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THE USE OF ARTIFICIAL INTELLIGENCE IN THE STUDY PROCESS AS A DETERMINANT OF THE EDUCATION PROCESS IN AN AGILE UNIVERSITY

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Purpose: The aim of the article is to examine the use of artificial intelligence (AI) in the study process and to assess how it affects the effectiveness of education in the context of agile universities. The key features of an agile university are presented and the ways in which AI technologies support the educational process are discussed.
Design/methodology/approach: The research was conducted using a survey method on a sample of 450 students from various universities. Respondents answered questions about the use of AI tools in the learning process, such as translating complex issues, preparing reports, identifying errors, generating new ideas, and creating tests and questions.
Findings: (mandatory) Studies have shown that students most often use AI to explain complex issues and generate new ideas. AI tools are also useful in identifying and correcting errors and creating abbreviations and summaries of long texts. AI tools have proven to be less effective in preparing reports and creating tests.
Research limitations/implications: Research limitations include the use of the online survey method, which may have reduced the diversity of respondents and limited sample representativeness. Further research could extend the analysis to other forms of education and greater demographic diversity among students.
Practical implications: The results of the research can be useful for universities that want to integrate AI technologies into their curricula. They can help identify the most effective applications of AI in education and develop strategies for implementing agile teaching methods.
Social implications: The use of AI in education can contribute to improving the quality of education and better preparing students for the requirements of the modern labor market. AI technologies can also support the development of soft skills, such as creativity and problem-solving skills.
Originality/value: The article provides a new perspective on the use of artificial intelligence in education, especially in the context of agile universities. It provides practical recommendations for educational institutions and emphasizes the importance of adaptive technologies in the education process.
Keywords: artificial intelligence, agile university, education process.
the paper: research paper.

1. Introduction

In the current economic and social reality, technology is developing at a dizzying pace, affecting various aspects of life, including education. Dynamic changes in the labour market and growing requirements for the competences of employees mean that universities have to adapt their curricula to the new reality. One of the key elements supporting this process is artificial intelligence (AI), whose role in education is becoming increasingly important. The use of AI in the study process not only facilitates the acquisition of knowledge, but also prepares students for the challenges that await them in their future careers (Anderson, Wilson, 2017).

The use of artificial intelligence in education is a topical and extremely important topic. The development of AI technologies, such as machine learning and neural networks, allows for the creation of advanced tools that can significantly increase the efficiency of the teaching process. AI is used in various aspects of education, from personalization of teaching, through the automation of assessment, to support in the development of soft skills. This makes it possible to adapt teaching methods to the individual needs and learning styles of students, which is especially important in the context of agile universities (Stverkova, Pohludka, 2018).

An agile university is a concept that is gaining more and more popularity, responding to the dynamically changing educational and technological needs of the modern world. Key features of an agile university include curriculum flexibility, technological adaptability, soft skills development, openness to change and innovation, and collaboration with industry and other institutions. The implementation of these elements allows for the creation of an educational environment that not only better prepares students for professional challenges, but also responds to changing socio-economic conditions (Leberecht, 2016).

Artificial intelligence plays a key role in the implementation of the idea of an agile university. Its use in the study process brings many benefits that can significantly affect the quality of education. Thanks to advanced algorithms, AI is able to analyze and interpret complex issues, support students in preparing reports, identify and correct errors, and provide innovative solutions in moments of lack of ideas. Automatic generation of tests and questions allows you to regularly check your knowledge, which in turn promotes better preparation for exams.

Despite its many advantages, the use of AI in education also comes with some challenges and limitations. Issues such as data privacy, the ethical aspects of AI use and the need for continuous improvement of technology require special attention. Therefore, research in this area is not only necessary, but also urgent. Analysing the effectiveness of AI tools in different educational contexts can provide valuable insights that will contribute to optimising learning processes and better adapting them to the needs of students.

Therefore, the aim of this article is to investigate how artificial intelligence affects the study process and what are its most important applications in the context of agile universities. The survey conducted on a sample of 450 students will allow us to assess the extent to which AI supports education and what its most important advantages and limitations are. The results of the research can provide a basis for further analysis and development of strategies for the implementation of AI technologies in educational institutions, contributing to improving the quality of education and better preparing students for the challenges of the modern labor market.

2. Literature Review

2.1. Hallmarks of an agile university

An agile university is a concept that is gaining more and more popularity in the context of the dynamically changing educational and technological needs of the modern world. There are several key features that define the agility of a university, and their implementation can significantly improve the quality of education and prepare students for professional challenges (Bondos, 2014).

Programming flexibility is an important element. Agile universities offer flexible curricula that can be tailored to the individual needs of students and the demands of the labor market. These programs are often modular, which enables students to compose educational paths according to their interests and career goals. Another aspect is technological adaptability (Overby, Bharadwaj, Sambamurthy, 2006). Agile universities invest in modern technologies that support the teaching and learning process. They use e-learning platforms, remote collaboration tools, and innovative teaching methods such as gamification and augmented reality. This approach allows for a more interactive and engaging learning environment (McNamee, Schoch, Oelschlaeger, Huskey, 2012).

An agile university is also characterized by a strong emphasis on the development of soft skills. Students are encouraged to develop skills such as communication, teamwork, creativity, and problem-solving skills (Teece, 2007). These skills are essential in today's job market and are an important part of education at an agile university (Martucci, de Felice, Schirone, 2012). Another feature is openness to change and innovation. Agile universities are ready to make changes to their curricula and teaching methods in response to new scientific discoveries, changing societal needs, and technological advances. This enables them to respond quickly to changing conditions and ensure that their educational offerings are up-to-date and relevant (Narasimhan, Talluri, Mahapatra, 2006).

Cooperation with industry and other institutions is also an important element. Agile universities are actively seeking partnerships with companies, NGOs and other universities (Almahamid, Awwad, Adams, 2010) to provide students with access to practical experience and up-to-date information from the labour market. Such cooperation also allows for better adaptation of curricula to the real needs of the economy (Sahopta, 2012).

Certainly, an agile university focuses on continuous improvement and development of teaching staff. Teachers are regularly trained in new educational technologies and innovative teaching methods, which allows them to transfer knowledge more effectively and support student development (Leberecht, 2016).

To sum up, the hallmarks of an agile university include curriculum flexibility, technological adaptability, development of soft skills, openness to change and innovation, cooperation with industry, and continuous improvement of teaching staff. The implementation of these elements allows universities to better prepare students for the dynamically changing world and to meet the growing expectations of society and the labor market.

2.2. The emergence and development of artificial intelligence

The emergence and development of artificial intelligence (AI) is a fascinating process that has significantly affected many fields of science and technology, as well as people's daily lives. The origins of AI date back to the 1950s, when Alan Turing proposed a test to determine whether a machine is capable of thinking in a human-like way (Turing, 1950). His work on digital machines laid the foundation for future research in the field.

In the 60s of the twentieth century, the first significant development in the field of AI took place. Programs were then developed that could solve mathematical problems and play games such as chess (McCarthy, 1960). John McCarthy's introduction of the LISP programming language allowed for more advanced work on AI, allowing for the creation of more complex algorithms and systems (McCarthy, 1960).

The following decades brought significant progress in this field. In the 1980s, expert systems emerged that were able to mimic the thought processes of specialists in specific fields. These systems have been used in medicine, engineering, and finance, demonstrating the increasing usefulness and complexity of AI technology (Feigenbaum, 1981).

At the same time, the development of computers and information technologies has contributed to further progress in AI. In the 1990s and early 2000s, computers became more and more sophisticated (Sanchez, Nagi, 2001) and their computing power increased exponentially, making it possible to create more complex and efficient algorithms. In 1997, IBM's Deep Blue computer defeated world chess champion Garry Kasparov, a watershed moment in the history of AI (Campbell, Hoane, Hsu, 2002; Goldman, Nagel, Preiss, 1995; Kidd, 1994; Bessant, Brown, Francis, Meredith, Kaplinsky, 1999; Meredith, Francis, 2000)).

In recent years, there has been an explosion of interest in artificial intelligence, largely due to advances in machine learning and deep learning (Chen, Li, 2021). These techniques allow computers to analyze vast amounts of data and draw conclusions from it, leading to the creation of more precise and efficient models (Cappelli, Tavis, 2018). Examples include the development of autonomous vehicles, speech recognition systems, and medical analysis tools (LeCun, Bengio, Hinton, 2015).

One of the most important developments in the field of AI is the development of neural networks (Fosso Wamba, 2022) that mimic the structure and functioning of the human brain. These networks, particularly deep neural networks, have become the basis of many modern AI systems, allowing for a significant increase in their ability to process and analyze data (Bray et al., 2019).

The development of artificial intelligence also comes with ethical and social challenges. Questions are raised about privacy, data security, as well as the potential impact of AI on the labour market and the future of employment. As a result, more and more attention is being paid to the legal and ethical regulations related to the use of this technology (Russell, Dewey, Tegmark, 2015).

In conclusion, the emergence and development of artificial intelligence is a complicated process that has evolved over the decades, leading to the emergence of advanced technologies that are an integral part of our lives today. The use of AI in education, technology and many other fields is a testament to its growing importance and potential to further shape the future.

2.3. Artificial intelligence in the study process

Artificial intelligence is playing an increasingly important role in the study process, significantly influencing the way students acquire knowledge and prepare for exams. The use of AI in education brings many benefits that can be observed at different stages of the teaching and learning process. One of the main applications of AI in education is its ability to translate complex issues (Brown, Jones, 2018). Thanks to advanced algorithms, AI systems can analyse and interpret difficult topics, presenting them in a way that students can understand. This allows for faster and more effective mastery of the material, which is especially important in the context of subjects that require deep theoretical understanding (Kurnia, Chien, 2020).

Another important aspect is the assistance of AI in the preparation of reports. Students often have to create comprehensive documents for credit that require precision and accuracy. AI tools, such as word processors with linguistic analysis capabilities, can automatically correct errors, suggest corrections, and offer structured advice, significantly improving the quality of final work (He, Harris, 2021).

AI is also extremely effective at identifying and correcting errors. Algorithms that detect grammatical, stylistic and logical errors help students to create more consistent and correct papers. This not only increases the quality of their studies, but also teaches them to avoid the same mistakes in the future (Kumkale, 2022).

In addition, AI can provide students with interesting solutions in moments when they lack ideas. Through big data analysis and the use of machine learning techniques, AI systems can generate new ideas and propose innovative approaches to solving academic problems. It is an invaluable aid in tasks that require creativity and innovative thinking (Skyrius, Valentukevi, 2021).

Another use of AI in education is the creation of questions and tests, which allows students to better prepare for credits. Automatic test generation based on the material covered allows students to regularly check their knowledge and identify areas that need additional work. Such interactive tools support the learning process and help to achieve better academic results (Cegarra-Navarro, Sánchez-García, Marco-Lajara, García-Pérez, 2021).

Another useful AI tool is systems that create abbreviations and summaries of long texts. Students who need to absorb large amounts of material can use AI technology to understand the most important content quickly and efficiently (Raišienė, Bilan, Smalskys, Gečienė, 2019). This saves time and increases the effectiveness of learning, which is especially important during periods of intensive study before exams. AI can also compile existing texts, which is extremely helpful when writing scientific papers. These tools can search databases and literature, identifying the most important information and combining it into a coherent study. This allows students to focus on analyzing and interpreting data, rather than time-consuming material gathering (Todorovich, 2020).

In conclusion, AI plays a crucial role in the study process, offering a variety of tools and technologies that support students at every stage of their education. From translating complex topics to helping to create reports, to generating new ideas and preparing tests, AI significantly increases the efficiency and quality of the learning process. Its use allows students to better prepare for academic and professional challenges, which is an invaluable support in a dynamically changing world.

3. Analysis of own research

3.1. Research Methodology

The survey was conducted in January 2024 on a sample of 450 respondents using the survey method. The aim of the study was to identify the degree of use of artificial intelligence by students in different areas of the study process and to determine the impact of these technologies on the effectiveness of learning. The research hypothesis assumed that artificial intelligence significantly supports the study process, especially in the field of explaining complex issues, preparing reports, identifying errors, generating new ideas, and creating questions and tests. The research was to answer the following questions: to what extent students use AI tools to

translate incomprehensible content, how AI supports the preparation of reports, how AI helps to identify and correct errors, how students assess the usefulness of AI in generating new ideas, and how often they use AI to create questions and tests.

In the course of the study, sociodemographic data on a group of 450 people were obtained. Of the study participants, the majority, i.e. 82.7% (372 people), have a bachelor's or engineer's degree, while 17.3% (78 people) have a master's degree. The gender analysis showed that 60.9% of the respondents were women (274 people) and 39.1% were men (176 people). With regard to the age of participants, 34.2% (154 people) were under 20 years old, 35.6% (160 people) were between 21-25 years old, 8.7% (39 people) were between 26 and 30 years old, 9.3% (42 people) were between 31 and 35 years old, and 12.2% (55 people) were 35 years of age or older. In terms of the type of studies, 43.8% (197 people) attend full-time studies, while 56.2% (253 people) study part-time. In terms of economic activity, 25.1% (113 people) are not employed, 35.3% (159 people) are full-time employed, 29.3% (132 people) work on a contract of mandate or specific work, 7.3% (33 people) run their own business, 0.4% (2 people) run a farm, and 2.4% (11 people) work permanently and run a business at the same time.

3.2. Presentation of Research Findings

The study sought to determine the extent to which students use AI in different areas of the study process. Table 1 presents participants' answers to questions about specific applications of AI, organized according to a five-point Likert scale, the extreme points of which are "Definitely NO" and "Definitely YES".

Table 1.
Use of Artificial Intelligence in the Study Process
(Likert Scale)

	strongly disagree	**disagree**	**neutral**	**agree**	**strongly agree**
AI translates concepts I don't understand, helping me to learn the material better and faster (1)	24	46	61	197	122
AI helps me prepare reports for assessment (2)	86	95	76	137	56
AI identifies and corrects errors, improving the quality of my work (3)	56	77	72	172	73
AI provides interesting solutions when I run out of ideas (4)	30	45	52	198	125
AI creates questions or tests, helping me better prepare for exams (5)	65	91	107	129	58
AI prepares summaries and abstracts of long texts for me (6)	62	83	65	143	97
AI creates compilations of existing texts (7)	52	75	115	145	63

Source: own.

The data shows that the largest number of students answered "Rather YES" to the question about using AI to translate issues they did not understand, which allowed them to master the material better and faster – this option was chosen by 197 respondents. The use of artificial

intelligence to provide interesting solutions when they lacked ideas was also very popular, which was indicated by 198 people.

Respondents were less enthusiastic about AI's help in preparing reports; most of the answers were concentrated in the "Rather NOT" category (95 responses) and "Definitely NOT" (86 responses). A similar distribution of responses can be seen when creating questions or quizzes, suggesting that AI is less commonly used in this context, with most responses clustered in the neutral or negative range.

When it comes to pointing out and correcting errors in studies, most students indicated that they use AI to improve the quality of their papers, with a dominant answer of "Rather YES" (172 responses). The last two questions concerned the development of abbreviations and summaries of long texts and the creation of compilations of existing texts, where positive answers also prevailed, although with a clear distribution in neutral and negative categories.

The presented data shows that students assess the usefulness of artificial intelligence differently depending on the specific application in the educational process. Table 2 shows the correlation matrix between the different applications of AI in the study process that have been identified and described in Table 1. The correlation table provides valuable clues as to the interrelationships between the different AI functions that are used by students in the study process, showing which of them are perceived as complementary or independent.

Table 2.
Correlation Table

	1	*2*	*3*	*4*	*5*	*6*	*7*
1	1						
2	0,52	1					
3	0,88	0,85	1				
4	0,99	0,52	0,87	1			
5	0,51	0,78	0,78	0,46	1		
6	0,95	0,67	0,93	0,96	0,54	1	
7	0,68	0,69	0,82	0,63	0,95	0,64	1

Source: own.

Correlation values ranged from 0.46 to 0.99, suggesting a varying degree of association between these applications. On a closer look, it's worth noting that the highest correlation (0.99) is between AI's ability to explain incomprehensible issues and its ability to provide interesting solutions, suggesting that the two aspects are almost identical in student perception. Equally high correlations are observed between the development of abbreviations and summaries of long texts and the creation of compilations of existing texts (correlation 0.95), which may indicate that these two tasks are perceived as similar in the context of information processing and synthesis.

Other important correlations are the relationships between pointing out and correcting errors and developing shortcuts and summaries (0.93 correlation) and between translating issues and developing abbreviations and summaries (0.95 correlation), which may indicate that the effectiveness of AI in one area is perceived as support in another.

On the other hand, the lowest correlation (0.46) is between the AI's ability to translate issues and the creation of questions or tests, indicating that students perceive these functions as less related to each other.

3.3. Discussion

Based on the research carried out, it can be concluded that students assess the usefulness of artificial intelligence differently depending on the specific application in the educational process. In some areas, such as explaining incomprehensible issues or providing interesting solutions, artificial intelligence is perceived as very helpful and efficient, which is confirmed by high correlations between these functions. This indicates a strong perception of the added value that AI brings in the context of facilitating understanding of the material and stimulating creative thinking.

On the other hand, in areas such as preparing reports or creating questions for tests, AI is perceived as less effective, which may be due to technological limitations or less adequacy of these tools to the task. This suggests that the role of AI in education should be further adapted and developed to better meet the expectations and needs of users.

Analyzing the correlation between different uses of AI also shows that students perceive certain functions as more interdependent. For example, the ability to develop abbreviations and summaries is closely related to the creation of compilations of existing texts, which may indicate that these tools are perceived as support in the efficient processing and synthesis of information.

In light of these results, universities and developers of AI-based educational tools can see the need to further develop and adapt these technologies to better meet the specific educational needs of students. Further research in this area could also contribute to a better understanding of how AI can support educational development and contribute to more agile and tailored universities.

Based on the analysis of the use of artificial intelligence in the process of studying and the observation of correlations between various AI functions, recommendations can be made for universities that want to bear the hallmarks of an agile approach in education. In order to meet the dynamic changes in the educational environment and increase the efficiency of the learning process, universities should focus on several key areas of implementation and integration of AI technologies.

The first recommendation is to develop and implement AI tools that are effective in explaining complex issues and in stimulating students' creative thinking. The results of the research indicate the high effectiveness of AI in these areas, which may contribute to a deeper understanding of the material and faster acquisition of knowledge. Universities should invest in the development and improvement of such systems, ensuring that they are intuitive to use and tailored to the specific needs of different academic fields.

Another recommendation is to increase the personalization of AI-based learning tools. Universities can use machine learning algorithms to create personalized learning paths that analyze a student's learning style and tailor learning materials to support their development as much as possible. This personalization can also include adaptive tests and quizzes that are tailored to the student's level of knowledge, which can help to better understand the material and prepare for exams more effectively.

Universities should also focus on improving the perception of AI tools for preparing reports and creating educational materials. As the results of the research show, AI tools are not yet fully effective in these areas, which may be due to technological limitations or the inadequacy of tools for tasks. Universities can invest in the development of more advanced natural language processing technologies that better understand the context of the task and are able to generate high-quality materials that will be helpful in the learning process.

Additionally, universities should also consider integrating AI systems that support the development of abbreviations and summaries of long texts and the creation of compilations of existing materials. The high correlations between these functions suggest that they may be effective in complementing each other, supporting students to efficiently absorb large amounts of information in a short period of time.

Finally, universities should promote and support research into the further development of AI in education in order to adapt and improve educational tools on an ongoing basis in response to changing student and pedagogical needs. Collaboration with technologists, educators, and students on this research can bring new perspectives and innovations that will significantly contribute to the development of agile approaches to education.

By implementing these recommendations, universities can not only increase the effectiveness of the teaching process, but also contribute to a more dynamic and flexible response to the needs and challenges of modern students. By taking steps towards personalization and adaptation of artificial intelligence technologies, universities can significantly improve the quality of education while increasing their competitiveness in the education market. Investing in technologies that enable a deeper understanding of the material and more effective learning can bring significant benefits to both students and institutions, enabling better learning outcomes.

Further developing AI capabilities that can support creative thinking and problematic aspects of learning can also contribute to more innovative approaches to education. By building an environment where technology works with pedagogy, colleges can create more engaging and interactive learning experiences for their students.Therefore, the university's efforts to fully integrate and optimize AI tools in the educational process are crucial for the development of agile educational institutions that are able to adapt to rapid changes in the information society and the needs of the labor market. By providing adequate resources and support for these innovations, universities can not only increase their efficiency, but also offer students a more comprehensive and tailored learning environment. These considerations can be presented as

an algorithm for the use of artificial intelligence in the education process at a university (cf. Fig. 1).

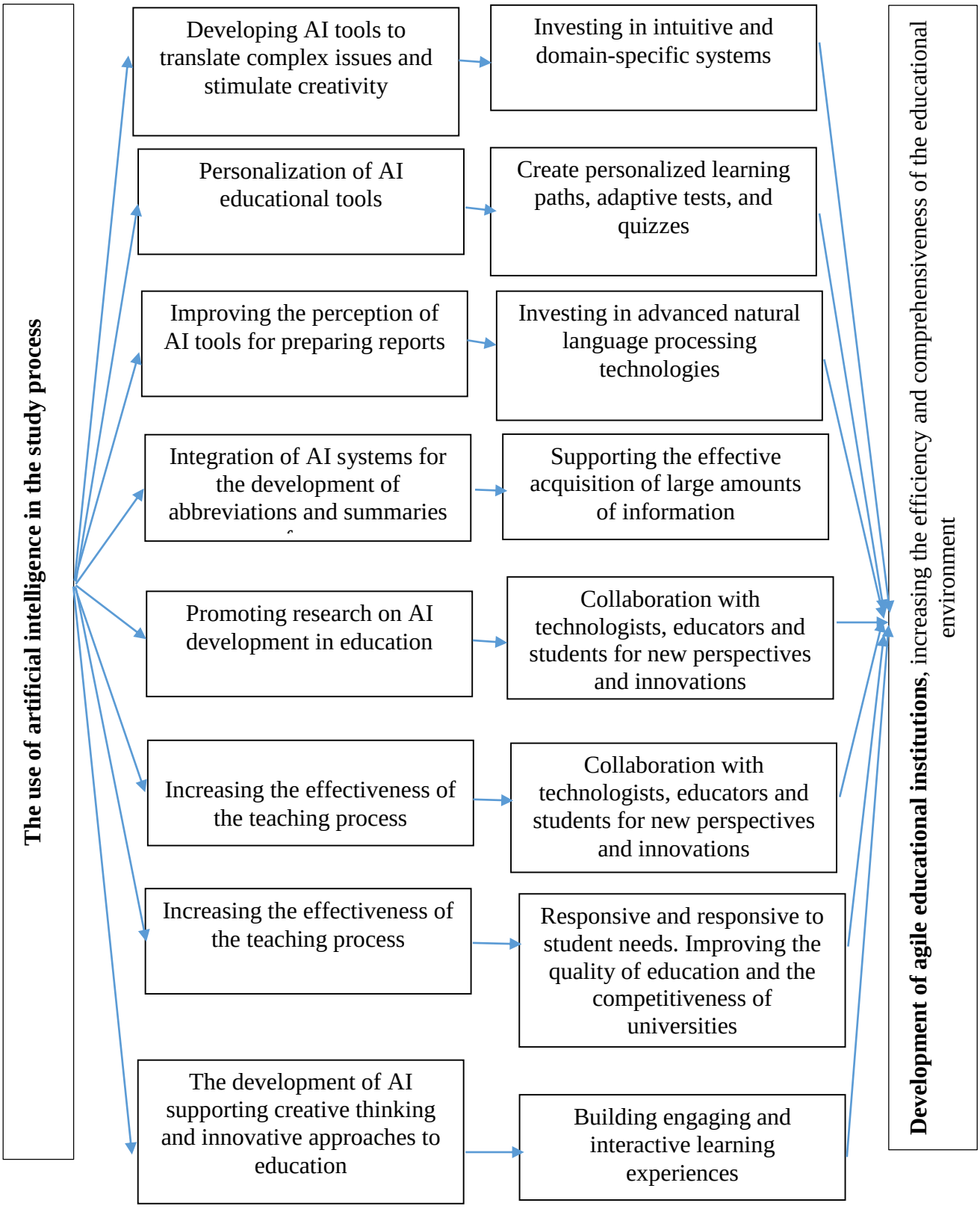

Figure 1. Allorhythm of the use of artificial intelligence in the education process at a university. Source: own.

In the course of the study, limitations were observed, resulting primarily from the methodology of data collection and the characteristics of the studied sample. The online survey method used could have limited the diversity of respondents, as people with access to the Internet and electronic equipment could take part in the survey. In addition, given the group of 450 respondents, there is a risk that it does not fully reflect the general population, which may affect the generalization of the results. Focusing on a specific type of university and form of study (full-time and part-time) also introduces a potential limitation related to the lack of representation of other forms of education. In addition, the selection of questions in the survey and their formulation may have influenced the respondents' subjective answers, which may be interpreted differently depending on their individual experiences and expectations.

4. Conclusions

The results of this study can be compared with those of other researchers conducting research on similar issues. In particular, research on the use of artificial intelligence (AI) in education shows convergence of results in several key areas. The results of the study indicate that AI is particularly effective in explaining complex issues and in providing interesting solutions when students lack ideas. Similar conclusions were presented in the research of Feigenbaum (1981), who emphasized the ability of expert systems to mimic the thought processes of specialists in various fields, which greatly supported education in complex areas of knowledge (Feigenbaum, 1981). In a study by LeCun, Bengio, and Hinton (2015), neural networks were cited as a tool for efficient data processing and analysis, which is consistent with our results on using AI to translate difficult topics (LeCun, Bengio, Hinton, 2015).

The presented research found that AI is less effective in preparing reports and creating questions for tests. These results can be compared with the findings of McCarthy (1960), who noted that while AI can process information at a high level, its ability to generate new content and context requires further development (McCarthy, 1960).

The high correlations between AI's ability to translate complex issues and its ability to provide engaging solutions indicate a significant perception of the added value that AI brings to education. Similar observations can be found in the research of Russell, Dewey, and Tegmark (2015), who emphasize the importance of AI in facilitating comprehension of material and stimulating creative thinking in education (Russell, Dewey, Tegmark, 2015). Based on our results, universities can see the need to further develop AI tools in education, which is in line with the recommendations made by Campbell, Hoane, and Hsu (2002). Their research on the Deep Blue system pointed to the need for continuous improvement and adaptation of AI technology to the specific needs of users (Campbell, Hoane, Hsu, 2002).

Overall, the results of this study largely coincide with those of other researchers, pointing to the need to further develop and adapt AI technologies to specific educational needs.

Further research avenues could include an analysis of the long-term effects of the use of artificial intelligence (AI) in education at different levels of study to understand how these technologies affect teaching and learning in a multi-year perspective. It is also possible to explore the specific benefits of personalising AI tools in education, including how adaptive tests and learning pathways tailored to individual student needs can impact their academic performance and learning satisfaction. Research can also focus on the integration of AI with other modern educational technologies, such as virtual and augmented reality, to assess their combined impact on learning engagement and effectiveness. It is also worth exploring how different demographics of students, including those with different learning styles and cultural backgrounds, respond to the introduction of AI in education, which can help develop more inclusive and effective teaching tools. Another interesting area of research is the impact of AI on the development of soft skills such as communication and teamwork, and how these technologies can be optimized to support these skills. Research may also focus on the ethical and social aspects of the use of AI in education, including issues related to data privacy and equity in modern educational technologies. Ultimately, further research could help to better understand how universities can effectively integrate AI tools into their curricula to foster a dynamic and agile approach to education that is tailored to the rapidly changing needs of the modern world.

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