Article

Needs and Performance Analysis for Changes in Higher Education and Implementation of Artificial Intelligence, Machine Learning, and Extended Reality

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Abstract: Higher education in the Republic of Serbia needs to be reformed. This paper presents a performance analysis of the changes that the authors assume are mandatory, presenting the research problem this article addresses. Cabinet research, performed by analyzing the theoretical building blocks of available knowledge and experience, is underway. Articles and studies from various publications, such as academic journals and institutes, were used as sources. In addition, academic articles and papers and studies about artificial intelligence, machine learning, and extended reality were also consulted. The authors consider that these technologies could be of great assistance in developing a new higher education strategy. Further, this research is exploratory given that information from the 100 Serbian students from selected higher education institutions was used to better understand if these technologies are welcomed by students. Based on SmartPls software, the research analysis proved that artificial intelligence (AI) and machine learning (ML) are appropriate technologies implemented in higher education institutions (HEI) to develop skills among students, a collaborative learning environment, and an accessible research environment. Additionally, extended reality (XR) facilitates increased motivation, engagement, and learning-by-doing activities between students, offering a realistic environment for learning.

Keywords: artificial intelligence (AI); digital competences; extended reality (XR); information and communications technology (ICT); higher education institutions (HEI); machine learning (ML)

1. Introduction

According to the Law on Higher Education, higher education in Serbia is provided by universities, faculties, academies of vocational studies, and vocational colleges that the national body has accredited. Therefore, the national body determines, among other things, whether a higher education institution or study program meets the National Council's standards through accreditation. Additionally, it should be determined whether the program's conditions for implementation are met. According to available data, Serbia currently has 18 universities, nine founded and funded by the state and nine privately owned. Like other higher education institutions, the question remains whether these universities follow educational trends, economic trends, and technological development, i.e., different needs for educational profiles and whether they innovate or discontinue existing programs in response to these continuous evaluations. Thus, this paper examines if higher education in the Republic of Serbia is developmental and progressive and if students are provided with adequate knowledge through educational programs [1].

The National Accreditation Body [2] accredits higher education institutions and their units, evaluates study programs, and ensures the quality of higher education. The mission

of the National Accreditation Body is to raise the level of training and education in Serbia, exceptionally professional and ethical behavior in the accreditation and quality control process, and the accreditation of institutions.

Teachers, especially at the undergraduate levels, use information and communications technology (ICT) very sparingly, which means they need to be extensively trained in the field of ICT to support societal reengineering through specialized abilities; ICT is the most efficient means of transferring information and knowledge quickly, encouraging the decentralization of work, and employing a larger workforce, but it is also costly. Furthermore, ICT enables teachers to function as orchestrators, supervisors, and leaders in the classroom. As many teachers have little or no knowledge of hardware and software or IT technology and thus do not have basic digital competence related to using information and communication technology for work and communication, promoting the mandatory acquisition of ICT skills is critical. This priority should be given attention [3].

There is still a lack of knowledge in Serbia regarding the impact of COVID-19 on higher education. In April and August 2020, two significant surveys were carried out by the NajStudent web portal, which used publicly available data for analysis. In the NajStudent.com [4] Survey conducted in April 2020, 1447 academics answered the questions about the pandemic's impact on their studies. According to information provided by the Republic Statistics Office in the academic year 2019/20, the Republic of Serbia has enrolled 241,968 students at all higher education institutions at all levels of study (Statistical Office of the Republic, 2020). Therefore, the sample size is 241,960, the sample size is 1447, the reliability is 95%, the confidence interval is 2.57%, and the sample is adequate.

Furthermore, the whole sample consisted of students in the Republic of Serbia in terms of the sample's representativeness so that the sample represents the whole population of Serbian students properly. Therefore, it can be stated that the sample is representative, i.e., it reflects the actual population structure. Furthermore, it can be said that the sample is sufficient because it is sufficiently large [5]. When asked about the measures taken by the faculties in response to a state of emergency, nearly half of the students indicated that faculties and professors sent PDF and PPT presentations with or without audio recording. In addition, the research results showed that every third professor holds online lectures, and 16% hold fixed-term consultations. Although most students, at 70%, believe that these changes have harmed their knowledge acquisition, nearly a quarter of them feel that there are no significant differences from regular lectures. At the same time, only eight percent say that it is easier for them to acquire knowledge in that way. With the introduction of emergency status, students expressed satisfaction with the measures taken at higher education institutions, with an average grade of 3.19 on a scale from 1 to 5. However, opinions among the student population on whether the faculty has taken all necessary knowledge transfer measures are divided in the ratio of 50% to 50%. When asked what faculties and colleges should do, almost two-fifths of students supported making professors more accessible. The same percentage believed that information on the websites of the institutions concerned should have been more accessible. About 20% of respondents had different suggestions: online lecture standardization, the introduction of an online colloquium, audio recordings followed by materials, etc. When asked what out of the regular work at the faculty should be better organized, almost 40 percent of the respondents nominated colloquia, and 35 percent nominated lectures, followed by 13 percent. Only every ninth student thinks it has been well-organized [6].

The new research was carried out in August 2020 on a sample of 1955 respondents. The sample is adequate, according to the population size of 241.968, a sample of 1955, a 95% confidence level, and a 2.21% confidence interval. The whole sample consisted of students in the Republic of Serbia in terms of the sample's representativeness so that the sample represents the whole population of Serbian students properly. Thus, the sample is representative, i.e., it realistically reflects the actual population structure. It can be said that the sample is sufficient because it is sufficiently large. This research concluded that the pandemic affected the students themselves and the organization of the online

study itself. This is supported by the fact that more than half of the students lost their sense of study, and the pandemic affected students so that due to the lack of lectures and practice, they needed longer to learn the material. Two-fifths of respondents reported a lack of contact with their colleagues, while only 21% had more time to learn from this situation. In unforeseen circumstances, respondents rated faculty work. They rated the organization of online lectures and conferences at an average of 3 on a scale from 1 to 5, with 1 being the lowest and 5 being the highest [5]. The respondents suggested how to improve their organization, naming almost all segments of study, in particular the organization of examination deadlines, and then timely information about the classes and examinations, lectures and consultancies, the organization of the practices and classes, and conferences. The research clearly shows the negative impact on students and the overall study process of the COVID-19 pandemic [6].

Other research studies were used to have insight into better solutions to perceived problems. In their research study, Sing and associates described how lean methodology could enhance non-traditional adult learners' (NALs) learning experience during the COVID-19 pandemic and examine students' attitudes and perceptions toward lean methodology in online classes. Their study presents a lean model for online instruction. The core lean concepts of jidoka, just-in-time, a customer-centered approach, team involvement, and standardization can also be used for education [7].

Rapanta et al. find that online learning involves a certain amount of knowledge about the pedagogical content (PCK), mainly related to the design and management of learning experiences and the creation of distinctive learning environments using digital technologies. They think we should not be talking about "new" learning but about "effective" learning, facilitated and enhanced by the technologies available to teachers, students, and schools. For higher education institutions globally to be competitive (again), evidence of faculty professionalism is required. This professional preparedness includes online teaching, but not exclusively. Universities should invest in faculty professional development to keep them updated on effective teaching methods and whether they use online technologies [8].

Scherer and associates find that the COVID-19 pandemic has forced teacher groups worldwide to move to online teaching and learning (OTL), requiring teachers to adapt their teaching within a short time, regardless of their preparation [9].

The paper discusses the current situation in Serbian higher education and the need for changes. Additionally, the paper analyzes the potential of artificial intelligence, machine learning, and extended reality and their introduction to higher education institutions. Our analysis shows that opportunities provided by AI and ML technologies in education significantly affect XR's teaching and learning opportunities. AI and ML are influenced by the opportunities offered by developing AI&ML's students' skills, the collaborative learning environment dedicated to HEIs, and the provision of an accessible research environment for researchers. XR also simplifies students' learning of complex subjects, and XR tools promote the development of creative thinking for students.

The research gathered data from 100 students. With the designed variables, a correlation matrix, a Cronbach's alpha analysis, and a regression model were used to complete the research on the hypotheses.

2. Theoretical Background

AI is a branch of computer science that emphasizes intelligent machines that think and work like humans. Examples of AI applications are speech recognition, natural language processing, image recognition, etc. The term ML represents the application of AI to enable systems' ability to learn and improve based on experience, without the explicit need for programming, using various problem-solving algorithms. For example, computers learn based on the data they process in machine learning, not program instructions.

In 2019, the OECD's AI Group of Experts [10] defined an AI system as a machine-based system that can make predictions, recommendations, or decisions affecting real or virtual environments in response to a given set of human-defined objectives. Furthermore,

AI systems are designed to operate autonomously to varying degrees. The phases of an artificial intelligence system's lifecycle are as follows: (1) planning and design, data collection and processing, model construction, and interpretation; (2) verification and validation; (3) deployment; and (4) operation and monitoring [11].

Artificial intelligence in learning (education) studies artificial intelligence techniques to understand or support learning or teaching. AI adoption in education will accelerate over the next five years, with global expenditure expected to reach $6 billion by 2025. The majority of growth will come from China, followed by the United States, accounting for more than half of global AI education spending [12].

When extended reality (XR) is added to virtual reality (VR), augmented reality (AR), and virtual worlds (VWs), you have an umbrella term for all the different technologies [13]. Like virtual reality, augmented reality combines computer-generated images (CGI) with real-world scenes. Apple's ARKit and Google's ARCore have recently gained popularity for smartphone AR. A computer-generated image is superimposed on the video captured directly by the camera sensor [14].

Augmented reality (AR) combines a physical image of the physical world with a digital image of the virtual world. While AR has a promising future, it differs from virtual reality in some ways. For example, instead of completely isolating the user and transporting them to a different location or world, augmented reality encourages them to interact with their surroundings. In addition, some devices combine VR and AR technology, allowing for seamless transitions between the two of them [15].

Mixed reality (MR) combines the physical and digital worlds to explore human, computer, and environmental interactions. Technology advancements in computer vision, graphics processing, display, and input systems have created this new reality. In 1994, Paul Milgram and Fumio Kishino published the "Taxonomy of Mixed Reality Visual Representation" [16].

2.1. Higher Education in the Republic of Serbia

2.1.1. The Challenges and Barriers for Providing Services to Students in Serbia

The Republic of Serbia is facing several problems in higher education. To meet new challenges, it is indispensable to modernize the entire system of higher education and universities. This level of education should also include new functions such as transferring and innovating with technology. Furthermore, it is essential to set up clear connections between universities and the economy. It is crucial to ensure that education policies are in harmony with contemporary scientific, technical, and technological advances and current societal and economic trends. Additionally, regulation must be harmonized with international documents like the UN, EU, and the Council of Europe; regulation must be created that lays the groundwork for an increase in the quality of education; regulation must lead to greater efficiency in education; and regulations must reduce the skills mismatch.

In addition, universities in Serbia face a decline in the number of students, an urgent need for digital competence among students and educators, and a crisis of student retention that became obvious with web-based teaching during the influenza pandemic because some universities faced and publicly declared a higher retention rate during the COVID-19 period.

On the other hand, it is estimated that as many as 24% of youth in Serbia are NEETs ("Not in Education, Employment, or Training") and that they are mainly found in the rural youth population and among young women. These young people are unreasonably sociologically and economically almost entirely invisible to the relevant institutions of the state that may support their inclusion [17]. The factors are leading to the same, including several social prejudices and an absence of an institutional capacity to support NEET youth, is the cause.

The decision to deliver simple guidelines in higher education has impacted the availability, quality, relevance, and efficiency of monitoring indicators. It concerns the fact that those national statistics do not report or monitor many of the most critical higher education

quality, coverage, relevance, and efficiency objectives. This means that, for a long time, the country has not been transparent about higher education.

2.1.2. Low-Skilled Adults in Serbia and PIAAC Data

Testing for the Program for International Student Assessment of Adult Competencies (PIAAC) is performed every three years. Pupils in Serbia did not participate in 2015. A previous test from 2012 showed that 38.9% of young people are below the threshold of functional literacy in terms of mathematical literacy, 33.1% in reading literacy, and 36.8% in scientific literacy. In 2018, the PISA test results put Serbia in 45th place out of 55 countries and territories. Students in OECD countries obtain around 500 out of a possible 1000. The remarkable feat in the scale of mathematical literacy was Serbia's score of 448. On the reading literacy scale, Serbia's score was 439, and on the scientific literacy scale, it was 440 points [18]. Serbia is far behind OECD countries, which means that Serbian students will have to spend an additional year and a half of school to learn from fellow students from these countries.

The World Bank developed the 'Skills toward Employment and Productivity Survey' (STEP) to examine the skills needed in low- and middle-income countries' labor markets. The following are additional regions where data was collected from 2012 to 2017: Albania, Armenia, Azerbaijan, Bolivia, Bosnia and Herzegovina, Colombia, Georgia, Ghana, Kenya, Kosovo, Lao PDR, Macedonia, Serbia, Sri Lanka, Ukraine, Vietnam, and the Yunnan Province in China. As measured by the OECD's PIAAC, learning achievement is also tested through reading assessments and associated competencies on the same scale as the PIAAC. Even though only eight countries have implemented the full cognitive assessment, which includes both the paper-based literacy assessment as part of PIAAC and a short reading test, no other country has implemented a full implementation of the cognitive assessment. IALS, ALL, and PIAAC literacy scores are not supported by the countries that completed only the reading core test, which consists of eight brief items and thus is unrelated to IALS, ALL, and PIAAC scores. The Mean Years of Schooling (MYS) is 20–64 years old, and for Skills-Adjusted Mean Years of Schooling (SAMYS), it is 18–62 years old [19].

Regarding the years of schooling of the available labor force in the Republic of Serbia, according to the Global Competitiveness Report for 2019, the average number of years of training is 11.1, which places our country in a relatively correct 43rd place out of 141 in the survey. Furthermore, in terms of years of school life expectancy, we are in the first half of the surveyed countries, which speaks volumes about a good source of labor for digital and traditional industries. Further conclusions regarding the exact analysis of the observed 141 countries are as follows: the Republic of Serbia ranks 51st when it comes to finding a skilled workforce, 65th place when it comes to the set of knowledge and skills they have, and finally, and 77th place in terms of digital skills that the same workforce has according to the Global Competitiveness Report for 2019 [20]. Results are presented in Table 1.

Table 1. The business capacity of the workforce in the Republic of Serbia [20].

The Selected Components of Skills in Serbia	Value	Score (1–100)	Rank among the Countries (1 to 141)	The Best Country
Current Workforce (0–100)	-	62.4	50	Switzerland
Mean Years of Schooling (years)	11.1	74.2	43	Germany
Future Workforce (0–100)	-	74	53	Denmark
School Life Expectancy (years)	14.8	82	59	Multiple (11)
Skills for the Future Workforce (0–100)	-	65.9	49	Denmark

The economy needs educational profiles that would quickly adapt to the workplace and change of activities and that are familiar with the company's overall business, that know the horizontal and vertical functions, and that, in addition to quality education, undergo training or preparation for effective inclusion in the world of work.

2.1.3. Guidance Services in Serbia and the Growth of the Knowledge-Based Economy

The Digital Economy and Society Index (DESI) is a composite index that evaluates European digital performance, monitors the progress of EU Member States, and tracks EU Member States' progress in digital competitiveness. Digital public services, connectivity, human capital (internet user skills and advanced skills), and internet use (e-government and e-health) [21].

Monitoring the Digital Economy and Electronic Communications Services in the Western Balkans and Turkey indicates that this region will have a better internet experience in the future. The report finds [21] that Serbia has risen two ranks from the 25th place it held the previous year, ranking it at number 22 on the list of European countries. The Connectivity and Digital Public Services results are responsible for the increased number of higher positions the site holds in the keyword research analysis. However, even with these new results, the country is still firmly seated in the lower-performing countries group, including Romania, Bulgaria, Greece, Italy, Poland, Hungary, Cyprus, and Slovakia. Compared to EU countries in the region, Serbia is near the middle [22].

Regarding connectivity, Serbia's progress last year led to it moving up in the ranking of European countries for this dimension. Regarding the human capital dimension, Serbia is the least prosperous country compared to its comparable countries. Regarding the use of the internet dimension, despite improving its results, Serbia ranked in the lower range in this respect. There are low values for the use of the internet and online transaction indicators (a small percentage of people use e-banking or shop online). Regarding digital technology integration, Serbia's score is above average. To some extent, this is because Serbia had better results in 2019. However, in large part, it is due to the latest methodology used to calculate EU scores, which includes the significant data indicator.

While better results have been achieved in the digital public services category regarding the digital public services dimension, Serbia remains the least successful performer among EU countries. The low value of e-Government-related indicators and low online medical service usage rate is responsible for this phenomenon. However, there are a few exceptions. Serbia is well below the EU average in most indicators in this dimension, except the open data indicator, equal to the EU average. This indicator measures the application of open data policies and their impact on the national data portals, political, social, and economic, and characteristics of national data portals (functionality, availability, and usage) [22]. According to the Internet World Stats, Serbia had 73.4% of the internet users concerning the total population as of 31 December 2020, shown in Table 2 [23]. Results are presented in Table 2.

Table 2. Internet statistics and Facebook users in Europe in January 2021 [23].

	Population (2021 Estimation)	Internet Users as at 31 December 2020	Breakthrough (% of the Population)	Users % in Europe	Facebook as at 31 December 2020
Serbia	8,733,407	6,406,827	73.4%	0.9%	3,400,000
Europe total	829,173,007	727,559,682	87.7%	100.0%	340,891,620

According to the Serbian Statistical Office data, 81% of households have an internet connection. These data account for an increase of 0.9% compared to 2019 and 8.1% compared to 2018 as presented in Figure 1 [24].
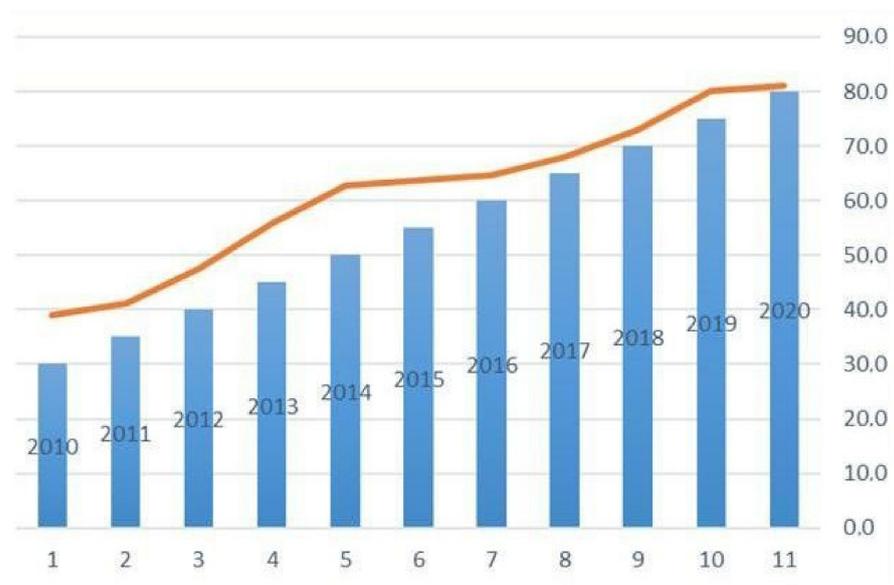
Figure 1. The internet in households in the Republic of Serbia [24].

The city of Belgrade has the highest proportion of internet connections (94.1 percent), which is only exceeded by the region of Vojvodina (75.3 percent). In contrast, the Southern and Eastern Serbia regions have the fewest internet connections (77.3 percent). Furthermore, when comparing internet connections in urban and rural areas, there is a significant disparity between them (87.1 percent in urban areas and 70.4 percent in other regions). In terms of the number of internet users in the Republic of Serbia, the data from the Statistical Office of the Republic of Serbia presented in the report on the Use of Information and Communication Technologies for the Year 2020 show that more than 4,110,000 people have used the internet in the last three months, according to the data presented in the report on the Use of Information and Communication Technologies for the Year 2020 [24].

Based on the latest figures from the Republic Bureau of Statistics, as many as 3.2 million people in Serbia were using a computer daily by 2020. Additionally, by 2020, one-third of the world's population used e-government services, and one-half of the world's population purchased goods or services via the internet between June and September of that year. According to this year's survey, approximately 81% of Serbian households have internet access, a rise of 0.9% over last year [24]. The number of computers in households increased from 74.3% of all households in 2014 to 75.1% in 2015. The most recent survey shows that 90.5% of internet users use a fixed broadband connection. However, mobile broadband internet connections are by far the most popular connection type. In the United States, over 71.9% of households have mobile broadband internet access. In Serbia, approximately 80.8% of households have internet access. A total of 72.4% of people used a computer in the last three months, which represents a 0.5% increase over the previous year.

The survey found that 78.4% of users used the internet, while 17.4% of users had never used it at all. Approximately 3.75 million people utilize the internet daily, according to recent statistics [24]. Among the thousands of users who had purchased or ordered goods on the internet over the past three months, 36.1% made their purchase in the last three months, while 11.8% had done so longer ago than that, and 9.1% had done so more than a year prior. A whopping 43% of internet users have never purchased or ordered anything online. After sports equipment, the most frequently purchased items are clothes [24]. Of all the companies that use internet, use the internet for business purposes, while 84.4% have a website. In 2019, approximately 27.9% of businesses used the internet to sell their products and services [24].

In Serbia, 28.1% of small enterprises, 30.2% of medium-sized enterprises, and 14.7% of large enterprises sold products or services via the internet in 2019 and realized based on sales of products or services via the internet a certain percentage of total turnover that is

less than 24% (57.3% of enterprises), between 24% and 50% (32.9% of enterprises), between 50%, and 75% (4.4% of enterprises), and 75% and over (5.3% of enterprises).

The further development of e-commerce in Serbia appears to be achievable. However, there is no nationally accepted strategy to encourage development in this sector in this country. For a dawning realization, the primary constraint is digital illiteracy, limiting the number of professionals who could design and launch projects in e-commerce. Further constraints include the economic situation, as well as other factors. As a result, more and more practitioners discover business concepts that could be implemented but lack the necessary knowledge and resources.

Technological advancement has led to more outstanding global communication, helping to fuel a greater demand for people's diverse skill sets in both personal and professional settings. As a result, knowledge is more widely available via computers and the internet. However, finding a good learning platform presents a challenge because it takes time to identify the digital skills we lack and the education courses we need to work on.

USAID's findings from the digital skills study in Serbia state that the main conclusions are as follows:

- We are at an intermediate stage of consumer digital competencies at the moment;
- It is the early days for e-commerce, with rapid annual growth;
- Trust is the major obstacle to the continued growth of the e-commerce market, and fear is the most significant culprit [25].

2.1.4. The Impact of Adult Guidance Services in Serbia

Key elements of the career guidance system in Serbia are [26]:

- The career guidance and counseling system's legislative framework was put in place in 2010 when the Strategy for Career Guidance and Counselling in Serbia and its four-year action plan were approved.
- Various educational, employment, and youth sector institutions and organizations provide career guidance services on the national level.
- Through its network of 34 regional offices, the National Employment Service (NES) provides career guidance to job seekers. Thirteen so-called CIPS Centers (information and professional counseling centers) have also been established in major cities, where individuals with issues needing information and professional guidance can seek assistance. In addition, NES has created Rehabilitation and Employment Centers to assist individuals with disabilities. Finally, the National Employment Service counselors provide professional orientation to school-aged children and programs related to internships and jobs.
- In 2013 and 2017, educational laws placed greater emphasis on career guidance for young people in the educational sector. As a result, some colleges and universities, secondary schools, and junior high schools offer career guidance from teachers, psychologists, and pedagogues. In addition, schools are relevant for middle and high schools, where career guidance programs and career guidance teams are recognized as mechanisms for developing students' career management skills.
- Universities and faculty career development centers offer career guidance for university students. In addition, every university has career offices that organize workshops and provide counseling and internship support. The website is designed to provide career-related information to youth while also offering advice and guidance from peers.

Policy

The relevant national authorities in Serbia include the Ministry of Education, Science, and Technological Development; the Ministry of Youth and Sports; and the Ministry of Labor, Employment, and Social Policy. In addition, several educational laws were enacted in 2013 to put career guidance at the forefront of education.

According to the Labor Law [27], giving career guidance an essential role in its implementation, the rights to education, professional training, and development are granted. The Law on Employment and Insurance in Case of Unemployment (2017) governs employment policy, measures of active employment policy, and concrete services to clients provided to those who have just been released from unemployment. According to [28], enhancing the availability of career guidance, especially when it comes to matching employees' skills to job openings, is an essential component of this plan. Also referred to as an action plan, the annual employment policies aim list is enhanced by regular action plans, which depict the primary goals and priorities of the employment regulations.

Regarding youth policies, from 2015 through 2025, a new Youth Strategy has been put in place. One specific goal is to establish a career guidance and counseling system that is both functional and sustainable. According to the new Youth Law [29], promoting career development is critical for young people.

Services and Practice

Institutions provide guidance services in Serbia, and the three sectors (universities, colleges, and research centers) coordinate them. When teaching curricula or extra-curricular activities are employed, schools implement guidance activities. The main job of teachers, school pedagogues, and psychologists is to give career guidance to students. Most of the activities on a primary-school level are geared toward providing students with career training and assistance for younger primary school students as they try to decide what level of education to pursue. A significant change to the educational laws in 2013 included provisions relating to career guidance, which brought about changes such as forming school teams for professional orientation. The success of the Professional Orientation in Serbia project initiated by the German Agency for International Cooperation (GIZ) in partnership with the Ministry of Education, Science, and Technological Development and the Ministry of Youth and Sports was significant in boosting sustainable development of the educational model. Additionally, the National Employment Service is directly involved in the project's activities. In universities, career centers provide students with career information and educational activities focused on job management, such as workshops, lectures, and training. Off-premises and online counseling can be provided at many counseling centers. There is a close collaboration between the education and business communities and internships and vocational training information. It should be noted that apart from the university-level career centers, there are many additional university-level faculty career centers.

In the employment sector, the Ministry of Labor, Employment, and Social Policy and the National Employment Service (NES) are the most important stakeholders for career guidance services. NES services are particularly beneficial to those seeking employment and young students in primary and secondary schools, college students, and people in search of new employment. For example, primary school pupils can learn about career options to help them transition to the next educational level using the Guide for Primary School Pupils.

Additionally, several additional online services have been created over the past few years that aim to provide self-assessment tools, career, educational information, and online counseling, such as obrazovanje.rs (accessed on 27 August 2021) and BOŠ Karijera. At the local level, youth guidance is provided by Local Youth Offices. As part of the youth office training in 2013 and 2014, Career Info Corners (CIC) were made available to help place information about various career paths at the fingertips of local youth.

Training

All the counselors working in the National Employment Service have either a psychology degree or a certificate in counseling. There are significant differences in the qualifications of practitioners working in other industries. For example, primary school teachers and pedagogues/psychologists were trained in professional orientation to meet

their new demands. Many teachers, psychologists, and educators from secondary education also participated in seminars designed to teach career guidance. There are ten continuous professional development (CPD) accredited programs. The new standards defining general and specific competencies of career guidance practitioners were adopted in 2019.

Research and Development

The adoption of the Bylaw on Standards of Career Guidance and Counselling Services by the Ministry of Education, Science, and Technological Development in 2019 has been one of the latest additions to career guidance programs. This document details quality services organization guidance for career guidance service providers.

Other studies have investigated the guidance system as a whole and various service sectors. For example, in 2014, as part of a project funded by the European Delegation to Serbia, a feasibility study was conducted to establish a national resource center for career guidance and counseling in Serbia and develop a career guidance and counseling system in Serbia.

Ethics

Serbia 2020, according to the OECD Reviews of Evaluation and Assessment in Education [10], has demonstrated that there has been an improvement in access to education, and international assessments have shown that learning outcomes are improving. Although many Serbian students continue to drop out of school without mastering fundamental skills, efforts to achieve educational excellence are hampered by a lack of institutional capacity and public funding for education. As a result of this review, which was conducted in collaboration with UNICEF, Serbia has received recommendations to help strengthen its evaluation and assessment system, with a particular emphasis on supporting student learning. It will be of particular interest to Serbia and other countries seeking to make more effective use of their evaluation and assessment systems to improve quality and equity and produce better outcomes for all students in general [30]. The researchers of this study are not aware of the impact of adult guidance services measured and monitored in Serbia.

2.1.5. SWOT Analysis Serbia

The United States Agency for International Development study on digital skills in Serbia [19] reveals that previous generations' education is unsustainable for both employers and workers. Because Serbia is facing three major industrial revolutions simultaneously, the country is overwhelmed by the economic and labor market opportunities that technological development brings. Therefore, one of the strategic goals outlined in Serbia's Digital Competence Strategy [31] is to support developing competencies in the labor market. This objective aims to foster training and workshops to raise employability and conduct business in the digital economy, particularly for disadvantaged and vulnerable populations.

Many of the primary conclusions that were reached are listed below in Table 3 (incorporating digital skills in HR service experiences)—the legend is as follows: S (strength), W (weaknesses), O (opportunities), and T (threats).

Table 3. SWOT analysis Serbia.

Strengths	Weaknesses
• High levels of digitalization in businesses are altering the way businesses do business. • Companies in Belgrade and Novi Sad have entirely digitized business operations. • Employees possess a certain level of digital competence required in all areas (information) and content creation security, data literacy, communication, and collaboration (digital problem-solving), depending on the work sector. • In nearly all positions in companies, a lower level of digital competence is implied; • The need for the highest form of digital competency has increased significantly, and since 2013, this need has increased by a factor of three.	• Digitization brings an increase in stress. • The e-commerce market is in the initial stages of development. • Fear is the main obstacle that needs to be overcome. • As far as crowdfunding is concerned, its development in Serbia is still in its early stages and digital consumer competencies.
Opportunities	**Threats**
• Digitalized companies in Serbia have the challenge to reach smaller and more isolated locations in-country. • The most critical competence is a willingness to learn continuously. • The challenge is to develop employees to use digital technologies creatively in the face of rapidly changing needs; • The state should support the digitization process by digitizing public administration and education processes at all levels of education [25]. • The increase in all levels of digital competence must be taken into consideration. • More education seeks higher levels of digital competence. • Digital competence is markedly increased for jobs of greater complexity, such as administration, system administration, and project management. • The current level of consumer digital competencies is at a moderate level. • Future activities should focus on the following areas: managing payments and finances through digital means, personal data and privacy management (with digital identity management), determining consumer rights in the digital market (after purchase).	• The future challenge for employees will be managing a large amount of data. • Information security breaches (internet fraud). • Misuse of data from public institutions (fake e-mails and SMS messages). • Publishing untruths and unverified information to endanger the reputation. • Threatening facilities and compromising security.

To become and remain high-performing, countries need a policy infrastructure that drives performance and builds the capacity for educators to deliver it in schools. Singapore's system is based on [25]:

- Meritocracy.
- Vision, leadership, and competence.
- Coherence.
- Clear goals, rigorous standards, and high-stakes gateways.
- High-quality teachers and principals.
- Performance management—Reward and recognition systems include honors and salary bonuses.

There are school excellence plans in which individual appraisals take place. However, meritocracy does not ensure equity. The best support systems for children and schools moderate the impact of a student's social background on their achievements and identify and nurture the extraordinary talents of all students. Teacher and school district networks and professional learning communities enable two-way learning between students and teachers. We must conduct classroom-oriented research to help teachers customize learning experiences, deal with increasing diversity in their classrooms, and keep up with curricula, pedagogy, and digital resources advancements.

The OECD report's evaluation and assessment findings on the effectiveness of evaluation and assessment in education are in Serbia. The education system in Serbia performs better than in other Western Balkan countries. Access to education has improved. After several years of significant reforms, including instituting achievement standards at the end of compulsory education, teacher standards, and a school evaluation framework, Serbia is carrying out a fresh round of reforms. The truth is, however, that no group has benefited from progress equally. Even though many students drop out of school in Serbia without ever mastering the essential competencies required for further education and the world, a significant percentage are still choosing to do so. With these educational challenges in mind, the country's economic development, social prosperity, and European integration are all dependent on how quickly educational issues are addressed [30], designing clusters of interdisciplinarity focusing on human health, one-health, sustainability (agroecology, education, innovation, intelligent houses, smart cities/village, etc., reducing ecological footprint), green economy, design, etc.

2.1.6. New Digital Skills

Some of the technological trends that mark the era of digital transformation and whose knowledge significantly contributes to the development of digital competencies are [32]:

- The 5G network.
- Artificial intelligence (AI).
- Autonomous devices (robots, i.e., the use of artificial intelligence to automate functions usually performed by humans).
- Blockchain technology.
- Augmented analytics: big data in combination with artificial intelligence, i.e., the use of machine learning for automatic learning, and optimization of decisions using in-depth data analysis.
- Digital twins, i.e., virtual replicas of the natural world or entities.
- Enhanced edge computing (the Internet of Things, complementary models with cloud solutions).
- Experiences in innovative spaces: Smart Spaces (virtual reality—VR, augmented reality—AR, and mixed reality—MR).

The importance of digital competencies in many countries is recognized by the authorities of these countries in various strategic documents. For example, the IT Industry Development Strategy for the period 2017–2020 [33] and the relevant action plan [34] recognized the importance of state support in terms of digital entrepreneurship and development of startup projects, as well as the importance of the formal education system in the process of acquiring digital competencies of students in Serbia.

From a different perspective, data sources contain limited evidence on digital entrepreneurs' competencies, especially educational research focused on digital entrepreneurial

competencies. Inclusive application of information and communications technology in education and classrooms empowers students and helps them succeed in the workforce. To ensure that all students have equal access to quality education, educators need to use ICT. In addition, teachers should utilize ICT to guide students in developing critical and innovative thinking, problem-solving, cooperation, and socio-emotional skills, all of which are required in our global society [35]. Teachers must be given digital media or ICT training to ensure that students develop relevant skills, such as digital competencies for life and work [35].

2.1.7. New Interdisciplinary Needs

Education plays a vital role in acquiring the necessary entrepreneurial competencies. In addition, entrepreneurial education helps the best graduates to turn their education into intellectually productive endeavors. Therefore, entrepreneurship education must be highly interactive and engaging to help students develop relevant entrepreneurial skills and competencies.

In Serbia, interdisciplinarity and mindset changes are needed. In the 2030 UN Sustainable Development Agenda, Sustainable Development Goal 4 is the educational goal. It aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (by the end of 2030). Target 4.4. is to "substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship" [36]. Serbia must try to reach this given target.

3. Survey Research AI, ML, and XR in Serbian Higher Education Institution

The student survey research is performed in the Republic of Serbia and involves students. Therefore, we surveyed Serbia's top vocational school students for selected higher education institutions [37]. To investigate both the opportunities and challenges of extended reality in higher education while collecting data to quantify the HEI student population's knowledge of extended reality. As a result, several opportunities and challenges for AI, ML, and XR were developed based on the Higher Education Sector variables.

1. The model described in Artificial Intelligence in Higher Education: Risks and Opportunities by Dhawan, Shivangi, and Batra was published in 2021 [38].
2. Teaching with XR (Extended Reality) in Higher Education: An Analysis of Student perceptions, published by Ahmet Ustun and Siba El Dallal [39–43].

3.1. Research Design

We employed a mixed-methods approach that included observations, participant observation, and a case study model [38]. After a grounded literature review, we designed a survey that collects data from students (former, current, and future). The survey had the aim to obtain a sense of how much knowledge students have about artificial intelligence and machine learning in general and, more specifically, to understand the opportunities and challenges associated with AI, ML, and XR in higher education. We previously studied other articles that present similar research [38–44]. In addition, we studied the literature, and we observed that researchers measured the usage of AI, ML, or XR in the daily life of students and their basic knowledge about those technologies. Additionally, those researchers have measured students' attitudes towards opportunities and challenges of implementing this technology in higher education.

The research addresses the following critical issues in this paper:

1. Opportunities offered by artificial intelligence and machine learning in higher education.
2. Opportunities offered by extended reality in higher education.
3. Students' skills in AI and ML in HEI.
4. Potential brought by AI and ML to improve the institution's security and efficiency.
5. Facilities brought by AI and ML for professional researcher environment.

6. XR facilitates increased motivation, engagement, and learning-by-doing activities between students, offering a realistic environment for learning.

Our analysis starts with the following assumptions:

Hypothesis 1 (H1). *AI and ML are appropriate technologies that, when implemented in HEI, develop skills among students, a collaborative learning environment, and an accessible research environment.*

Hypothesis 2 (H2). *XR facilitates increased motivation, engagement, and learning-by-doing activities between students, offering a realistic environment for learning.*

We gathered data from 100 students and coded each question as a variable. With these variables were designed a correlation matrix, a Cronbach's alpha analysis, and a regression model analysis in order to answer H1 and H2 The data were analyzed with Smart-PLS3 software. The analyses followed the hypothesis, which empowered us to design a regression model in the second step of the research [45].

The lack of research on using AI, ML, XR, and university students in general, especially in the Republic of Serbia, is primary for this research and its added value.

3.2. Data and Variables

The survey contained two main categories of questions: one category referred to opportunities engaged by AI and ML in the higher education process and the second category referred to opportunities brought by the XR technology in the educational and learning process. It resulted from two main variables, OAIML and OXR, with nine sub-variables presented in Table 4.

Table 4. Variable analyzed.

Code	Variable Name
OAIML1	AI and ML can enhance customized learning
OAIML2	AI and ML can develop skills among students
OAIML3	AI and ML are capable of providing a collaborative learning environment in the HEI
OAIML4	AI and ML can help in keeping lifelong connectivity with alumni
OAIML5	AI and ML have much potential in improving the institution's security
OAIML6	AI and ML have much potential in improving the institution's efficiency
OAIML7	AI and ML allow sharing and storing a large amount of data
OAIML8	AI and ML provide researchers with a peaceful, flexible, and accessible computing environment, thereby letting them focus on research without any constraints
OAIML9	AI and ML provide researchers with an accessible research environment
OXR1	XR is an excellent tool in supporting learning
OXR2	XR is an excellent tool in facilitating teaching processes
OXR3	XR systems permit learners to more actively control their learning strategies
OXR4	XR motivates and engages students
OXR5	XR allows students to learn complex subjects in a simplified way
OXR6	XR allows students to practice the learning content directly in a realistic environment
OXR7	XR supports the interactivity and connectivity that students and faculty experience
OXR8	XR tools encourage the development of students' creative thinking process
OXR9	XR systems facilitate effective learning, encouraged by learning-by-doing

The survey contained many questions regarding student opinion on AI, ML, and XR. For this study, only two questions were selected as relevant: (a) opportunities of integrating AI and ML in HEI and (b) opportunities brought by XR in HEI. These two questions had multiple choice answers evaluated on a 1 to 5 Likert scale, where 1—not at all and 5—very representative. The variables were coded as might be seen in Table 4. After coding variables, we applied qualitative statistical analysis to validate the survey validity (Cronbach's alpha, composite reliability, and AVE). Observing the different intensity of correlations

between variables, we designed a regression model that stated that AI and ML can enhance customized learning, influenced by the opportunities for AIML-developed skills among students, a collaborative learning environment dedicated to HEI, and providing researchers with an accessible research environment. Additionally, XR allows students to simplify complex subjects, and XR tools encourage students' creative thinking processes.

3.3. Results

The results are presented in two stages: the first stage contains a Cronbach's alpha analysis, which evaluates the survey's validity, and a validation process based on composite reliability, AVE (average variance extracted) and R squared was implemented. The second stage contains a correlation matrix, based on the correlation matrix and regression analysis.

3.3.1. The First Stage—Cronbach's Alpha Analysis

The Cronbach's alpha analysis shows a solid model because all the OAIML and OXR sub-variables values are very high (greater than 0.7). The validation process was based on the criteria presented in Table 5. The Cronbach's coefficient (0.93 for OAIML, 0.959 for OXR) proves that our analysis is consistent because the sub-indicators of the variables mentioned above (Figure 2) correlate between themselves and the additive result of all sub-indicators. Keeping in mind that all the criteria are met, the researchers created a consistent regression model. The inner model is statistically significant because its standardized track coefficient (0.703) has a high value. Overall, OAIML significantly affects the variable OXR— opportunities offered by AI and ML technologies applied in education significantly affect the opportunities XR brings in HE teaching and learning (Table 5, Figure 2). Thus, HEI has to implement both AI and XR in the teaching and learning process to answer students' requirements and offer them transversal skills appropriate for the market evolution in continuous change.

Table 5. Validation process.

Reflexive Construct	Composite Reliability	Cronbach Alpha	AVE	R Square
	(>0.7)	(>0.7)	(>0.5)	(>0.5)
OAIML	0.930	0.930	0.598	
OXR	0.959	0.959	0.723	0.494

Notes: The LV OAIML does not have an R2 value, as it precedes the other variables in the SEM (structural equation modeling).

3.3.2. The Second Stage—Correlation Matrix Results and Regression Model Correlation Matrix

Within the matrix correlation, we may see:

- A strong correlation between OAIML1 and OAIML2 and OAIML3 (the correlation coefficient is higher than 0.7 in these cases); thus, we may say that AI and ML can enhance customized learning, developing skills among students and providing a collaborative learning environment in the HEI.
- A relatively strong correlation between OAIML1 and OAIML4, OAIML5, OAIML6, OAIML8, OAIML9, OXR1, and OXR2; thus, we may say that AI and ML can enhance customized learning, keeping lifelong connectivity with alumni, improving the institution's security and efficiency, and offering to researchers an adequate and accessible research environment. AI and ML facilitate the utilization/implementation of XR in teaching and learning processes.
- A strong correlation between OXR1 and OXR2, OXR4, OXR6, and OXR7. The correlation coefficient is higher than 0.7 in these cases. XR is an excellent tool in supporting learning through adequate teaching processes, offering content directly in a realis-

tic environment and supporting the interactivity and connectivity of students and teachers.

- A relatively strong correlation between OXR1 and OXR3, OXR5, OXR8, and OXR9; thus, we may say that XR facilitates increased motivation, engagement, and learning-by-doing activities between students, offering a realistic environment for learning.
- There are other relatively strong correlations between variables, but they are not very representative for our analysis. Correlation between variables is shown in Table 6.
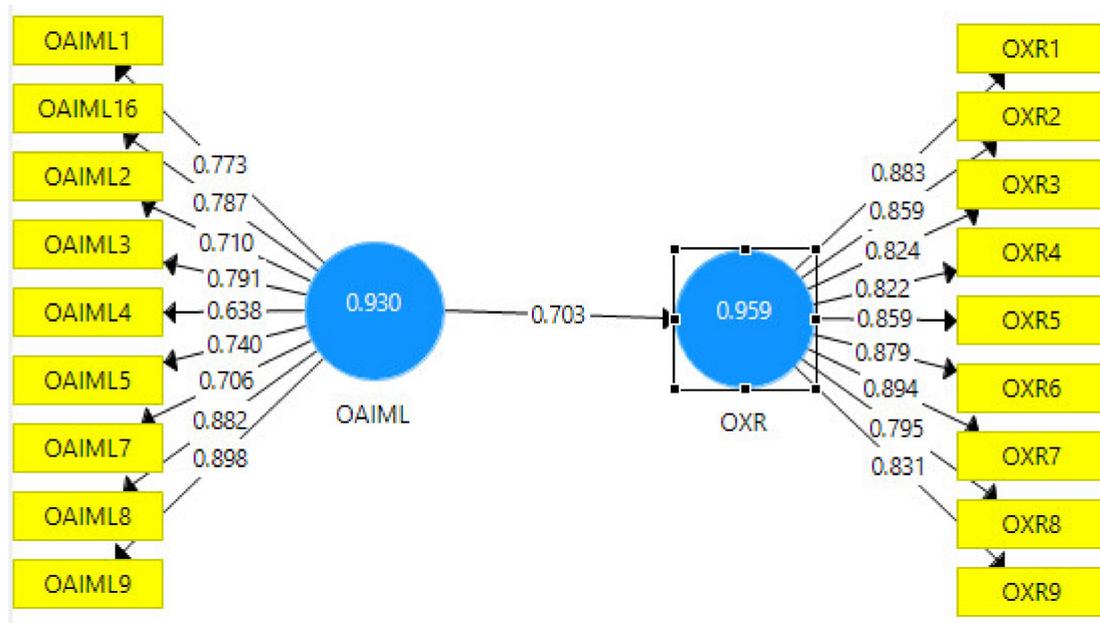

Figure 2. Cronbach's alpha analysis.

Table 6. Correlation between variables.

	OAIML1	OAIML2	OAIML3	OAIML4	OAIML5	OAIML16	OAIML7	OAIML8	OAIML9	OXR1	OXR2	OXR3	OXR4	OXR5	OXR6	OXR7	OXR8	OXR9
OAIML1	1.00																	
OAIML2	0.72	1.00																
OAIML3	0.76	0.74	1.00															
OAIML4	0.50	0.58	0.68	1.00														
OAIML5	0.60	0.58	0.59	0.59	1.00													
OAIML6	0.62	0.60	0.58	0.45	0.69	1.00												
OAIML7	0.46	0.50	0.51	0.44	0.60	0.45	1.00											
OAIML8	0.65	0.63	0.64	0.54	0.60	0.58	0.55	1.00										
OAIML9	0.67	0.55	0.68	0.53	0.61	0.63	0.55	0.81	1.00									
OXR1	0.50	0.47	0.44	0.37	0.41	0.39	0.39	0.63	0.56	1.00								
OXR2	0.51	0.45	0.50	0.26	0.42	0.48	0.39	0.53	0.56	0.73	1.00							
OXR3	0.41	0.45	0.45	0.44	0.46	0.43	0.30	0.50	0.55	0.68	0.76	1.00						
OXR4	0.43	0.40	0.42	0.42	0.39	0.42	0.38	0.50	0.49	0.76	0.64	0.71	1.00					
OXR5	0.48	0.40	0.49	0.35	0.42	0.53	0.43	0.48	0.55	0.69	0.69	0.68	0.75	1.00				
OXR6	0.46	0.42	0.43	0.29	0.48	0.50	0.43	0.52	0.52	0.72	0.72	0.73	0.81	0.76	1.00			
OXR7	0.43	0.40	0.49	0.45	0.51	0.43	0.47	0.55	0.56	0.70	0.60	0.64	0.80	0.75	0.75	1.00		
OXR8	0.37	0.37	0.47	0.40	0.42	0.44	0.49	0.44	0.45	0.69	0.63	0.62	0.71	0.82	0.72	0.73	1.00	
OXR9	0.46	0.39	0.50	0.38	0.41	0.38	0.49	0.50	0.51	0.67	0.65	0.63	0.74	0.83	0.76	0.71	0.82	1.00

Regression Model Analyses

Our hypotheses are proven by the correlation matrix and the model below. AI and ML are appropriate technologies that, when implemented in HEI, develop skills among students, a collaborative learning environment, and an accessible research environment. XR facilitates increased motivation, engagement, and learning-by-doing activities between students, offering a realistic environment for learning. Overall, the model is representative (R^2 is 0.69), meaning that AI, ML, and XR are essential instruments in teaching and learning in HEI. The variation of the independent variable (OAIML2, OAIML3, OAIML9, OXR5, and OXR8) explains 69% of the variation of the dependent variable (OAIML1). Other factors might explain the other percentages.

The ANOVA test confirms the initial findings, as F > F crit and Sig F0.01 are more significant than one. Additionally, the Anova test assumptions are satisfied. On a continuous scale, the dependent variable is measured. The independent variables are comprised of

four distinct categorical, self-contained groups, while the observations are self-contained. This indicates no correlation between each group's observations or between the groups themselves. Furthermore, there are no extreme values, the variable is normally distributed within each independent variable group, and the variants are homogeneous (Table 6).

The Multiple R coefficient is 0.83 has a high value. The *p*-value shows Prob (F-statistic), representing the F-test marginal significance level. In a *p*-value less than 0.05 (significance level), for H1 and H2, the alternative hypotheses are accepted. The new model statistics can be seen in Table 7. The *p*-value is 0.06 (almost 0.05) for OXR8, meaning that the coefficient of this variable is not very well-estimated, but, overall, the model is reliable. The other variables' *p*-value is smaller than 0.05, meaning that the coefficients are well-estimated (Table 6). The R2 coefficient of this model is 0.83, indicating that the variation of causal variables determines 83% of the OAIML1 variable variance, and the model cannot explain 17% of this influence.

Table 7. Regression analysis statistics.

Regression Statistics					
Multiple R	0.83				
R Square	0.69				
Adjusted R Square	0.67				
Standard Error	0.63				
Observations	103.00				
ANOVA	Df	SS	MS	F	Significance F
Regression	5.00	83.66	16.73	42.20	0.00
Residual	97.00	38.46	0.40		
Total	102.00	122.12			
Coefficients		Standard Error	*t* Stat	*p*-Value	Lower 95%	Upper 95%
Intercept	0.20	0.33	0.62	0.54	−0.45	0.86
OAIML2	0.37	0.09	3.89	0.00	0.18	0.55
OAIML3	0.36	0.11	3.47	0.00	0.16	0.57
OAIML9	0.24	0.09	2.67	0.01	0.06	0.42
OXR5	0.23	0.11	2.04	0.04	0.01	0.46
OXR8	−0.22	0.12	−1.90	0.06	−0.45	0.01

Regression model equation:

$$OAIML1 = 0.2 + 0.37 * OAIML2 + 0.36 * OAIML3 + 0.24 * OAIML9 + 0.23 * OXR5 - 0.22 * OXR8$$

Following the statistical t-test, the resulting coefficient for the OAIML2 variable was 0.37, with a probability of guaranteeing results (Prob) of 0.00 (less than the sensitivity threshold of 0.01), so this variable's coefficient is very well-estimated with a deficient standard error (0.09), and with 95% likelihood, it will be found in the interval [0.18; 0.55]. The coefficient for the OAIML3 variable is 0.36 with a deficient standard error (0.11), and with 95% likelihood, it will be found in the interval [0.16; 0.57]. The coefficient for the OAIML9 variable is 0.24, with a probability of guaranteeing results (Prob) of 0.01, so this variable's coefficient is very well-estimated, and with 95% likelihood, it will be found in the interval [0.06; 0.42]. The coefficient for the OXR5 variable is 0.23, with a probability of guaranteeing results (Prob) of 0.04, so this variable's coefficient is very well-estimated, and with 95% likelihood, it will be found in the interval [0.01; 0.46]. The coefficient for the OXR8 variable is −0.22, with a probability of guaranteeing results (Prob) of 0.06, so this variable's coefficient is not very well-estimated, and with 95% likelihood, it will be found in the interval [−0.45; 0.01]. The t-test for each variable generated validates the model and contributes to the predictive power of the regression. For Prob, the significance threshold of the variables should be less or around 0.05 (Table 6). In conclusion, following the above results, we can state that regression analyses allowed us to confirm our hypothesis (Table 6).

4. Discussion

The COVID context brought tough challenges regarding teaching and learning in the HEI system. However, at the same time, it offered many opportunities, especially through AI, ML, and XR facilities redesigning the method of teaching in the safety of the home environment.

Some researchers suggested an early recognition system for AI, ML, and XR implemented in a blended learning process by the beginning of the academic semester as a thriving education tool. Working on students' success is the most effective motivation for all sides in the education process—students, professors, and the school administration [46]. Today, we approach numerous learning processes in higher education institutions where students use different learning platforms [47]. Therefore, all the data generated for the education process can support both learning and teaching with the great help of AI, ML, and XR. In addition, learning analytics has enormous benefits for the interactive education process [48].

In some countries, the newest technologies of education have been already implemented. For instance, in the United Kingdom, the United States of America, and Australia, higher education institutions adapted learning processes to support students' performance feedback. Especially in the USA, AI learning applications were included in science observations, and certain inventors are already available [49]. In German universities, the AI topic is presented occasionally, although its implementation is still not available [50].

Modern data-based technologies are not so widespread within universities worldwide because infrastructure has not been expanded, and there are no skilled human resources [51]. Meanwhile, the education sector witnesses enormous potential for automation learning support and digitalization [52]. On the other hand, administration is supported by AI systems in the USA. It supports the administration with enrolment activities, monitors students' entry and retention, and improves financial support programs [53]. Students prefer to use new technologies in education, such as XR, due to the high level of interactivity, the requirement for motivation and enthusiasm, and the opportunities for experimentation and simulation, as demonstrated by research from Serbia, Romania, and Hungary. Universities must embrace these technologies and develop new methods of training and teaching to meet the expectations of millennials and the technological revolution [54]. Research from Romania among students showed that students find that immersion of virtual reality (VR) and augmented reality (AR) in the process of presenting the information and knowledge acquisition can be considered a method to improve the quality of higher education [55].

In most countries and also in Serbia, teachers have used e-learning platforms, online classes, and simulations. Now, teachers are prepared to use all the facilities offered by AI, ML, and XR. First, however, the universities must systematically implement them in their facilities, which demands a strategic approach and a broad platform. Nevertheless, the students are ready and welcoming such initiatives.

Within the matrix correlation, it is self-evident that AI and machine learning can help students develop customized learning skills and provide a collaborative learning environment in HEIs. Additionally, AI and machine learning can be used to enhance customized learning while maintaining lifelong connections with alumni, enhancing the institution's security and efficiency, and providing researchers with an adequate and accessible research environment. AI and machine learning enable the use/implementation of XR in educational and learning processes. The matrix correlation demonstrates that XR is an excellent tool for supporting learning through appropriate teaching processes, providing content directly in a realistic environment, and facilitating students' and teachers' interactivity and connectivity and that XR enables increased motivation, engagement, and learning by facilitating activities between students and providing a realistic environment for learning. Therefore, the alternative hypotheses H1 and H2 are accepted. The study confirmed the possibilities of adapting AI, ML, and XR technologies in HEI and their potential.

5. Conclusions

Serbia's education system is undergoing a significant transformation at the moment. A solid commitment to EU integration is coupled with several education reforms in Serbia. Over the past decade, an international assessment conducted in Serbia has found that the country's students' learning outcomes have remained reasonably stable, with the most accomplished students improving. However, this shows widening educational disparities, demonstrating that many students may not be prepared for further education and future careers. In addition, groups such as socioeconomic class and geographic region are primarily out of reach for numerous people, who stifle progress at the national level. This chapter provides an overview of Serbia's education system and the assessment and evaluation strategies that help move the country toward higher education goals for all students.

While student engagement and outcomes persist as issues, international comparisons show that students in OECD countries perform worse than their counterparts. A better understanding of how students learn and how the education system functions are needed to foster effective teaching and learning environments. Teaching and learning about equity and improving the quality of the educational system will require a framework that empowers students, teachers, and the school and the system itself to be more agile in anticipating the changing demands of the market. The great assistance of artificial intelligence, machine learning, and extended reality can be helpful on that path.

The research among Serbian students showed considerations for digitizing education processes, especially in personalized learning and automated counseling with their lecturers and professors. Making effective learning analytics at Serbian universities leads to the improvement of the whole academic system.

Serbian universities are increasing the implementation of learning analytics. Our research proved that AI and Ml are effective methodologies implemented in HEI to develop academic skills among students and their learning surroundings. XR in the field of learning analytics increases students' engagement with the education process.

However, there is a particular risk of publishing untruths and unverified information and endangering reputations and compromising security. Therefore, modern data technologies should be designed in so that they provide fairness and transparency. Additionally, if the applications mentioned above are wanted to be widespread in the Serbian universities, it is necessary to provide appropriate resources. Implementing digital learning technologies in the education system requires coordination between students, educators, and educators' managers.

This study, like all others, has limitations. Unasked questions and generalizability are the research's limitations. Nonetheless, future research suggestions based on this study's findings must be included. In addition, future research should propose concrete AI, ML, and XR platforms for Serbian education.

Author Contributions: Conceptualization, A.J. and M.P.I.; methodology, A.J., M.P.I. and D.P.; software, A.J. and D.P.; validation, A.J., D.P. and M.P.I.; formal analysis, A.J. and D.P.; investigation, A.J., N.P.Š. and D.P.; resources, A.J. and D.P.; data curation, A.J. and D.P.; writing—original draft preparation, A.J. and M.P.I.; writing—review and editing, N.P.Š., D.P. and A.H.; visualization, A.J. and M.P.I.; supervision, D.P. and N.P.Š.; project administration, N.P.Š. and A.H. All authors have read and agreed to the published version of the manuscript.

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