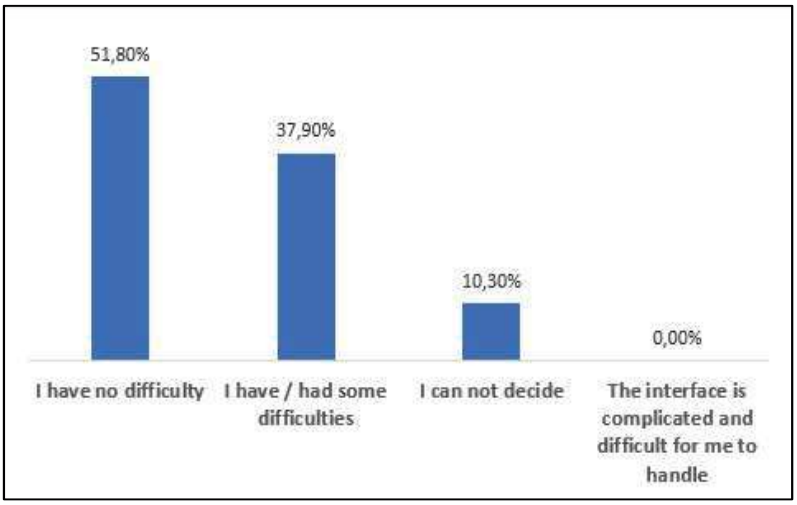
Regarding their commitment related to the number of courses / disciplines (Figure 2), of those who use the respective system, 48.3% are enrolled or participate in more than 5 courses / disciplines, 5.2% in five, 8.6 % in four, 7,8% in three, 6% in two, 13.8% in one and 10.3% answered that they did not adopt these methods in the learning process. To the question whether, even before the imposed transition to distance learning in the last year, the participants have used the LMS and / or a web application for online communication, nearly 76% give an affirmative answer. This shows that the level of reception and use of such tools is on a solid footing and the pandemic situation is more of a catalyst for its mass introduction into the learning process.



Source: own work

Figure 2 Number of LMS courses/disciplines in which the participants in the study are enrolled

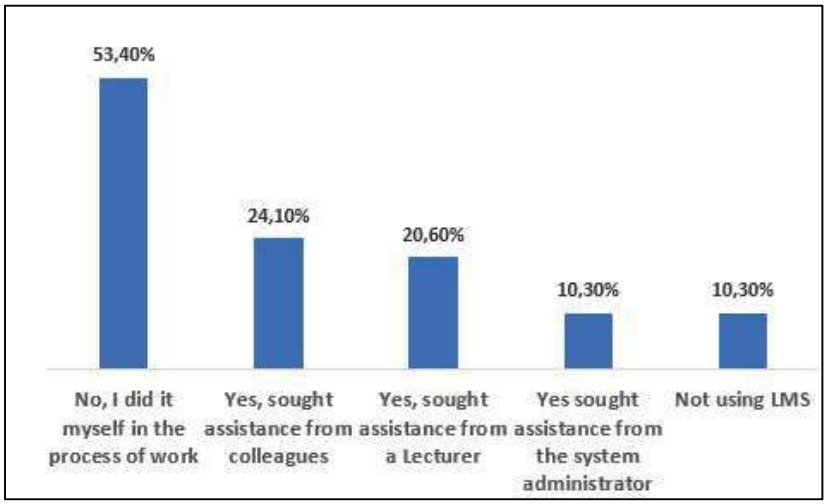
As for how they assess, in general, the ease of working with the menus of the LMS used by them, more than half of the participants state (Figure 3) that they do not encounter any difficulties, nearly 38% have encountered some problems, but have overcome them and 10.3% cannot say. It is noteworthy that none indicated the complexity of the interface as an obstacle to work, which means that both types of LMS - commercial and freely distributed are at a good level of development and with the same degree of intuition in terms of interface and functions.



Source: own work

Figure 3 Degree of satisfaction with the interface of the used LMS

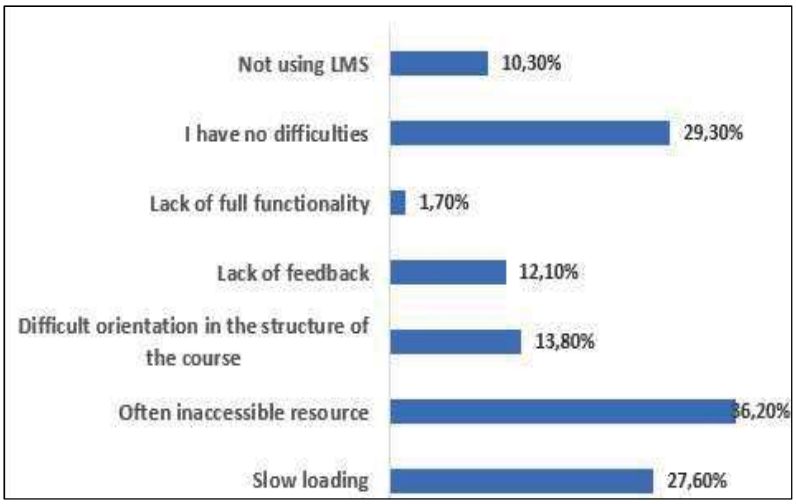
It is noteworthy that in case of a possible problem related to working with the platform or the need for assistance in terms of the use of a given function (Figure 4), almost 2 times more respondents sought help from colleagues than from a system administrator, which shows that better awareness is needed on how to communicate with those responsible for working with the platform and on carrying out such communication.



Source: own work

Figure 4 Ways to deal with a possible issue regarding the work with the LMS

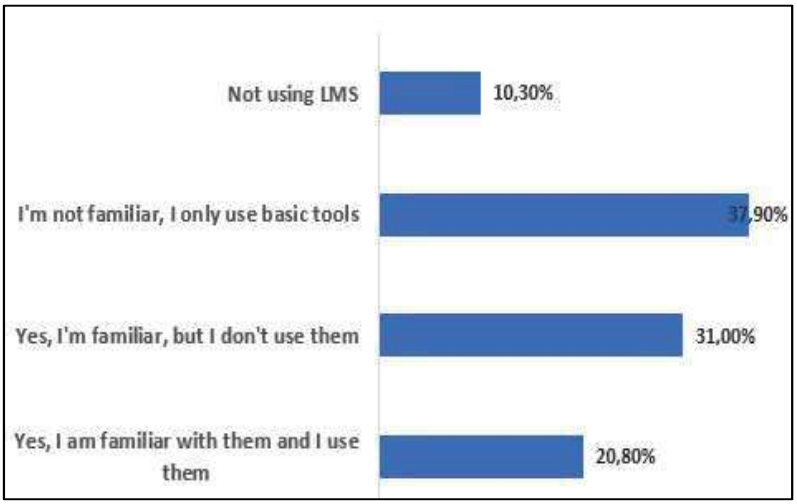
Regarding the issues related to the operation and use of LMS /participants have the opportunity to indicate more than one answer to this question/, almost one third (Figure 5) do not meet such, for approximately as much - 27.6% the main problems are related to slow loading, the highest percentage - 36.2% identify as a problem the frequent inaccessibility of the system at certain moments. The number of those who find a problem in difficulty navigating the structure of the given resources and in the lack of feedback from the other participants is almost equal - 13.8% and 12.1%, respectively. Only 1.7% see any drawback caused by the fully functional use of the system. This shows that there is an urgent need to improve the technological infrastructure and hardware security related to optimizing and increasing the speed and smooth operation of the LMS.



Source: own work

Figure 5 The most common problems when working with LMS

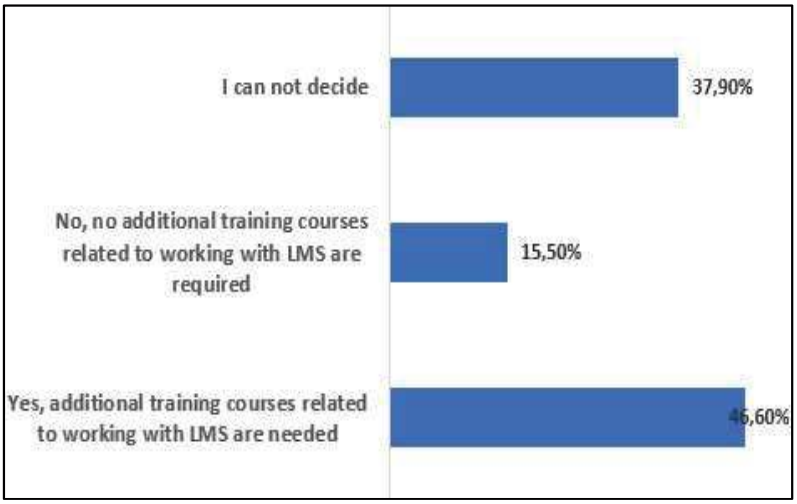
The analysis also shows the need to increase the use of the built-in functions of LMS / wikis, blogs, magazines, discussions, online synchronized tools /, pertaining to additional ways to increase efficiency in electronic and distance learning, where only one fifth of the participants approbated them in the work processes (Figure 6). Approximately one third - 31% are familiar with them but do not find incentive and motivation to use them, and 37.9% do not know how to introduce them. This requires additional familiarization with their advantages, as well as the similarities and differences in terms of their use compared to web applications and online communication software.



Source: own work

Figure 6 Degree of knowledge of the additional tools of the LMS

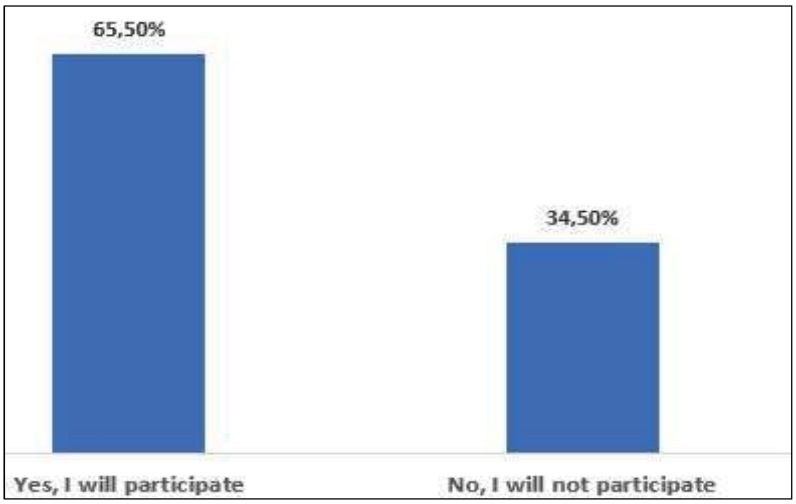
In this regard, based on their previous experience in working with the platform (Figure 7), nearly half of the participants - 46.6% believe that it will be useful to organize additional courses related to working with the platform, and 65.6 % of them (Figure 8) state that they would participate in them.



Source: own work

Figure 7 Need to organize additional courses for working with LMS

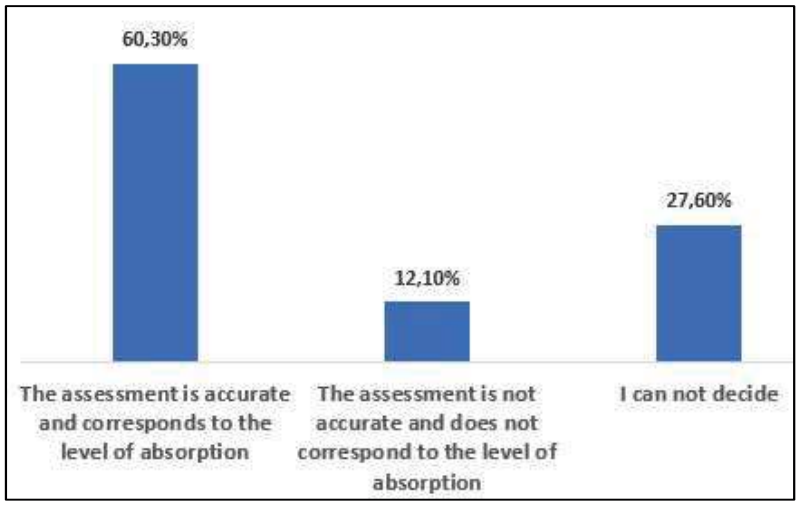
This shows that there is a desire to increase the level of specialization and improvement of the application of not only the basic functions of the LMS, but also of the other tools that are available in the platform solutions used.



Source: own work

Figure 8 Willingness to participate in training courses related to the use of LMS

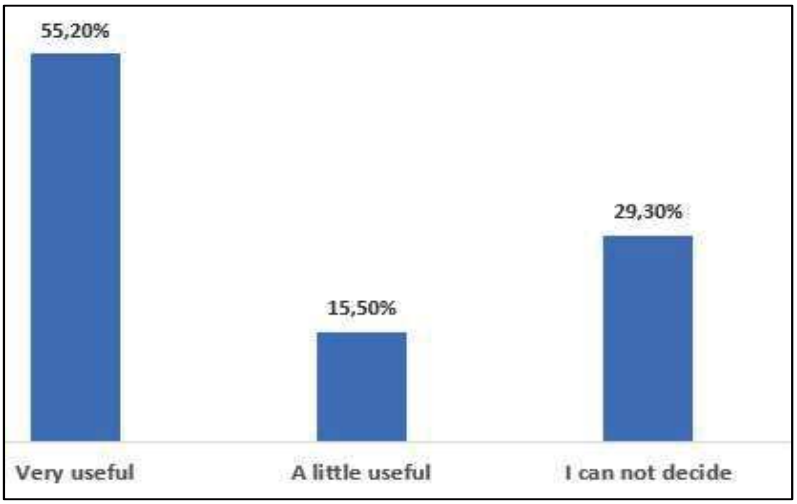
For 60.3% the assessment of the degree of assimilation of the set material (Figure 9), using the appropriate tools of the LMS / conducting tests, additional course assignments / is accurate and corresponds to the actual level, as only 12.1 % express disagreement. This can be considered an indicator in terms of optimizing this process, through their centralized introduction, especially with regard to forms of teaching other than full-time.



Source: own work

Figure 9 Satisfaction with assessment through LMS

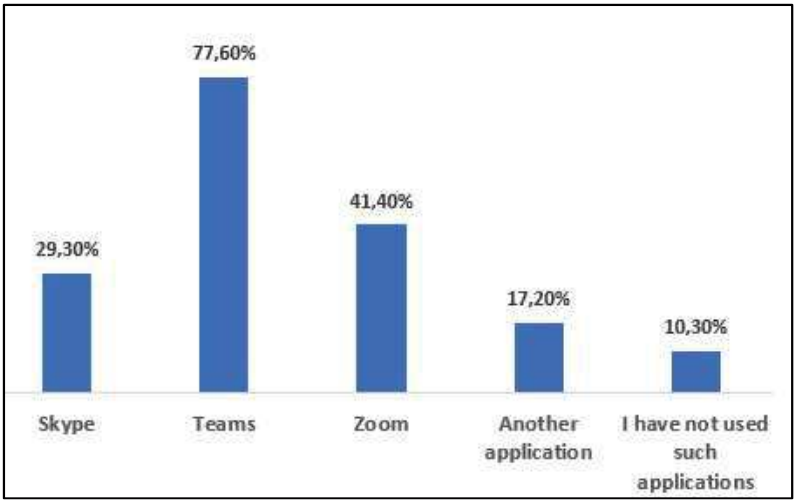
In summary (Figure 10), more than half of the respondents - 55.2%, assess the role of the use of LMS in conducting distance learning as "very useful", and 29.3% cannot say, which shows the right direction is being taken by the academic community since their introduction into the educational process.



Source: own work

Figure 10 Assessment of the role of LMS in the training process

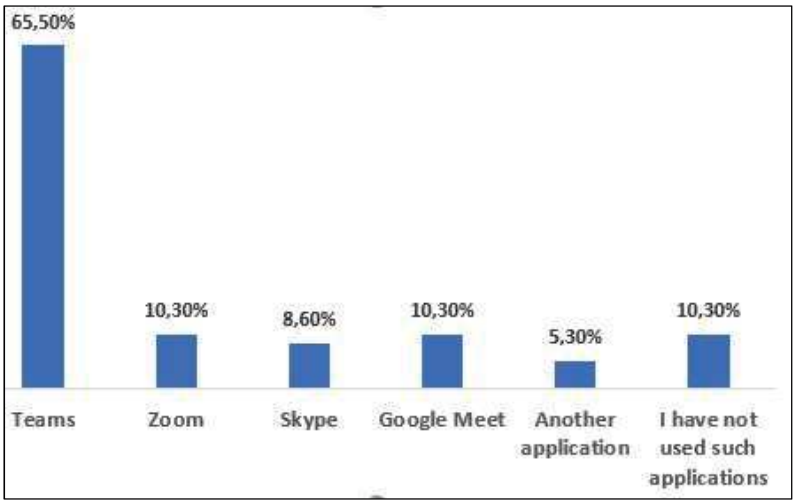
In the last year, regardless of the presence of the LMS, universities in Bulgaria have had to look for an alternative for conducting their activities related to education and administration in the form of funds for their execution. E-learning software and synchronous tools for online communication have found their application, and thanks to the desktop applicability and minimal technical training and level of mastery of ICT skills for their use, the latter have gained increasing popularity. In this regard, individual applications such as Zoom, Google Meet, Teams and Skype, developed and available at an earlier stage, have become a preferred option in the online alternatives to lectures, exercises and, in part, even to practical classes. In addition to user preferences, their use is also influenced by the operating system used, the centralized use at the university level of a certain office suite, as well as to some extent the hardware used. In the process of distance learning conducted last year, what made an impression was (Figure 11) the low percentage of those participants who answered that they did not use such applications - 10.3%, and this percentage is equivalent to the number of respondents who do not use LMS. This can be interpreted as a solid value in relation to the percentage of participants in the educational process who completely reject or do not perceive as relevant the use of new technological means and related assessment methods in the traditional learning process in an academic environment.



Source: own work

Figure 11 Extent of use of some of the most commonly used synchronous applications for online communication

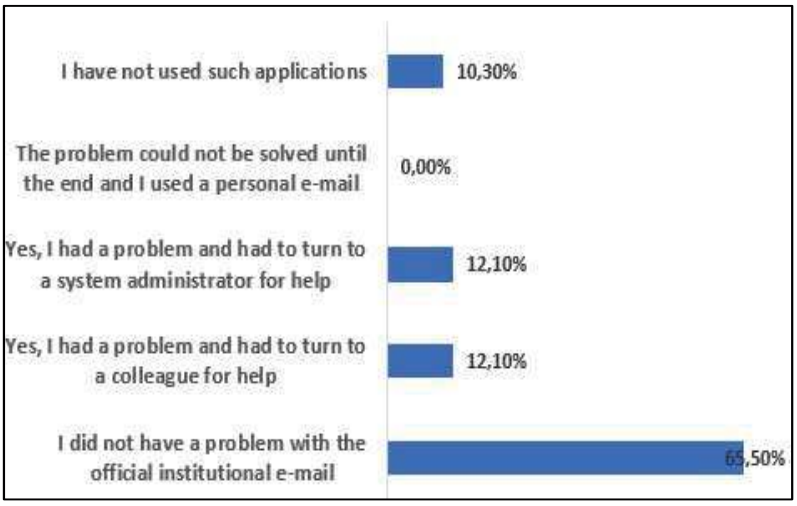
Leading - 77.6% is the use of the Teams application, followed by Zoom and Skype. Here, participants had the opportunity to choose more than one answer, and of defining importance here is the greater use of Office 365 by universities; part of its package also includes Teams. Despite the possibility of multiple choices related to use, in the next question which was based on their user experience with the applications, the majority - 65.5% again indicate Teams (Figure 12), as the most suitable for the purposes of distance learning, followed by Zoom - 10 , 3%, Google Meet - 10.3%, Skype - 8.6% and other - 5.3%.



Source: own work

Figure 12 User preferences for app used for synchronous communication

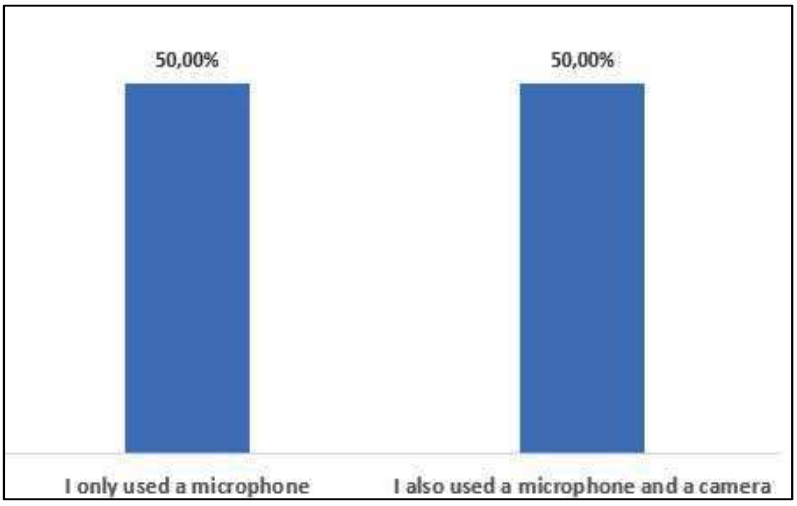
Due to the need for business account use, connected to access to the full functionalities and specialized tools of some of the applications, 65.5% indicated that they had no problems in their administration (Figure 13). Equal is the number of those who sought a lecturer or system administrator to eliminate difficulties related in any way to the necessary e-mails, which again, as in the case of LMS, shows the need to strengthen contacts, feedback and responsibilities of officials dealing with these activities.



Source: own work

Figure 13 Problems and their elimination related to the administration of institutional e-mails

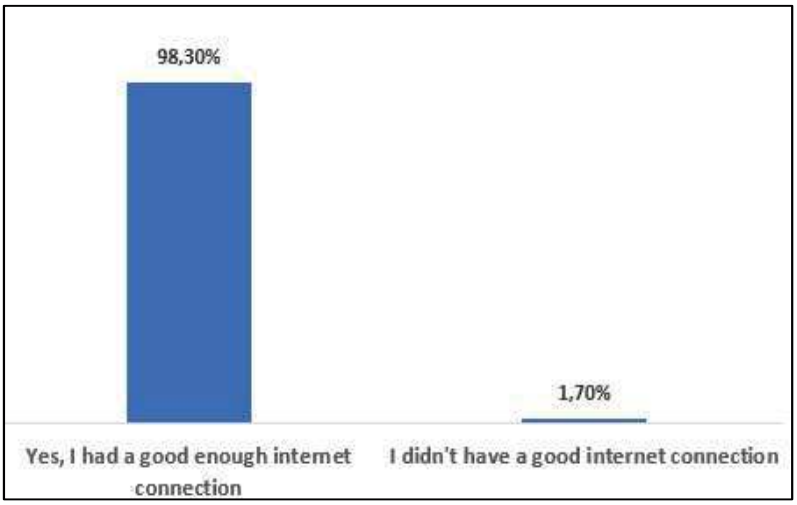
Regarding the way of conducting online communication, there is a balanced trend in the use of both a microphone and a microphone and camera, on (Figure 14).



Source: own work

Figure 14 Way of conducting online communication in real time

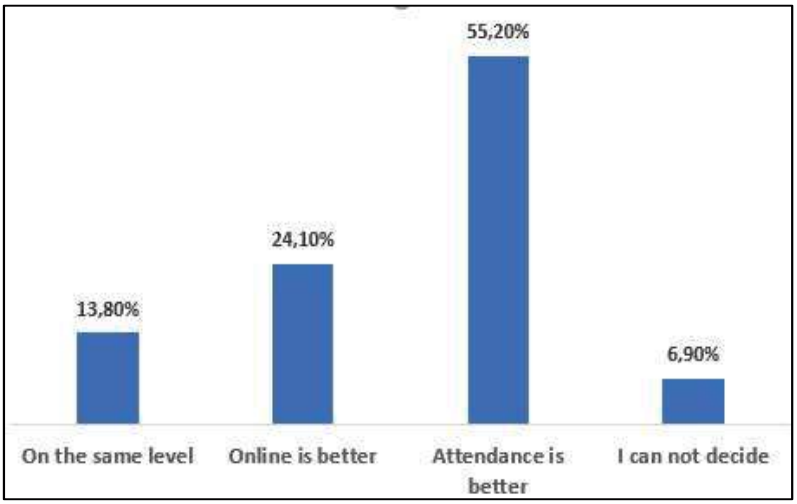
This, in addition to the presence of a sufficiently good internet connection at home noted by the participants in the survey - 98.3% (Figure 15), meeting the requirements of the considered applications, gives grounds to seek greater responsibility and requirements on the part of facilitators of the meetings initiated through the individual applications, thus achieving a stronger engagement on the part of other participants. In this sense, it is necessary to seek a solution for the control and traceability of these activities.



Source: own work

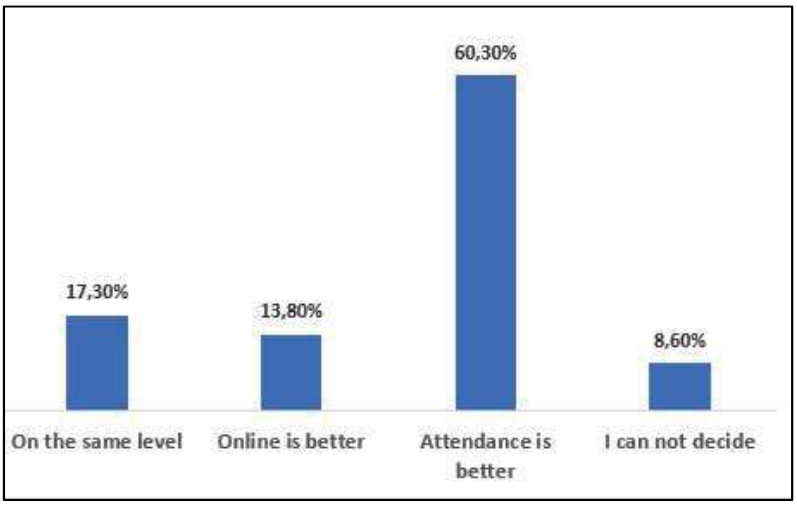
Figure 15 Assessment of Internet connectivity at home

The attitudes of the participants in the process of online learning show close levels of approval and positive assessment regarding the differentiation of lectures and exercises that do not require explicit presence / such as those related to medicine / conducted online and in person (Figure 16 and Figure 17). According to this indicator, 55.2% express the opinion that the current lectures lead to better mastering of the material, and for the exercises this percentage jumps to 60.3%. This shows that the present form still remains preferred. It is noteworthy that the lectures in online format are approved almost 2 times more - 24.1% compared to the exercises conducted in this way - 13.8%, which opens the possibility, in the future, for a mixed form of training, including the remote display of parts of the lecture material, to be considered as a priority option. For 13.8% the two forms of conducting lectures have the same weight, and for the exercises this percentage is 17.3%.



Source: own work

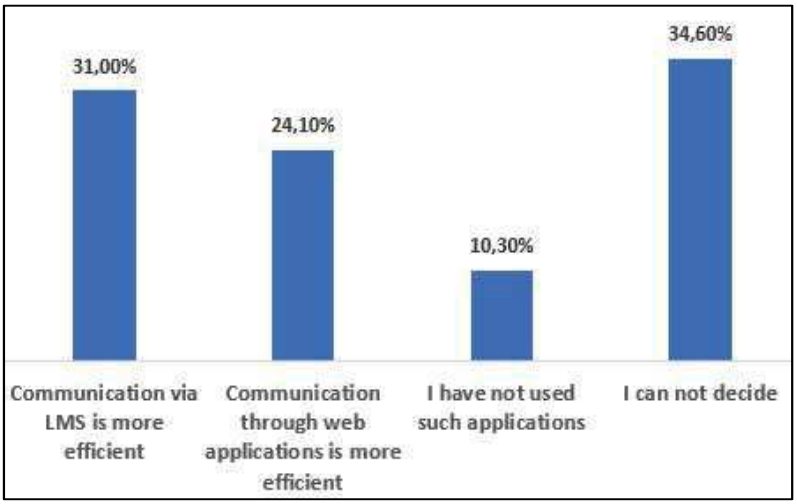
Figure 16 Equivalent of lectures regarding the utilization of material for online and attendance form



Source: own work

Figure 17 Equivalence exercises in terms of mastering the material online and in the attendance form

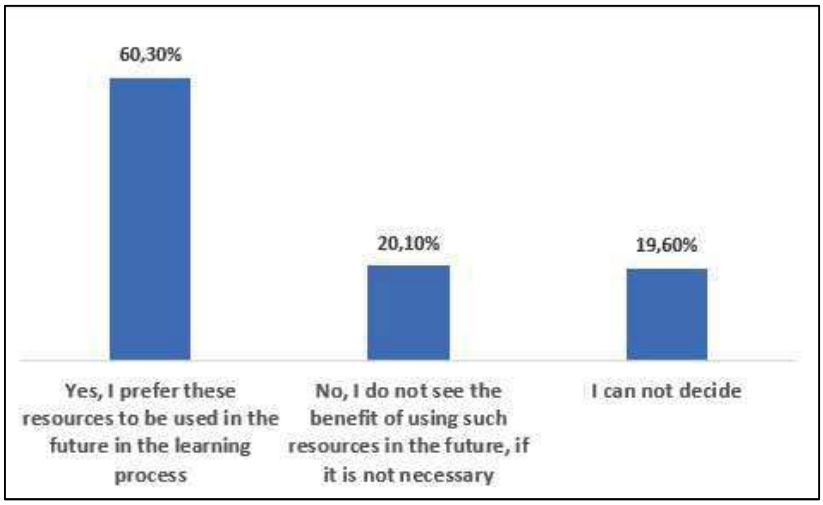
In terms of efficiency, the possibilities for synchronized communication between students and teachers via Moodle / Blackboard, compared to those via Skype, Teams, Zoom and Google Meet (Figure 18) have similar values of preferences and approval, with 31%, LMS are with a slight predominance and are indicated as more suitable for these purposes over web-based applications - 24.1%. Nearly half - 44.8% do not have a clear opinion on the issue.



Source: own work

Figure 18 Comparison of the way of synchronous communication through LMS and through web-based applications

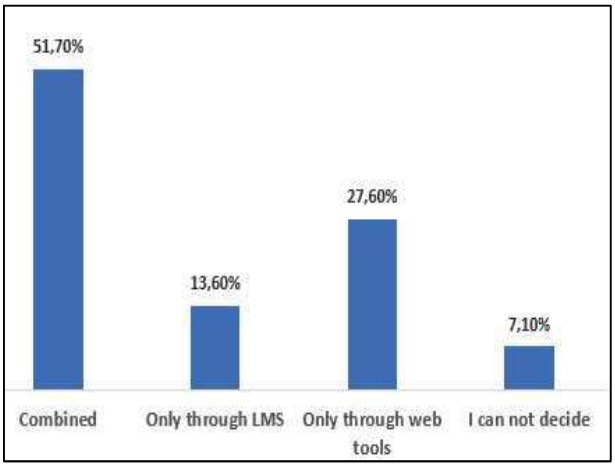
Regardless of the means used in the processes connected to increasing the efficiency of conducting distance learning, there is a clear satisfaction with their impact and the opportunities they provide, which is evident from the fact that 60.3% (Figure 19) would prefer in the future, regardless of other factors, for them to remain as an alternative and approved toolkit for use in specific academic activities related to education.



Source: own work

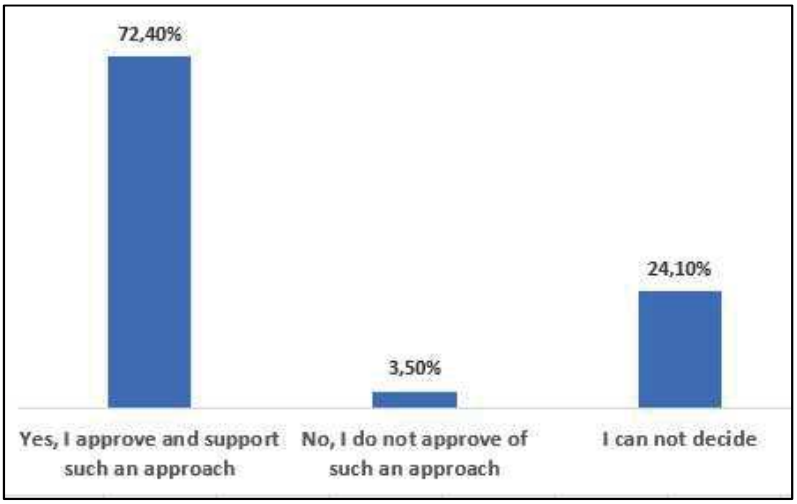
Figure 19 Tendency of the participants to continue in the process of learning in attendance form, to use web-tools / LMS

In this regard, the preferred form in the future when conducting distance learning based on the experience gained in the last year and determined as the most effective and useful is the combined form (Figure 20) - indicated by 51.7%. The majority - 72.4% approve and associate this with an approach in which it will be useful, convenient and effective in terms of learning the content of the uploaded teaching materials related to lectures and exercises in the discipline to be in LMS, and their discussion should take place through the web communication tools (Figure 21).



Source: own work

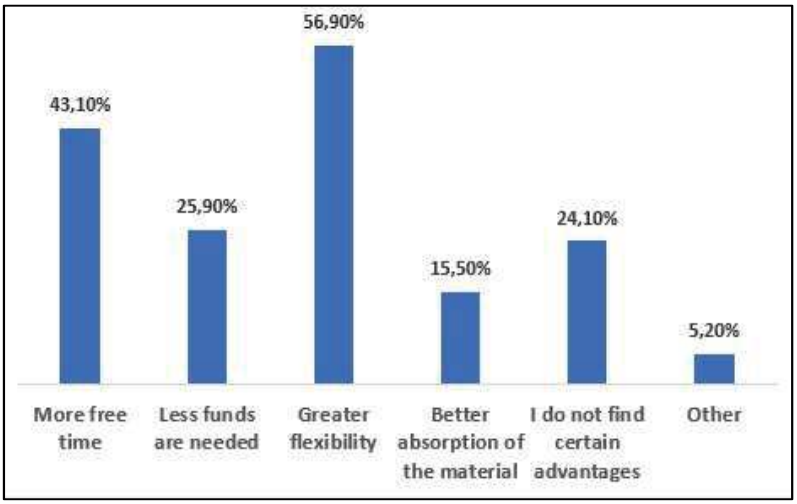
Figure 20 Preferences for the use of resources related to improving the effectiveness of distance learning



Source: own work

Figure 21 User attitudes related to the approach for shared distribution of learning content through web tools / LMS

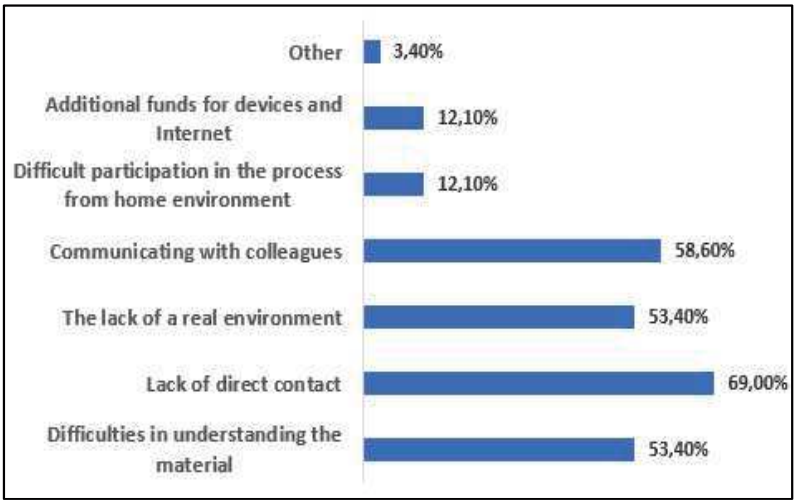
Regarding the advantages and disadvantages related, in general, to the conduct of distance learning (Figure 22 and Figure 23), the greatest benefit is determined by the greater flexibility - 56.9%, which is provided in terms of educational processes, and as a disadvantage - 69%, the lack of direct contact with teachers.



Source: own work

Figure 22 Indicated advantages of conducting distance learning

Additional advantages include most free time, as well as the need for less money, and as disadvantages - the lack of a real environment for training and communication with colleagues, as well as the impossibility or difficulty of conducting from home.



Source: own work

Figure 23 Indicated disadvantages of conducting distance learning

Summary and conclusions

From the analysis it can be summarized that in general the academic community and in particular the universities in Bulgaria are prepared to conduct distance learning. LMS with their development and improvement in recent years are increasingly used in academia. Their easy integration with other systems at institutions, the maintained information system for the participants in the educational processes and rich tools make them a preferred instrument used in the processes of blended, online or full distance learning. Their flexibility, full range of features and reliable future configurability make them the basis for future training models. In order to reap the benefits of these new ways of conducting their traditional activities, higher education institutions need to combine their use with the innovative solutions provided by e-learning software applications.

This requires changes in the technological infrastructure, to ensure the proper functioning of processes in order to maintain positive attitudes on the part of consumers. This way, the maximum effect of advantages that LMS provide in terms of centralized training, unlimited access to training materials, reduction of development and

training costs, easy tracking of progress, will be achieved. The integrated approach in the use of web applications for online communication will provide improved resource allocation, personalized online learning, as well as the opportunity to introduce social learning into the overall strategy of the educational process. The development of cloud services and the benefits they provide in terms of reduced risk of critical data loss and easier access to information should be maximized in the direction of globalization of the opportunities and services offered by universities, providing users with unlimited access to resources, through devices of their choice and in different time zones. It is necessary to invest in modern equipment and connectivity of resources under strict rules for information processes protection, and in the future to consider the establishment of specialized units responsible for their maintenance and proper functioning.

References

ALDIAB, A., CHOWDHURY, H., KOOTSOOKOS, A., ALAM, F., ALLHIBI, H. (2019). Utilization of Learning Management Systems (LMSs) in higher education system: A case review for Saudi Arabia. *Energy Procedia*, 160, 731-737. Doi 10.1016/j.egypro.2019.02.186

CAVUS, N. (2015), Distance learning and learning management systems. *Procedia - Social and Behavioral Sciences*, 191, 872-877. Doi 10.1016/j.sbspro.2015.04.611

DRAGOZOVA, E., MILTCHEV, R. (2018). Acquisition of competencies to work in research projects and networks. In *Conference Proceedings "Management and Engineering'18"*, 1, 126-137.

KABASSI, K., DRAGONAS, I., NTOUZEVITS, A., POMONIS, T., PAPASTATHOPOULOS, G., VOZAITIS, Y. (2016). Evaluating a learning management system for blended learning in Greek higher education. *SpringerPlus*, 5, 1-12. Doi 10.1186/s40064-016-1705-8

LOPES, A. (2011). Teaching with moodle in higher education. In *proceedings of INTED2011 – International Technology, Education and Development Conference*.

MLADENOVA, M., BREZIN, B. (2014). Influence of modern e-learning system on motivation to make young people learning for a lifelong activity. *Innovation in Woodworking Industry and Engineering Design*, 3(1), 175-180.

PAVLENKO, D., BARYKIN, L., NEMESHAEV, S., BEZVERHNY, E. (2020). Individual approach to knowledge control in learning management system. *Procedia Computer Science*, 169, 259-263. Doi 10.1016/j.procs.2020.02.162

PHILLIPS, R., MCNAUGHT, C., KENNEDY, G. (2012). *Evaluating E-learning: Guiding research and practice*. New York: Routledge.

POULOVA, P., SIMONOVA, I., MANENOVA, M. (2015). Which one, or another? Comparative analysis of selected LMS, *Procedia - Social and Behavioral Sciences*, 186, 1302-1308. Doi 10.1016/j.sbspro.2015.04.052

RHODE, J., RICHTER, S., GOWEN, P., MILLER, T., WILLS, C. (2017). Understanding faculty use of the learning management system. *Online Learning*, 21(3), 68-86. Doi 10.24059/olj.v%vi%i.1217

ADZHARUDDIN, N. A., LING, L. H. (2013). Learning management system (LMS) among university students: doesit work? *International Journal of e-Education, e-Business, e-Management and e-Learning*, 3(3), 248-252.Doi 10.7763/IJEEEE.2013.V3.233