Digitalization in Bulgarian Higher Education – Present and Future Opportunities

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Abstract

This paper presents the current status and outlines some future trends in the digitalization process of Bulgarian universities. Digital transformation is of great importance for our society because it gives the dynamics of the pace of development towards the new, global digital world. By converting traditional learning processes to digital, many educational institutions had the opportunity to flawlessly continue their work through the pandemic since 2020. Many processes and development plans on both European and national level have been considered. Some of the policies aimed at the educational digitalization comply with the "Education for Tomorrow" and the Digital Education Action Plan (2021-2027) of the European Union (EU). The goals are to develop and enhance the efficiency of the digital education ecosystem and enhance digital competences and systems that develop digital skills. Good results and applications can be found in the electronic system for online training and online materials – Moodle. Another move has been made deploying online classrooms /Zoom, MS Teams, etc./, electronic student books, online monitoring of student attendance, electronic library with the necessary educational materials, online courses, online exams, etc. Based on existing technologies and policies, we also look at future trends regarding university education like artificial intelligence, smart classrooms, the use of big data to analyze student achievement and assessment. Bulgarian universities, and in particular - the University of National and World Economy follow the road of the newest trends and developments from the European commission action plan for the period 2021-2027.

Keywords: Digitalization, higher education, trends, big data, security
1. Introduction

We live in a digital and constantly changing world and after each year we enter in new digital dimensions which make our lives easier. We enjoy better communication, more efficient digital environments that increase the technological qualities and capabilities of people. The Covid 19 pandemic, that started in early 2020, has shaken and continuous to do so the whole world and also has fundamentally changed the way different businesses operate. Despite the controversy around the worldwide health issue, no one disputes one thing - it has helped to speed up digital transformation of various processes. In search of solutions for a rapid transition of an online environment, many businesses, government institutions and educational institutions have faced huge challenges in the digitalization. In its essence, digitalization is a strategy or process that goes beyond the implementation of digital technologies in each environment and the transformation of paper into digital documents and processes, and implies a deeper, fundamental change of the whole business model and evolution of work activities. [1]

The pace of digitalization in all aspects of society is different. While some people work entirely online, there are others where the pace of transformation is not the same. Digitalisation in higher education, for example, is seen as an additional challenge, rather than an integral part of the provision of higher education in the digital world. Digital learning is more than just digitizing learning materials. It is a process with enhanced flexibility and more personalization than the traditional forms of education. This change has revealed new and innovative ways for education for students and lecturers/professors. There have been new approaches to organize their teaching and learning activities and interact in a more personal and flexible way online. Learners have the opportunity to improve their knowledge and to gain qualities such as teamwork, communication, higher personal responsibility and acquire skills in new areas, thanks to the use of software and other digital technologies. [2]

The education system is very complex sector, in which the use of digitized learning processes and methods affect the future of very large number of people and their place in society. The document examines the current state of digitalization in education in some EU countries and in Bulgaria. Various European and national plans and programs are also covered, which aim at the realization of digitalization of processes in the educational system. Based on already formed trends, proposals for digitalization of higher education in Bulgaria are presented. [1] [2]

2. Current state of digitalization – European and National level

Digitalization and digital transformation are very important nowadays and make an enormous impact in every economic sphere. In the last two years everything around the world changed in a matter of days, and education was one of the domains that needed to adapt immediately. All students had to be able to continue their education, because there wasn’t any certainty of how long this will continue. Bulgarian education system was no exception from this case.
The Bulgarian Higher education system started its reform a bit later than all the European countries and still needs some time to complete the process. Every country that is part from the European Union tries to adapt all the policies and programs that are produced by the institutions in the Union, but some countries can do it faster than others. Universities and colleges are very often big institutions, and the processes of digitalization could be split up in three main spheres: Campus, Teaching and Learning. Each of these processes includes many people who either work, study or teach and have an integral part in the digital transformation. Figure 1 presents the issues and topics, that have to be taken into consideration before starting a digital transformation in the Higher education.

2.1. National level

Digital transformation is of great importance not only during times of pandemic but also for the future. Tools for video conferencing for the students, which study abroad and be able to continue their education, adaptive learning to personalize the content for every student, artificial intelligence and chatbots to help the students with questions, smart classrooms and last but not least - the learning platforms that are used by the universities to give their students materials, exams, etc.

Currently there are more than 2600 educational institutions of various levels in the Bulgarian national education system - schools, colleges, universities, etc. More than 85000 teachers and lectures support and participate in the educational process. Looking at the higher education system in Bulgaria there are 51 higher education institutions, of which 37 are public and 14 are private. This numbers, include 44 universities and specialized high schools and 7 independent colleges. Each one of these institutions has different IT competences and dynamics, various equipment, but the pandemic situation made everyone realize that there is need of rapid digitalization and digital transformation of all processes – from administration through teaching, learning, and examining the students.
2.2. European level

For the aims of the paper and to make a comparison between the current European level of digitalization and the level of Bulgaria in this field, we take a close look in a survey conducted between April and June 2020, as the same was conducted in 2014 by the European University Association. The survey looks not only at the changes due to the pandemic but also how the universities around Europe have advanced in the sphere of digitalization since the survey in 2014. Some 368 higher education institutions from 48 countries participated in the survey, with 15 universities in Bulgaria, which will give us a chance to make a proper comparison.

The survey was prepared before the outbreak of the pandemic, and the questions given there are for the times before lockdowns started happening with some additional questions for what and how it changed after that. [4] Before the current situation emerged, there were two important aspects of the digitalization. The first is the positive impact that the digitalization is making in education - amazing opportunity for the students and the lecturers, to be able to give and receive knowledge, even when not attending the university on-site. The other is the likely negative impact of the full digitalization and online teaching and learning – lack of social contact, lack of the cultural diversity, direct communication, etc. The first lockdowns in Europe showed us that all people, included in the Higher education processes, can adapt fast into the new situation. Topics and situations that looked quite odd and unusual for the day-to-day life in the university became reality. The next lockdowns showed us that during the digitalization of the university processes something very important for the educational processes is happening – people need interaction between each other. One of the most important questions, answered on European level in this survey is about what types of delivery modes for learning they have – blended learning, short online courses, full online degrees, and online mobility.[3]

There are four options of learning/education offered by the universities that took part in the survey. Blended learning is a combination of on-site classrooms and innovative IT technologies. As technology develops faster, they become more accessible and present different options for studying - in the last months, the hybrid model has entered the scene. The survey confirms that on European level, the blended learning is the most used method, and it is mostly offered and used in Northern (92%) and Western Europe (85%). Compared to the previous survey made in 2014, the higher education institutions that offer blended learning have not increased, but it is likely to happen in the future. Some 228 institutions, from all 368 participated in the survey, have offered short online courses as the main aim of these courses are adult learners or working people. Compared to the previous survey from 2014 there is no increase in the percentage of the offered online courses, even there is a decrease, because for the Balkans the percentage is low and for the Northern part of Europe is over 60%. The online mobility offered by some of the institutions is again more common in the North of Europe (38%), as 35% of the universities are planning this type of mobility. One can see that there are prospects for this type of mobility, because when the pandemic started in the beginning of 2020, many student’s mobilities were cancelled and a digital one could have given them a chance at least to receive some international experience. [3]
Even though universities from all around Europe have participated in the survey, the Balkans and especially Bulgaria are building the foundation of the digitalized education, even though in the last year and half, many higher education institutions converted to online teaching and studying using different platforms for these aims. Before the beginning of 2020, all these platforms weren’t used as much, but the pandemic triggered enormous change and digitalization of many processes not only in the Higher education but also in every other educational institution.

2.3. Comparison of some digital services

After examining the European and Bulgarian level of digitalization, it’s time to make a brief comparison of some digital services for two universities – we pick one from Bulgaria and the other one from another European country - Portugal.

The University of World and National Economy (UNWE) is the first and the largest higher economic education institution in Bulgaria, situated in the capital Sofia with more than 100 years of history. [5]

The Polytechnic Institute of Cavado and Ave (IPCA) is the youngest polytechnic university in Portugal, based in Barcelos, Northern Portugal. [6]

Even though both universities look like they do not have a lot in common, a closer look shows another story. UNWE is not only economic university, but offers a wide variety of Bachelor, Masters and PhD programs in many spheres including technological disciplines as Business Informatics, Big Data, Artificial Intelligence, etc. As of IPCA, it is a polytechnic university, but offers a great variety of disciplines not only in the technological sphere, but also in economics.

Some of the digitalized services that both universities offer and made a comparison with them in Table 1.

<table>
<thead>
<tr>
<th>Service</th>
<th>UNWE</th>
<th>IPCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online library</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Online classrooms</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Moodle /online resources/</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Student’s cards combined with bank card</td>
<td>YES</td>
<td>Only student card</td>
</tr>
<tr>
<td>Online attendance system</td>
<td>pilot</td>
<td>YES</td>
</tr>
<tr>
<td>Online open courses</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Online exams /MS Forms, other/</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Online enrolling for semester</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Online application for scholarships</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Online Erasmus application</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Canteen lunch / dinner reservation</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>
Both universities offer a number of digital services. One of the main digital services in the UNWE is the student card combined with a bank card, which is patented by the Patent Office of Republic of Bulgaria. Some of the digital services were motivated and activated because of the pandemic, and still, they are of great value, because they will help all students and lecturers in future and will make the development of the Higher education institutions even better.

3. Plans for realization of digitalization at National and European level

3.1. European level

Three programs on European level are examined. One of them, which is considered is of the European Commission. EU Member States' projects and plans for the digitalisation of the educational process are documents that aim to outline a strategy aimed at making the adaptation and understanding of the learning process easier by both learners and teachers themselves.

Various studies have been done to establish digitalization. One of them, organized by the Organization for Economic Co-operation and Development (OECD), concluded that only 40% of EU lecturers are willing to use digital technologies in their teaching. Another ICILS survey in 2018 showed that more than a third of 13- and 14-year-olds do not have a basic level of digital skills in different EU countries. According to a recent Eurostat survey, a quarter of low-income households do not have access to computers or the Internet, with differences in the EU affected by household income. [7]

A public consultation organized by the European Commission was held from June to September, which led to surprising findings. During this process, it became clear that the digital literacy of schools and especially the digital skills of teachers vary considerably across Europe. They are often unsatisfactory in their current development. [7] [8]

The action plan has two priority areas, presented in Figure 2:
There are five important components in any information system that need to be addressed by people who plan its activities or require a change in system operation. These components are people, hardware, data, network, and processes. The digitalization of education is also considered to be such a process that, in order to be successfully implemented, it must first pay attention to the above components.

The first priority focuses on promoting the development of a highly efficient digital education ecosystem. According to the plan, this will be achieved with the right infrastructure in the school, planning and development of digital capacity, increased digital competence of teachers and staff to properly manage the processes. Another important goal to complete this priority by improving
the quality of educational content and the use of convenient and secure platforms that meet ethical standards in the electronic environment.

The second priority is aimed at increasing digital skills and competencies for digital transformation. To deal with this problem, the creators of this plan point out that people in the education system need to have computer knowledge, basic digital skills, and digital literacy so that they can successfully deal with misinformation. In order to be able to improve the level of digital education and to intrigue learners with the development of technology, it is necessary to have more advanced digital skills and knowledge and understanding of the subject of artificial intelligence. The opportunities for a successful start for each learner must be equal. [7]

The next plan that is considered, the DIGI-HE project, implemented with the support of European universities and the European Commission's Erasmus + program, is aimed at improving the digitalization strategy by sharing good practices and peer-to-peer learning and experience between institutional management in higher education institutions across Europe. The tools used are various surveys aimed at identifying digital self-assessment by different participating countries, as well as partner groups, including reports in seminars and different groups of learners to develop and present good practices. The aim of the seminars is to develop and launch an independent digital training resource. The duration of the project is from January 2020 to December 2022. [9]

Another important document is the UNESCO plan – The Strategy on Technological Innovation in Education 2022-2025. The ongoing digital transformation in the educational process is leading to an increase in hybrid learning, which is supported by increasing connectivity worldwide. Entering and understanding the importance of digital services such as artificial intelligence, big data, cybersecurity, and higher education management information systems helps higher education institutions to better plan and fund their activities. UNESCO provides support and political advice on inclusion and access to higher education institutions. The use of digital technologies for hybrid education is one of the main goals. UNESCO supports the development of e-learning platforms and higher education for online and blended learning. [10]

3.2. National level

The main national program is Digital Bulgaria 2025, which is a continuation of Digital Bulgaria 2015. The newest version of the program aims to modernize and implement new intelligent Information Technology solutions in all areas of economy. There are three main objectives of Digital Bulgaria 2025, presented in Figure 3.
The first objective is the most important for our paper. Modernization of school and higher education in the field of ICT includes development of reliable and modern ICT infrastructure at schools and Higher education institutions, improving digital competences, modernization of teaching methods of teachers in high schools and lecturers in universities. The second objective for increasing the number of highly qualified specialists in the field of ICT has two key activities, which are to increase the young people, which are trained for Information and Communication Technology professions and to promote the development of these specialists. The third objective is to improve the digital and ICT skills of the workforce. Under this program different programs financed by the Bulgarian Government are considered. [11] [12]

4. Trends

Society and the professional world continue to evolve and change with the rise of technology and the beginning of the Fourth Industrial Revolution. This in turn has had a huge impact on the education sector, as it leads to technological trends in the world of education. In order for students to be motivated, teachers need to keep up with the latest changes and key factors that affect education. Understanding them helps to create more effective learning environments by applying technologies to the teaching and learning process such as interactive lessons, artificial intelligence and robotics, 3D platforms, repositories and virtual simulators and provide platforms for collaboration and organization of process integration and people such as workflow systems,
educational social networks, learning management systems integrated with academic administration systems, and virtual communities. Fast Internet in every lecture hall, free use of tablets, intelligent telephones and computers in the learning process, electronic textbooks are some of the possible solutions to increase the student's interest in education in the future. [13]

As data confidentiality becomes an increasingly important concern in various sectors, higher education institutions are turning their attention to their own information security strategies. Cybersecurity plays an important role in such a case. Vulnerabilities can be anywhere in the university network. With the growing deployment of IT technologies and IoT devices, the need has emerged to protect the network from cyber threats. Higher education institutions need to implement new tools that improve cybersecurity, such as consumer and entity behaviour analysis (UEBA), which detects suspicious activity in typical consumer behaviour. [14]

4.1. Data security

Institutes should also consider the safest way to share data. Sensitive information must be encrypted both when not in use and during transmission. All educational centres seek to protect their reputation from the potentially catastrophic impact of cyberattacks and exposure to sensitive information. Jonathan Rajewski of Champlain College in Vermont said one of the security policies used in higher education should be to ban the use of popular services such as Dropbox to share sensitive information or student data. Experts in the field of cryptography point out that a good technology is the blockchain. Blockchain is a modern technology that is used to store and transmit information in a distributed, secure, and efficient way. Educational institutions can use the blockchain to store student data, such as personal data and learning effectiveness. The advantage of such technology, among other things, is security and non-repudiation. In addition, the blockchain is usually used for authentication, so it can significantly reduce fraud. [15]

4.2. Access control

Distance learning presupposes more and more students to have access to tuition payment systems, access to shared materials of teachers. [16]

Student authentication should go beyond a simple username and password to include additional factors where appropriate, such as multifactor authentication (MFA), which can go a long way to better protect the network. Directories and privileges must be kept up to date. [15]

4.3. Improving student performance

With new technologies, some difficulties arise for students with special needs. Therefore, as a trend, several technologies are being formed to be used:

- voice-to-text technologies that transform classes into notes are useful for students with hearing impairments,
- text-to-speech technologies help students with dyslexia to be enumerated instead of reading so that they can learn effectively.

Personalized learning can involve a diverse range of technologies, including artificial intelligence, to understand how the student learns best and to adapt education accordingly. [17]
4.4. Artificial Intelligence

The new options for real-time data assessment provide an opportunity to adapt the learning content and methods to the individual needs of students. Intelligent software can track their progress and identify which material has been mastered and which areas still need more instruction. In this way, the courses can be customized, focusing on the development of the potential of individual students. [15]

4.5. Big Data

All educational institutions – high schools, universities, etc. gather great amount of information about grades, courses, personal information of students from different sources. Collecting and then analysing Big Data could provide better conclusions and ability to understand different student trends. Learning how to interpret and analyse the vast amount of Big Data gathered, educational institutions can isolate trends which can help to improve different parts of the educational process – learning experience as lectures, seminars, improvement of the resources offered, etc. The data that is collected can help immensely, if analysed properly, about making the full educational experience better. [18]

5. Conclusion

Bulgarian education system and in particular the way students learn and the way of teaching must be adapted to the era of digital transformation. This is necessary because, along with reading, writing and arithmetic, digital skills have become the next key competence for success of human education. In order for digital education to become a reality, teacher training must also be modernized. Digital education requires well-trained lecturers/professors who can use digital media to convey relevant information to students. This can include digital platforms, virtual or augmented reality, online libraries, or webinars. Digital media makes possible many new and innovative forms of teaching and learning in schools, professional institutions, and universities, as well as in corporate training and development programs. [2]

Building partnerships with many stakeholders and negotiating a digital skills strategy is an example together with the project to improve the digital skills of small and medium enterprises between Google and the Software University in Sofia, Bulgaria, with the support of the Ministry of Economy, which started in May 2018. [13]

The Bulgarian education system needs urgent measures to increase the digital skills of young people in real action. This can be done with the support of business and the civil sector, as their development depends to a large extent on the increased digital culture of employees in all sectors of the economy. [13] [19]
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