RESEARCHING DIGITALIZATION OF THE EDUCATION: A CASE STUDY OF BULGARIAN UNIVERSITIES[*]

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Abstract. Digitization in education is a process formed because of the general digitization of society and all its sectors. Digitization improves the education quality and methods. Digital technologies are an integral part of any field of education. The following criteria defining the level of digitization of the learning process in the universities are essential. The first criterion, we think, is expanding learning opportunities by providing electronic materials (slides from lectures, videos, exercises, projects, etc.); acceptance and evaluation of materials related to the learning process in digital form based on already existing and popular technologies allow training from any location, regardless of the physical location of the university. The second criterion is the education interactivity; the increasing and massive entry of audio and visual devices helps for this. The third criterion is the demand for new digital skills from businesses - creating websites, mobile applications, cyber security and more. Another criterion could be the digital expansion of the competence of the university - the increase in the number and attractiveness of the offered digital services (enrollment, education, exam process, practices, etc.), which are tailored to the interests and preferences of students based on their digital experience and digital expectations. All these questions will be the subject of research in this article.

Keywords: education; e-learning; digitalization; learning process

1. Introduction

The Pandemic related to COVID-19 from 2020 has revealed new opportunities for applying online training approaches that are otherwise known and used for many years. The need to comply with the rules on isolation and distance allowed the development and entering into the practice of some new platforms, information systems and accompanying learning methods in an electronic environment. As part of digitization, traditional training patterns

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are transformed into e-learning models. Although not entirely, universities and schools began to have the characteristics of electronic universities and electronic schools. After 2020, it can be considered that in developed countries (and those with a high network and mobile connectivity), pupils and students not only use e-learning opportunities, but in specific periods they entirely rely upon and work in remote training mode. It is this very fast, mass transition in a remote training regime in the last year with the mass application of digital technologies at all levels and stages, it cannot yet clearly identify and with the respective weights the risks that arise in the learning process. In this regard, the purpose of this article is to present the essence of digitization and its specificity to the educational process, to develop a methodology and carry out a study on digital training in Bulgarian higher education institutions

2. Literature Review

The term "digitization" has been very widely used in recent years. There are different definitions for it. According to Ochs and Riemann (2018), it is related to integrating digital technologies in everyday life by digitizing everything that can be digitized. Scuotto, Serravalle, Murray and Viasone (2019) claim that digital technology is adopted to modify the business model to create value using new, modern technologies. For Abubotain and Chamakiotis (2019), it is the use of digital technologies which upgrades the processes. Botella-Carrubi and Torras (2019) study how companies reorganize their methods and work strategies to get more incredible benefits, thanks to introducing new technologies.

According to Gupta, Kishor, Mishra and Gupta (2021), it is a process of transforming information into digital (bit - 0.1) format (i.e. readable by computers). This allows any information to be stored, processed and transmitted easily using a network of computers. Romdhane, Loukil and Kammoun (2021) state that digitization is a trendy phenomenon that transfers the economy from the era of the physical world to the virtual, Internet-based, big data and mobile devices. Angelova (2020) claims that business and social life are rapidly changed due to COVID-19 social isolation, and one possible working solution is the digitization of organizations.

Or digitization can be seen on the one hand as a process of switching from analogue to digital strategies. On the other hand, this concept can be seen as a technological revolution related to the change in society, particularly in the economy, culture, education, politics, health and others (Hofmann et al., 2018). Digitization is the increasing use of connected digital technologies in society. This covers machine management, Internet communications, robotization, change in the work environment, and a different way of learning (Wasserman, 2018).

To take advantage of emerging technologies and their rapid expansion in human activities, organizations must be adaptive and flexible and transform all their processes. For this reason, digitalization requires a change of focus and involves innovating in technology and modifying the institutional culture to guarantee the evolution of digital transformation (Abad-Segura et al., 2020).

Specific case for digitalization in universities can be considered as overall policy, covering many aspects – starting with typical educational and scientific processes of one university, but also including digitalization for: university business incubators (Chan, Krishnamurthy, & Sadreddin, 2022), digitization in libraries and secure digital resources (Islam et al., 2022), connection and different intermediates between universities and industries (Albats et al., 2022; Roig-Marín & Prieto, 2021), possibilities for digital certification (Litoussi et al., 2022), the role of Massive Online Open Courses in the university activities (Guerrero, Heaton & Urbano, 2021; Krasnov et al., 2018), simulation models in the e-learning environment (Boumiza et al., 2018). Researchers also consider already working models for improving university digitalization–such as the Agile model (Kerroum et al., 2020). Some scholars even further view Artificial Intelligence as the future development of digitization (Anguelov, 2021).

3. Methodology of the study

Empirically few studies to date have introduced much on the digitalization of higher education. Pu, Tanamee and Jiang (2022) provided research on 22 students and 9 instructors to understand the attitudes towards digitalization. Based on their survey results, scholars described three major attitudes - teaching and educational attitudes, which compose the first level, and the second level is the digital platform attitude, technology use attitude, and resource attitude. They also claim that the third level is network attitude, service attitude, and development attitude. Stoyanova, Stoyanov, Remnova and Kushniruk (2021) define the scientific provisions on the feasibility and effectiveness of using e-learning under conditions of quarantine restrictions related to the COVID-19 Pandemic. Ugur (2020) explores the assumptions by instructors and students concerning why and how multimodal and digital technologies are incorporated into undergraduate classes under a qualitative approach. Islam and Nusrat (2018) surveyed various students to understand the effect of digitalization on educational purposes. Machine learning was applied to classify happy and unhappy students with digitalization, where focused time was spent on educational goals. Shana and Abulibdeh (2022) think that the applications of cloud computing for educational efficiency are vital today because they maximize educational outcomes and allow students to benefit from technologies while gaining a greater understanding of the latest technological advancements. Viberg and Mavroudi (2018) present online learning opportunities applicable to the Swedish context. Bejinaru (2019) presents the current state of the phenomenon of digitalization in Europe and discusses the existing strategies to increase the degree of digitalization in the field of education. Bygstad, Ovrelid, Ludvigsen and Daehlen (2022) focus on two streams of digitization in higher education; digitization of education and digitization of academic subjects. Tang, Chen, Law, Wu et al. (2021) explored several critical factors in the research framework related to learning motivation, learning readiness and student's self-efficacy in participating in live online learning during the coronavirus outbreak, taking into account gender differences and differences among sub-degree (SD), undergraduate (UG) and postgraduate (PG) students. Toader, Safta, Titirișcă and Firtescu's (2021) present study also aims to harness the university experience of these times from some of the leading Romanian university centres; the method used was quantitative and qualitative research based on a questionnaire. Toader, Safta, Titirişcă and Firtescu (2021) present the process of online learning in some of the prominent Romanian university centres using quantitative and qualitative research based on a questionnaire. Man, Liao and Sun (2020) provide a research-based analysis of 782 articles and prove that it is essential to implement digital technologies in the educational process, suggesting the increasingly important role of organizations and people in adopting digital technologies. Zancajo, Verger and Bolea (2022) analyze three preponderant areas of response: the digitalization of the educational system, educational inequalities, and teachers' development.

The general understanding of the authors of the current study is that digitization transformation is not only in the working environment where we most often face it but also in all other aspects of our personal and public life. Education is no exception - digitization occurs in teaching and learning, which is not a novelty. Still, in recent decades the rapid rate of technology development has made the process much more visible and significant. And this is due to the penetration of computers, mobile phones and the Internet in classrooms and at home. The potential of digitization in education is enormous and provides many opportunities and challenges.

Digitization in education is a process formed due to the general digitization of society and all its sectors. With the help of digitization, education methods and quality improvement. Digital technologies are no longer subject to study and implementation from relatively narrow areas of the past electronics, computing machines and communications. Still, they are an integral part of any field of education. A definition that, in essence, does not differ from the others says that digitization in education refers to using desktops, mobile devices, the Internet, software applications and other types of digital training for students of all ages. Doing tests using a computer and

an electronic exam platform, online teaching and presentation of materials for training, e-books, and interactive and video materials represent only a few examples of digitization in education these days.

The criteria defining the level of digitization of the learning process in the HEIs are also critical:

- The first criterion we think of is expanding learning opportunities. Providing electronic materials (slides from lectures, videos, exercises, projects, etc.), acceptance and evaluation of materials related to the learning process in digital form based on already existing and popular technologies allows training from any location, regardless of the physical location of the university;

- Another criterion is the education interactivity. The increasing and massive entry of audio and visual devices helps for this.

- The third criterion is the demand for new digital skills from businesses - creating websites, mobile applications, cyber security and more.

- Another criterion could be the digital expansion of the competence of the university - the increase in the number and attractiveness of the offered digital services (enrollment, education, exam process, practices, etc.), which are tailored to the interests and preferences of students based on their digital experience and digital expectations.

The Pandemic related to COVID-19 from 2020 has revealed new opportunities for applying online training approaches. The need to comply with the rules on isolation and distance allowed us to develop and enter into the practice of several new platforms, information systems and accompanying learning methods in an electronic environment.

Based on the above, we can bring out the introductory statements in the present study, namely:

The education process in higher education institutions (HEIs) is a comprehensive and systematically organized process containing the following components:

1. Knowledge, skills and the presence of staff teachers

2. Knowledge, skills and capability of the HEI in the information and administrative servicing of the process of education of ICT specialists to create and maintain infrastructure for a dynamic relationship between "student - lecturer" and of specialists from the administrative and management structure of the HEI, serving the education process in the HEI -inspectors, informational document administration information centre, enrollment, submitting applications for choice of disciplines, enrollment for state exams and others.

1. Knowledge, skills and securing teachers

1.1. Knowledge and skills for work with training platforms: MOODLE, TEAMS, BBB, ZOOM, others

1.2. Presence of a set of prepared lectures in a format suitable for the digital environment;

1.3. Digital skills - Information competence for work in a digital environment in the course of lectures conducted online

1.4. Knowledge and skills for entering lecturing and exams with students at accessible and established official sites of institutions, organizations, companies and their sub-sites with databases and reports - annual, analytical, and statistical.

1.5. Presence of hardware with accompanying software product and Internet connection

2. Knowledge, skills and provision of the HEI in the informational and administrative servicing of the process of education - of ICT specialists to create and maintain infrastructure for dynamic relationship "student - lecturer" and of specialists from the organizational structure of the HEI, serving the education process in the HEI - inspectors, informational document administration information centre, enrollment, submitting applications for choice of disciplines, signup for state exams and others.

2.1. Internet connectivity of the HEI - examines connectivity and provision of wired and wireless Internet and Intranet access in classrooms, laboratories, cabinets, centres, and WiFi connections within the university campus.

2.2. Platforms used, access and storage models for Internet-based content provided by the HEI and its lecturers for the learning process - created and maintained platforms, a unit to service the method of access and use of educational platforms from students and lecturers.

2.3. Competence of administrative staff in the learning process:

- In the educational process - a level of digitization of education in the traditional and remote form concerning lectures, ongoing control and exams.

- in concomitant activities - the digitization of the curriculum timetable; digital services for students, digitization of library activity;

- in the administrative process - digitization of processes of applying and enrollment of students at the university -digital submission of documents, approval, admission to the examination and conducting an examination; processing the results of the exams and ranking of accepted students.

This methodology allows for a comprehensive and multi-aspect assessment of the state of digitization of the learning process. It helps the higher education management to make reasoned decisions for optimal process management in the short and medium term.

To determine the level of digitization of the educational process under COVID-19, we carried out a study among higher education institutions in Bulgaria, which covered a variety of questions on the way they conduct their learning process over the past two years. One part of the results we will provide further in this article.

The study was conducted in the period 10-12.2021. It covered 51 accredited higher education institutions in Bulgaria. The questions were addressed to managers and higher and medium managerial level administration. The profile of the participants is relatively balanced by gender and age, with a slight predominance over the rest of the respondents: respondents-women at the age of 50-55. In the comparatively uniform distribution of other participants, the most significant percentage are respondents in the age group 40-45 by 16.2%, and the smallest share is that of participants between 20-25.

Respondents with the highest percentage are those with over 20 years of internship in specific higher education institutions. They ranked those with training between 10 and 20 years, the positions and professional experience of the participants are diverse - rector, deputy rector, director of the study and centre for distance learning, program coordinator, department manager, chief expert in the department, administrative secretaries, teachers.

4. Summarized survey results and comments

4.1. Knowledge, skills and the presence of staff teachers
In this part, the survey questions are grouped to obtain information regarding:

- hardware provision with concomitant software product and Internet connectivity on the one hand, for the digital environment in the HEIs - available equipment, software solutions and others, and on the other hand, how teachers appreciate their knowledge and skills to work in a digital environment; results are presented in Fig 1.
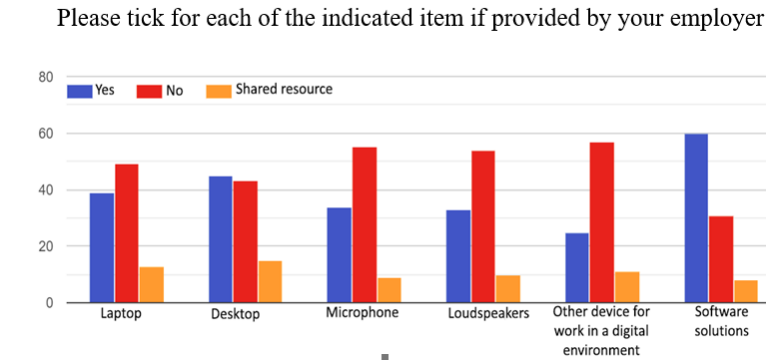
Please tick for each of the indicated item if provided by your employer

Fig. 1. Software and hardware equipment of the teachers

As can be seen from the graph, for the most part, the equipment is personal, in some cases, shared. Higher schools generally provide information software solutions.

Teachers give high self-assessment for their laptop and desktop skills during online lectures, seminars and exams. They encounter some difficulties in working with specific software products. The teaching staff's most famous work platforms are Teams, Zoom, Moodle, and Skype. Answers are summarized in Fig. 2.

Please, indicate to what extent you can use the following software products
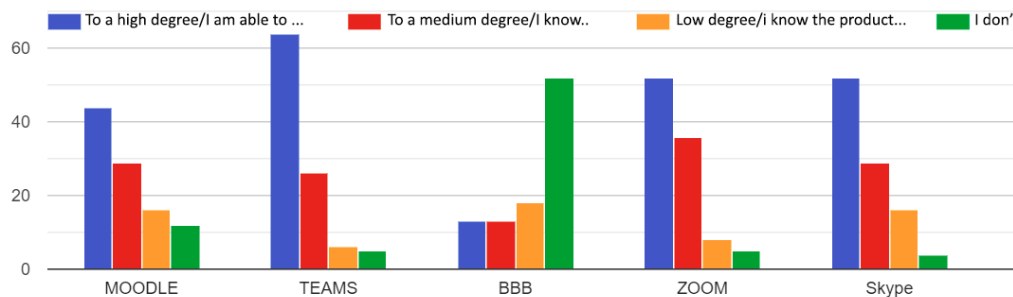
Fig. 2. Degree of knowledge of software platforms

Against this high self-assessment in terms of skills to work with digital devices and software solutions, the high percentage - 62.5 of negative answers to the question "Have you attended a course of work in a digital environment over the past two years?" are expected. The high percentage of negative responses may result from the lack of need for the teaching staff to pass training in a digital environment.

From another point of view, the rapid transition to education in a digital environment as a consequence of the Covid-19 Pandemic left not many opportunities for teaching staff to do additional training, go smoothly through training or improve existing competencies in the field of digital technologies (Fig. 3).

Have you attended training for developing digital skills for the last two years?
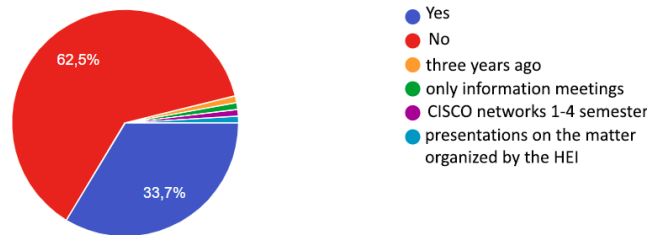

Fig. 3. Participation in training to improve digital skills

Out of the comments that the participants in the survey have made, it can be concluded that in the last two years, they have undergone various pieces of training to increase their digital skills organized by the management of the higher education institutions and self-learning which individual lecturers have taken using the resources in the Internet space.

Regarding the presence of a set of prepared lectures in a format suitable for the digital environment: 88, 3 % responded positively (Fig. 4).

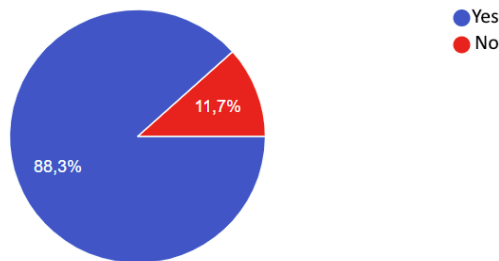Do you have ready-made PPT lectures in a form suitable for a digital environment?

Fig. 4. Presentations adapted for online learning

The high percentage can be a logical consequence that much of the learning materials, whether lecture courses or seminars are also used to attend school hours before moving into a digital environment. The equipment of many higher education institutions allows for presentation equipment, which implies ready-made materials in different disciplines, the transformation of which digital training is not time-consuming.

Skills to work in a digital environment in lectures and exercises conducted online.

93.3% of respondents have experience and skills in teaching online. This high percentage may also result from introducing new technologies into the teaching staff's everyday life before the digital training environment (see Fig. 5).
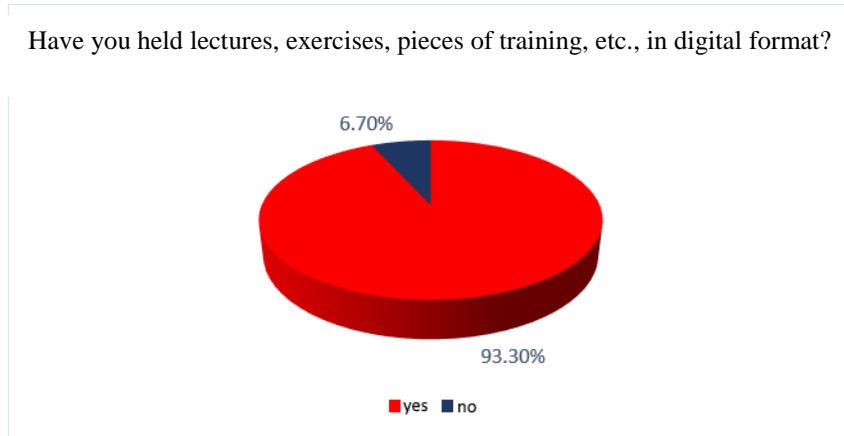
Have you held lectures, exercises, pieces of training, etc., in digital format?

Fig. 5. Skills to work in a digital environment

Online participation in international conferences, symposiums, round tables and others is a practice for many higher education teachers that provides them with the necessary experience, knowledge, and habits to conduct online training (Fig. 6).
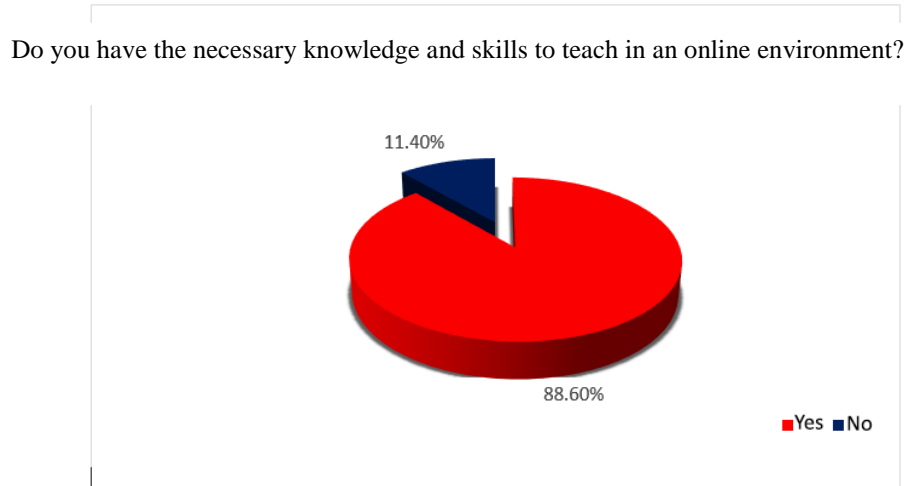
Do you have the necessary knowledge and skills to teach in an online environment?

Fig. 6. Online participation in international conferences, symposiums, round tables and others

It is necessary to note the high self-assessment of digital work competencies, developed lectures and materials applicable to online education, as a top place for the best-known product is assigned to the Teams platform. It was also one of the first to be massively introduced for daily activities in the digital form of training.

The second part of the survey covers the evaluation of knowledge, skills and equipment of the HEIs in information and administrative services of ICT specialists to create and maintain infrastructure for dynamic relationships between "student - lecturer" and specialists from the executive and management structure of the HEI, serving the education process in the HEI -inspectors, informational document administration information centre, enrollment, submitting applications for choice of disciplines, enrollment for state exams, etc. the subject of study here is:

- Internet connectivity of the HEI - examines connectivity and provision of wired and wireless Internet and Intranet access in classrooms, laboratories, cabinets, centres, and WiFi connections within the university campus.

The level of connectivity also includes the provision of broadband Internet access, mobile broadband access, and broadband speed.

    - About 80% reply that wired and wireless Internet is provided in the HEIs (Fig. 7).
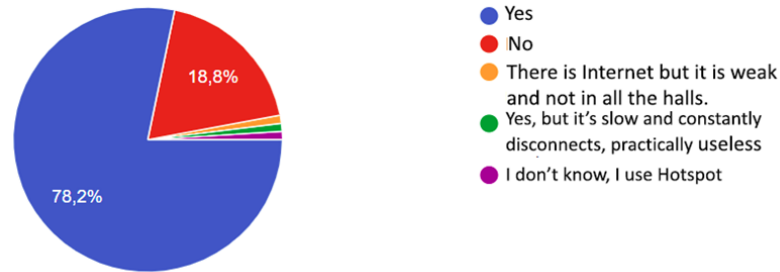

Fig. 7. Availability of Internet in the classrooms

On a question of what Internet-based access and storage platforms provide the HEI to its teachers for the learning process, there is quite a variety of answers.

Teams, Google Drive, One Drive, and Dropbox are the most popular storage platforms. Over 80% of respondents indicate that they are updated promptly (see Fig. 8).
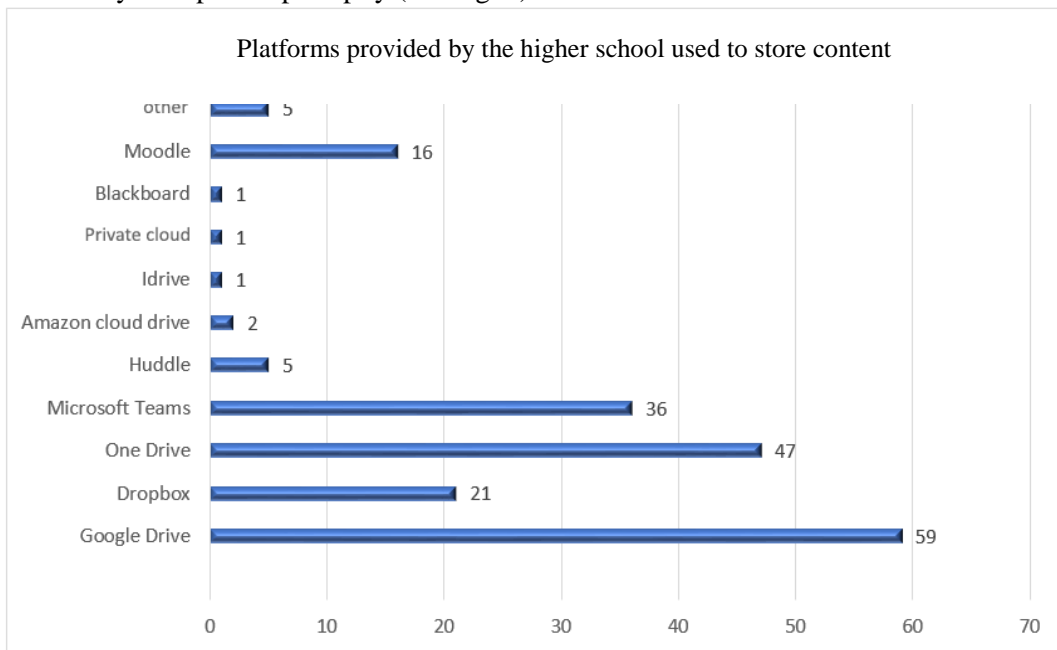

Fig. 8. The most popular storage platforms

    - Competence of administrative staff in the learning process:
In the educational process - a level of digitization of education in regular and remote form; level of digitalization during an ongoing control; exams level of digitalization.

There are no significant differences in the digitization of individual processes - over 50% reply that it is high (Fig. 9).
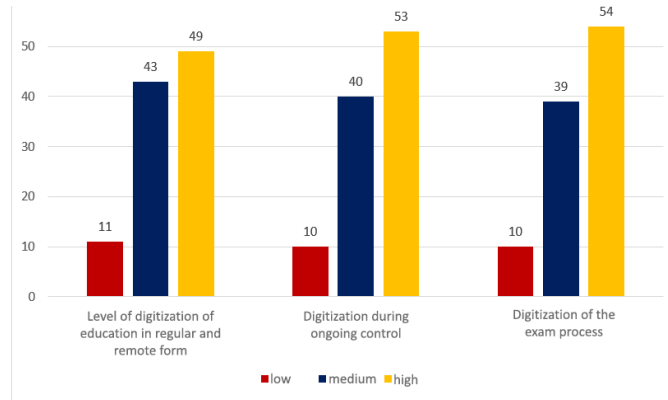

Fig. 9. Level of digitalization of the learning process (103 respondents)

- In concomitant activities - digitization of the library activity. The analysis of the results shows that more than half defined it as a low and medium, which significantly hinders students in lectures and exercises held from a distance (Fig. 10).
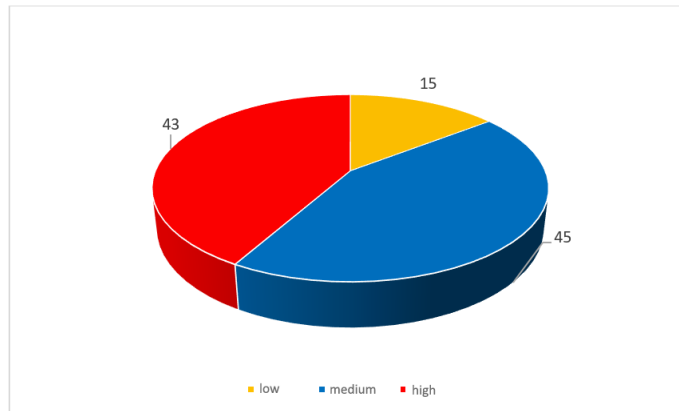

Fig. 10. Digitalization of the library fund (103 respondents)

- in the administration - digitization of processes of applying and enrollment of students at the university - includes digital submission of documents, approval, admission to the examination and conducting an examination; processing of the exams results and ranking of accepted students (Fig. 11).

What is the degree of digitalization of the university student application and enrollment process?
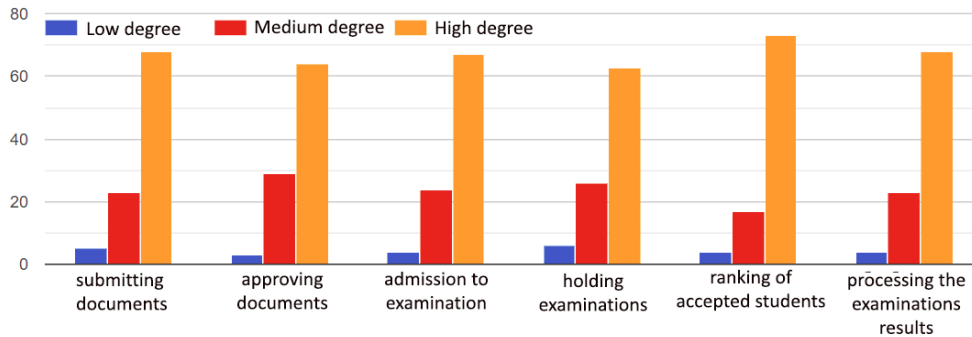

Fig. 11. Digitization of processes of applying and enrollment students at the university

- Ethical norms, regulations and rules for the content provided in the digital environment, incl. lecture materials, PPP, information and reference materials. /the presence of documents in HEI providing the absence of plagiarism, originality and credibility of students and lecturers/.

66.3% responded positively, meaning that respondents are familiar with ethical norms and rules, a prerequisite for correctness and loyalty in a digital environment (Fig. 12).
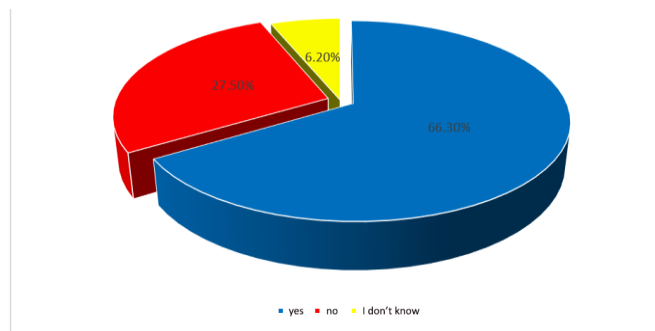

Fig. 12. Existence in universities of regulation and rules for the content used in a digital environment

The future digital generation is related to the development of revolutionary technologies, which links education and technology more important than ever. Providing an environment that activates and motivates learners for efficient work is related to introducing modern educational technologies. Still, they are only a means by which the school/university implements interactive methods based on the individual approach to work. Using these technologies in the learning process allows for the transition from a lecturer- to a learner-oriented educational policy.

Conclusions

For the first time since the COVID 19 pandemic, such a representative study is being conducted, which covers all universities in Bulgaria and shows the level of digitization of their educational process. Unlike other research that has been done in recent years and refers to individual universities in Bulgaria, this gives an idea of the education systems used, the level of digital skills of the teachers, administration and students, the presence of intellectual property protection systems in an online environment and the preparedness with learning materials for this type of learning.

Our general findings based on the empirical research could be summarized as follows: the central part of Bulgarian universities did not provide special technical equipment for their staff in the period of home office work during COVID-19 restrictions and social isolation. The support role of universities could be found only in software solutions. Our results also show that most Bulgarian universities did not provide their staff with special training to improve their computer and digital skills. At the same time, almost all have to conduct online lectures. The most well-known platform for Bulgarian HEIs is Teams, followed by ZOOM and Skype. Traditionally, Bulgaria and educational institutions have good Internet infrastructure, including classrooms.

In conclusion, Bulgarian universities must reconsider and implement specific policies to support their staff (including administration and academics) by providing exceptional training and equipment to prepare them for the next step of digitization.

Today's education faces major transformations caused by integrating new digital technologies into academic activity and the active demand for effective training models. Digitization undoubtedly changed our educational system, but we cannot say that the value of old classroom education has been reduced. The best part of the digitization of education in the 21st century is that the two forms of education can be successfully combined. Digitization in education also appears to be the proper method of saving resources; thus, digitizing the education system in the 21st century also proved to be a grace for our society.

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