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Application of Artificial Intelligence and Machine Learning in higher education, available platforms and examining students` awareness

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Abstract: (I) Student access to Artificial Intelligence (AI) and Machine Learning (ML) platforms and powerful computers is only possible if educational institutions make these tools available. Students who do not have direct access to these technologies can still access this technology through university computer labs or studios. (M) The paper based on survey method addresses the research problem that students who are not aware of artificial intelligence (AI) and machine learning (ML) technologies, or have a rudimentary understanding, find it challenging to adopt AI-powered systems. Therefore, the research paper explores the awareness of AI&ML among students of chosen Higher education institution (HEI). (R) Exploratory research provided results that gives us insight in Hight education in Republic of Serbia, and state of mind of Serbian students. (D) The results show that students of chosen HEI are aware of these technologies and use them on a daily basis, indicating that they will easily adapt to AI-powered systems currently, during the development phase.

Keywords: artificial intelligence (AI), machine learning (ML), higher education institutions (HEI), AI-powered systems

1. Introduction

In the study of artificial intelligence, OECD defined AI as a machine-based system able to make predictions, provide recommendations, or influence an environment by using given sets of human-defined objectives. As with any system, artificial intelligence systems have varying levels of autonomy, depending on their design. Data collection and processing, model building and interpretation, as well as verification and validation, comprise AI system lifecycle phases [1].

AI and ML specialise in extracting information from automated sensors and machines, all the while deciding on their own where they should be looking. ML algorithms use self-improving algorithms, providing more accurate results over time. ML works faster and better than traditional business intelligence tools, offering faster and more accurate operational predictions. Artificial intelligence is an essential supplement to the Internet of Things because of technologies like deep learning, computer vision, natural language processing, and machine learning. It can be used for prediction and optimisation [2].

New technology-based educational models contribute significantly to helping students understand their cognitive abilities in maintaining different levels of knowledge. Personalisation and acceptance of new technical challenges are best facilitated by Artificial Intelligence [3]. As education relies on a wide range of technologies, personalised education does, too. Artificial intelligence, mobile applications, virtual reality, and other technologies have been analysed by different studies, and it was found that the educational systems could be significantly improved in this way [4] [5]. Artificial intelligence is a process that empowers students with computer programs that enable them to design specific projects and perform tasks, which otherwise depend on human assistance. They are often utilised to help students and serve as their assistants by procuring information when needed [6].

ML is a form of AI that provides the ability to learn through a computer. It focuses on data analysis, through which new models are identified which allow certain conditions of behaviour modification [7]. Stakeholder interactions and information processing are vital in the education process. Machine learning methods provide a perfect foundation for modelling, prediction, and system control in general [8].

Williamson [9] discovered solutions for psychological states and brain activity in the learning process by applying big data analytics. Tsai et al, based on AI and ML, created a database of possible learning indicators to determine what motivates students in the learning process [10]. A team of highly educated researchers developed a specialised application that has revolutionised the medical education industry [11].

Two critical studies on the introduction of AI and ML technologies in education systems are:

- Future-ready institutions: Assessing US Higher Education Sector's AI Adoption and Capabilities; (implemented by IDC, commissioned by Microsoft) [12].
- HolonIQ Global Executive Panel [13].

IDC states in its research that the most significant constraints related to AI implementation are financial constraints, since successful implementation can be very costly, a lack of developed competencies within the company that could develop an adequate solution and the inability to attract them, and the fact that the given strategy is not a priority [12].

According to another study in which the CEOs of EdTech companies took part, the primary obstacle to the application of AI in education is the lack of adequate resources capable of producing such solution (39%); then comes the lack of funds for AI initiatives (34%), and lack of data (30%), where the lack of data also includes fragmented systems from which data are collected, i.e. problems related to privacy policies. The authors of this study concluded that AI's vision and use transcend functional boundaries and come with high implementation costs; it is not surprising that company management and lack of technical infrastructure are additional obstacles to consider [13].

The most noteworthy education trends involve improved access to education, which is further facilitated by implementing distance learning systems and new technologies. The impact of these technological shifts is shown by the increased use of artificial intelligence (AI) and machine learning (ML) in higher education. Also, there is a greater level of individualisation in how each student is treated, considering their knowledge, needs, and skills. Inability to find a sufficient number of teachers has necessitated the use of software to replace teachers in both public and private higher education institutions (HEI). The recent education market growth requires education institutions and EdTech companies to innovate to keep pace.

AI and ML can solve HEI's many problems involving enrolment and funding, dropout rates, high admission costs, insufficient number of educators, along with assessing the students' level of knowledge as objectively as possible [14]. The paper presents the best AI-powered platforms and analyses the features and problems they address for potential application in HEI and EdTech. Also, exploratory research provides valuable insight into the awareness and usage of AI and ML in chosen HEI.

2. Materials and Methods

The research used the methodology that includes observations, participation observation, document and content analysis and survey. The research was conducted within the master's vocational studies at a higher vocational school with the respondents' consent. The paper's authors are partly engaged as professors, and the research was conducted in their group. One of the authors is a student of master vocational studies. Therefore, it is an observation with participation. As part of the document analysis, various numerous research studies, scientific papers and EduTech web portals were consulted to conclude available AI-powered applications and technologies that enable AI & ML. This part of the research is presented in the introduction paragraph (literature review), and chapter III Results shows content and document analysis.

Survey (exploratory) research among 83 students of Information Technology School ITS – Belgrade was conducted to understand the level of awareness of AI and ML among students. The survey was designed using the model of Dhawan, Shivangi & Batra [15]. The respondents were asked questions identifying their awareness of the mentioned technologies (by recognising basic definition) and their daily usage of these technologies:

The primary research started from assumptions in the form of hypotheses:

- (null hypothesis) H0: The use of artificial intelligence in everyday life does not depend on the age of the respondents.
- (alternative) H1: The use of artificial intelligence in everyday life depends on the age of the respondents.

The variables analysed in this research are given in table 1. The table 1 explains code and names of the variable analysed.

Table 1. Variable analysed

Code	Variable name
Sex	Gender
Age	Age
Schooling	Already completed
Activity	Type of activity
AIUSE	Use AI in your daily lives
AIDEF	AI represents the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

3. Results

3.1. Best AI-powered platforms and technologies that enable them, document and content analysis

The prominent positioning strategies used by companies related to the application of AI and ML in higher education institutions and EdTech companies are most often personalisation and customisation, analytics and performance reporting, Virtual Tutor and Learning Support (Based on AI chatbots), and Gamification. Adaptive learning is provided within solutions such as the Century Tech [17] platform, which starts from the assumption that every student in the learning process encounters obstacles that slow him down, affect the quality of knowledge acquisition and that the educator is the one who needs to identify these obstacles and remove them. However, monitoring each student individually, analysing individual results and creating materials according to the needs of students requires much time and is almost impossible. Therefore, the Century platform, which was created with the help of a team of educators at Century Tech, allows educators to undertake "smart interventions" with each student based on the data that this platform collects about

students' knowledge and needs. The platform combines knowledge from Artificial Intelligence, Learning Science and Neuroscience. In addition, to help students develop skills and retain knowledge for a lifetime, the Century platform uses learning principles such as interweaving. Students study multiple subjects over time, not just one. This stimulates the brain to connect different topics and establish connections between them, improving long-term memory retention.

An excellent example of an AI-powered system is the Knewton ALTA platform [18]. This company has constructed an ALTA platform through which students attend courses. Like other platforms based on the adaptive learning principle, this platform learns from the learner and identifies gaps in their knowledge. The ALTA platform enables the educator to organise courses, exercises and quizzes that students will attend and solve, and provides "real-time" insight into student performance. For example, suppose the student has problems with the material or with a particular exercise. In that case, the platform recognises this and offers "just-in-time remediation" – feedback, help, return to previous material that can help the student solve the task. The advantage of the platform is "Just-in-time remediation" for students and "Real-time visibility" for educators. It is a platform that tries to keep the student in the learning process through immediate help when they are struggling with solving the task. Therefore, the number of "dropout" students is significantly less than the number of those who complete the course. The teacher has a very transparent insight into student performance and is supported in creating new courses and exercises.

Education automation is possible using the Microsoft package. However, the inability of educators to devote themselves sufficiently to each student in the group (class) causes mediocre performance and a large number of student dropouts. An essential part of automation is QBot. When students ask questions, they use the tags of the lessons to which the questions refer, and the teachers from whom they expect to receive an answer. After an initial period in which only the teachers answered the questions, the Chatbot recognises which answer refers to and gives suggested answers. If the Chatbot cannot find an appropriate answer in its database, it forwards the question to the teacher. At the same time, in addition to answering questions, Chatbot referred to discussions in which similar topics were discussed.

Regarding gamification, a good example is the Memrise application [19]. This application uses gamified technology to make language learning enjoyable for users. The user is an astronaut embarking on a journey of language learning. He has different flip cards with words and ways to remember them and the ability to point his camera at the phone at a real object and get a written word and pronunciation in the target language. The student collects points, and with a higher number of points, his "alien pet" grows. In addition to all this, the application gives him a constant insight into his progress and is full of colours and fun ways to memorise words. Its intention is to solve the problem of learning vocabulary and phrases through standard courses and textbooks. The app provides ways to learn and memorise words.

A good AI-powered application is Sololearn [20] which uses gamified technology in creating programming courses. Like any educational platform, Sololearn contains lessons and materials on almost every programming language. The platform offers Code Playground, and players can compete head-to-head in a coding challenge, and the winner earns XP. Course tracking is also available for mobile phones, computers and tablets. Sololearn utilises progression, EXP, and leader boards to encourage players to continue learning to code. The platform solves the problem of great interest in learning coding and the lack of courses that are difficult to follow. In learning a programming language, students progressively go through the basics, while the application provides challenging material and tasks. The platform provides many challenges and the opportunity to compete with other participants. Sololearn repeatedly returns to the material and to questions that the student did not master well.

The application of AI is always conditioned by the existence of an adequate data set. If there is no critical data or the data is not "clean", the application of AI will not be successful. When AI is applied, a computer program composed of algorithms derives conclusions based on data sets. Without data, the algorithmic set cannot identify trends and therefore has no basis for decision making. The equations can be set up perfectly, but AI will not correctly interpret or predict information without an equally good data set. Also, in order to obtain good predictions, the data must be clean.

In the HolonIQ study, respondents were asked to consider which technologies have led to the most significant impact. The majority answered that Algorithms followed by Natural Language Processing/Linguistics had created the most impact. "Voice-based AI applications followed, having a broader spread on higher impact with a median impact score of 7 shared with hardware and vision. Hardware has a tighter set of views than vision-based AI, which is more spread towards lower impact/potential than peer technologies "[13]. Frequently used programming languages in implementing AI & ML solutions are Python, Java, R, MATLAB, Lisp, and Haskell.

3.2. Survey results

The main survey results are displayed in table 2. Most of the respondents are female, 53,01%, while 46,99% are male. Respondents are aged from 18 to 24 years (54.22%), then from 25 to 31 years (26,51%), and 32 to 40 years (19,28). Mainly, respondents have completed Higher education (vocational studies) within 77,11% and high school 22,89%. The respondents are students (master vocational studies) 69,88% or former students (30,12%). Respondents are aware (86,75%), not aware (9,64) and not sure (3,61%) of AI, and they use this technology in their daily lives (63,86%), do not use it (6,02%) and maybe (not aware of it) 30,12%. The table 2 shows questions and variables of interest.

Table 2. Questions and variables analysed

Variables	N	Code %
Please choose your gender		GENDER
Male	39	46,99
Female	44	53,01
I do not want to specify	0	0,00
How old are you?		AGE

from 18 to 24 years old	45	54,22
from 25 to 31 years old	22	26,51
from 32 to 40 years old	16	19,28
Regarding your schooling, please choose only one of the options (already completed):		SCHOOLING
High school	19	22,89
Higher education	64	77,11
Regarding your activity, please choose only one of the options:		ACTIVITY
I am a student	58	69,88
I plan to become a student	0	0,00
I am a former student	25	30,12
Artificial intelligence represents the theory and development of computer systems able to perform tasks...		AIDEF
True	72	86,75
False	3	3,61
I do not know	8	9,64
Do you use Artificial Intelligence in your daily lives?		AIMLUSE
Yes	53	63,86
No	5	6,02
Maybe (not aware of it)	25	30,12

The subject of the research is to examine the connection between the use of artificial intelligence in everyday life and the age of the respondents. In order to check the existence of the mentioned connection, the method of inference statistics was used, i.e. the calculation of the correlation coefficient. The correlation coefficient is the most commonly used statistical method that indicates the relationship between variables. The correlation value is determined by measuring the correlation coefficient, which is a numerical value that indicates the degree of correlation between the two variables. This indicator takes values from -1 to 1. Although the number of observations in the sample is greater than 30, which would accept the hypothesis of a normal distribution of variables, the answers of respondents about artificial intelligence are non-metric (measured on the ordinal scale), and the data on age are ranked, so the most relevant indicator of a possible relationship is Spearman correlation coefficient. Therefore, the Spearman correlation coefficient is calculated using the SPSS program for statistical processing and data analysis. The test hypotheses are as follows:

- H0: The use of artificial intelligence in everyday life does not depend on the age of the respondents.
- H1: The use of artificial intelligence in everyday life depends on the age of the respondents.

Correlations

			AGE	AIMLUSE
Spearman's rho	AGE	Correlation Coefficient	1.000	.866**
		Sig. (2-tailed)	.	.000
		N	83	83
	AIMLUSE	Correlation Coefficient	.866**	1.000
		Sig. (2-tailed)	.000	.
		N	83	83

Figure 1. Nonparametric Correlations

Based on the obtained results, a statistical conclusion is made that there is a high positive linear correlation between the variable age and the use of artificial intelligence, i.e. the Spearman correlation coefficient equals 0.866. In the context of the correlation strength, according to Cohen, the correlation is high because the value of the correlation coefficient is higher than 0.5. The correlation coefficient is, considering the level of statistical significance of the obtained result (Sig. 2-tailed), statistically significant at the level of 1%. The obtained probability does not speak about the strength of the connection, but rather about the level of trust for which the stated results should be accepted.

4. Discussion

Most of the respondents are female 53,01%, aged 18 to 24 years old, with completed Higher education (vocational studies), and in the status of student (master vocational studies) within 69,88%. In general, respondents are aware of AI (86,75%) and use this technology in their daily lives (63,86%). Also, 30,12% of respondents, regarding whether they use AI in everyday lives, chose the option "maybe (not aware of it)" that implicates that they are uncertain whether they use AI or not. In mentioned research that is used as a starting point [15], the authors stated: "At times, we are using technologies powered by AI without labelling them as AI. These could be something as mundane as email spam filters or face ID unlocks."

In a sample of 83 surveyed students, and based on the obtained value of Spearman's correlation coefficient, it is concluded that the use of artificial intelligence in everyday life depends on the age of the respondent. This result is justified by the fact that as the respondent's age grows, also grows their access to technological solutions without restrictions or someone's supervision, and there are interests that did not exist in specific years, as well as the awareness of the benefits that AI can bring in everyday life.

5. Conclusion

Education must be as accessible as possible in the 21st century. Access to education and lifelong learning is incorporated into significant strategies, UN included. No economic sector has escaped data management, which is why education-related systems need to utilise data analysis in order to deliver new personalised educational programmes that can quickly and precisely bridge the "learning gaps". Also, it has long been believed that teaching the same type of material to many students is dysfunctional. Problems within HEI have been made even worse by an insufficient number of educators in many educational systems. Educators can be informed of the strengths and weaknesses of students with intelligent systems supported by AI and ML technology. As the demand for highly educated workers increases, education institutions and businesses are utilising AI and ML or plan to do so in future.

The article addresses the research topic that students unfamiliar with artificial intelligence (AI) and machine learning (ML) technologies find it difficult to embrace AI-powered solutions. Thus, the study examines students' awareness of AI&ML (HEI). Exploratory research gave insight into high school education in Serbia and the mindset of Serbian pupils. Students at the chosen HEI are well aware of and familiar with these technologies, implying that they will readily transition to AI-powered systems now in development.

The research problem statement presented in an introduction is: Students who are not aware of AI & ML technologies, or have a rudimentary understanding, will find it challenging to adopt AI-powered systems. The research gap indicates the lack of field research studies to support this assumption. Therefore, future research should inspire more field research studies indicating the possible relation of AI awareness and the adaptability of AI-powered systems.

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