INTEGRATION OF ARTIFICIAL INTELLIGENCE, CREATIVITY DEVELOPMENT IN CLASSROOM TEACHING

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Abstract

The dynamic development of artificial intelligence (AI) is bringing about significant transformations in many industries, and the world of education is no exception. The integration of AI technologies opens up new horizons for increasing the efficiency of teaching and learning. AI offers innovative opportunities especially in face-to-face education, where traditional teacher-student interaction can be complemented by intelligent technological tools. This study aims to present the theoretical foundations of AI integration, the challenges of practical implementation, and, through the results of empirical research, to explore the attitudes of higher education teachers and students towards the use of AI in face-to-face education. The research highlights the key factors that determine the acceptance and effectiveness of AI in an educational environment.

In addition to the above, we also seek to answer how AI can contribute to the development of students' creative thinking and how it can support teachers' pedagogical practice. The use of AI tools is not only a technological innovation, but can also promote the development of new pedagogical paradigms in which learning can become more personalized, interactive, and inspiring.

The aim of this study is therefore not only to explore the current situation, but also to examine how AI can be integrated responsibly, ethically, and purposefully into the everyday practice of classroom teaching.

Keywords: artificial intelligence (AI), higher education, creative thinking, technology acceptance model (TAM), ethical use of AI in education, teacher and student attitudes

1. Theoretical background

The educational application of artificial intelligence is based on several pedagogical and psychological theories that help interpret the impact of technology on learning processes. This study applies three main theoretical frameworks: constructivist learning theory, self-determination theory, and the technology acceptance model (TAM). These three approaches enable a complex examination of how artificial intelligence influences students' motivation, autonomy, and the quality of their learning experience. Constructivist theory emphasizes active knowledge building, which can take new forms through interactive and adaptive AI tools, promoting deeper understanding and creative problem solving. Self-determination theory helps us understand how AI can support intrinsic motivation by providing learners with the experience of competence, autonomy, and relatedness in an appropriate manner. The technology acceptance model provides a framework for exploring the attitudes, perceptions, and user experiences that influence the practical acceptance of AI in the educational process. Together, these theories offer the opportunity for artificial intelligence to be seen not merely as a technological tool, but also as a pedagogical factor that transforms the learning environment.

1.1. Constructivist learning theory

The basic principle of Jean Piaget's (1972) constructivist learning theory is that knowledge is not acquired passively from external sources, but is constructed by the learner through their own active experiences and interactions. AI-supported learning environments are well suited to facilitating this constructive process. These systems allow learners to progress at their own pace and according to their own interests, while AI supports the learning process with personalized and adaptive feedback. Such systems are able to recognize the unique needs and difficulties of each learner and provide support accordingly, facilitating deeper understanding and lasting knowledge retention. AI-based educational platforms can also encourage discovery-based learning, in which students form their own opinions through problems, simulations, and interactive tasks. Artificial intelligence can analyze real-time data on student behaviour and adapt the curriculum or tasks accordingly, promoting continuous self-reflection and self-regulation. This means that students are not just passive recipients of knowledge, but also active creators, which is a central element of the constructivist approach. The role of the teacher is transformed: they become facilitators who do not directly impart knowledge, but support students' independent discoveries and help them shape their own learning paths. Artificial intelligence does not replace the teacher, but provides them with a tool for more personalized, reflective, and experience-based education.

1.2. Self-determination theory

Deci and Ryan's (1985) self-determination theory draws attention to three basic psychological needs for motivated learning: autonomy, competence, and relatedness. The use of AI tools can contribute significantly to satisfying these needs. For example, by allowing learners to decide for themselves on the content, pace, and order of tasks, their sense of autonomy increases. AI's immediate and relevant feedback can reinforce a sense of competence, helping learners recognize their progress and abilities. Although the aspect of connection may seem less obvious at first glance with AI, certain systems support collaborative learning and community interactions, thereby also strengthening the sense of connection. In AI-supported learning environments, maintaining and deepening motivation is not only a technological issue, but also a psychological one. Applications that are able to personalize the learning experience and take into account the emotional state or interests of learners are more effective in supporting the development of intrinsic motivation. In addition, AI-generated learning paths that are tailored to students' current knowledge levels help ensure that tasks are challenging but not too difficult or frustrating—a key factor in developing a sense of competence. The dimension of connection can also take on a new meaning in the context of AI: learners interact not only with each other but also with the system, which accompanies them as a "partner" in their learning. If this relationship can be established in such a way that learners feel supported, listened to, and receive feedback, AI can also contribute to creating an emotionally supportive learning environment. This is particularly important in face-to-face education, where teachers and AI can work together to create an environment that is stimulating, easy to understand, and personalized.

1.3. Technology Acceptance Model (TAM)

Davis's (1989) Technology Acceptance Model is a widely used framework for explaining and predicting user acceptance of new technologies. According to the model, users will adopt a new technology if they perceive it as useful and easy to use. The acceptance of AI systems in education is therefore greatly influenced by perceived usefulness and perceived ease of use. Teachers and students will be willing to integrate AI into the learning-teaching process if they feel that it offers significant benefits (e.g., improves learning outcomes, saves time) and is not difficult to use. These aspects are also critical in the empirical part of the study, where the focus of the research is on attitudes and acceptance. However, the acceptance of AI technologies is not solely determined by perceived usefulness and usability; later extended versions of the model also highlight additional factors such as social influence, experience, self-efficacy, and openness to innovation. In the case of teachers and students, previous experience with AI, digital skills, and general attitudes toward technology can significantly influence acceptance. It is also important to note that organizational culture, institutional support, and the educational policy environment can contribute to the successful introduction of AI systems or, conversely, provoke resistance. In face-to-face education, it is particularly important that AI does not become an end in itself, but rather represents a tangible added value in the teaching and learning process. Understanding this is essential for the analysis of subsequent empirical studies and practical strategies for AI integration.

1.4. Related research

The number of studies dealing with the application of artificial intelligence for educational purposes is growing in international literature. Shute (2008), for example, showed that real-time formative feedback provided by AI can significantly contribute to increasing the efficiency of the learning process. Gransden, Smith, and Patel (2024) highlighted the importance of differentiated treatment of learning outcomes with the help of AI, which enables the creation of personalized learning paths. This is related to the work of Popenici and Kerr (2017), who argue that it has become necessary to rethink the relationship between teachers and students.

In Hungary, an increasing number of researchers are studying the role of AI in education. Baditzné Pálvölgyi and Jakab (2023) and Bognár (2024) examined the possibilities and challenges of applying AI in teaching practice. Horváth (2023) comprehensively analyzed the challenges posed by the integration of AI in education, including from an ethical and data protection perspective. These national studies contribute to a deeper understanding of the topic in the local context and serve as a basis for the empirical investigation in the present study.

International and national research also shows that the use of AI in education raises not only technological issues, but also complex pedagogical and ethical questions (Syamsiana et al., 2024). In their comprehensive study, Luckin et al. (2016) point out that a deeper understanding of the learning process and the pedagogical design of algorithms are essential in the development of AI systems. Holmes et al. (2019) highlight the dangers of data-driven decision-making, pointing out that automated feedback cannot replace teacher interpretation and human context. The ethical handling of student data and the transparency of AI systems are also key issues, which Williamson and Eynon (2020) address in detail in their examination of educational data policy.

As mentioned earlier, at the national level, Bognár (2024) also emphasizes that systems using AI can only become an integral part of teaching if educators have sufficient methodological preparation and technological confidence. Horváth's (2023) research confirms that ethical dilemmas—such as student observation, assessment, or data use—are already causing concern among teachers at the higher education level. These specific findings clearly highlight that the successful integration of AI into education is not merely a technological issue, but a complex process that requires institutional support, professional dialogue, and normative frameworks. In light of these findings, the aim of this study is to examine how students and teachers in Hungarian higher education evaluate the role of AI, with a particular focus on the quality of teaching and learning and the factors influencing acceptance.

International and national findings thus offer common lessons: the effective and accepted use of AI can only be achieved if we can place it within a comprehensive theoretical, methodological, and practical framework. This study sets out to achieve this goal: building on previous research findings, it examines how these issues manifest themselves from the perspective of teachers and students working in Hungarian higher education.

2. Research questions

This study focuses on a thorough examination of the use of artificial intelligence in presence-based education. The research seeks answers to four main questions that provide a comprehensive picture of the multifaceted effects and challenges of AI integration:

1. What are the attitudes of teachers and students towards the use of AI in classroom teaching? This question explores the perceptions, expectations, and possible concerns of those involved with AI technology.

2. How does AI influence the personalization and effectiveness of the learning process? The focus here is on the adaptive capabilities of AI and whether it can truly improve learning outcomes by taking individual needs into account.

3. What are the challenges of integrating AI into classroom teaching? This question focuses on practical obstacles, such as deficiencies in technical infrastructure, the need to transform pedagogical methodology, or issues related to teacher training.

4. Does the use of AI-based tools in the classroom influence the development of creative thinking? This specific question examines whether AI hinders or actually encourages students' creative problem-solving skills and innovative thinking.

3. Methodology

The research used a complex and comprehensive methodological approach based on the analysis of quantitative, independent surveys. This combined approach allowed for an in-depth exploration of the phenomenon and increased the validity of the results.

In the first phase, we examined the attitudes of current and former students of a Hungarian university towards education and artificial intelligence. The aim of this method was to explore the subjective opinions, experiences, and perceptions of current and former students regarding the use of AI in education. Respondents rated their support for the use of artificial intelligence in education on a five-point Likert scale, and the vast majority (more than 50 percent) supported the use of AI. This was true for both alumni and current students.

In the second phase, we conducted a quantitative questionnaire survey. We used a standardized questionnaire to examine attitudes, technology acceptance (based on the TAM model), and perceptions related to creative thinking. The collection of quantitative data enabled statistical analyses to be performed on a larger sample and the generalizability of the correlations identified.

3.1. Sample

A total of 1,537 people participated in the first data collection: 1,409 students and 128 alumni. In terms of gender, men made up 60 percent of the sample, while women made up 40 percent. These participants were selected from the same national higher education institution, thus ensuring diversity and the representation of perspectives from different age groups. A smaller sample of 132 students participated in the second questionnaire survey, which also led to the identification of significant correlations.

The Tóth Creativity Estimation Scale (TKBS) was used to assess creativity. This scale measures an individual's creativity along 12 subscales and 72 items and has been used in many cases in the fields of education, research, and psychology. This scale is a reliable and validated tool for measuring different dimensions of creative thinking, providing us with a more accurate picture of the impact of AI-based tools on creativity. Our results confirmed that respondents scored highest on the playfulness subscale, while impatience was the weakest area. There were 62 men and 69 women among the respondents, 76 of whom were full-time students and 56 of whom were part-time students.

3.1.1. Analytical Methods

We analyzed the first survey using SPSS statistical software and performed comparative analyses involving the background variables of age, faculty, department, place of residence, and student/alumni status. It is important to note that support for the use of artificial intelligence in education is clearly positive for all background variables. It is worth noting that there was a significant difference in the acceptance of artificial intelligence between genders. Our results confirm that men are significantly more supportive of the use of AI (Table 1, Figure 1).

Although the difference is not significant among alumni and student respondents, it is still noticeable, as nearly 10 percentage points more students than alumni chose the most supportive response option. (Table 2.)

Table 1. The acceptance of artificial intelligence between genders

Total N	1136
Mann-Whitney U	135096,000
Wilcoxon W	233886,000
Test Statistic	135096,000
Standard Error	5230,571
Standardized Test Statistic	-3,542
Asymptotic Sig. (2-sided test)	<,001

Source: TKBS, the authors' own editing; Independent-Samples Mann-Whitney U Test Summary

Figure 1. Independent-Samples Mann-Whitney U Test

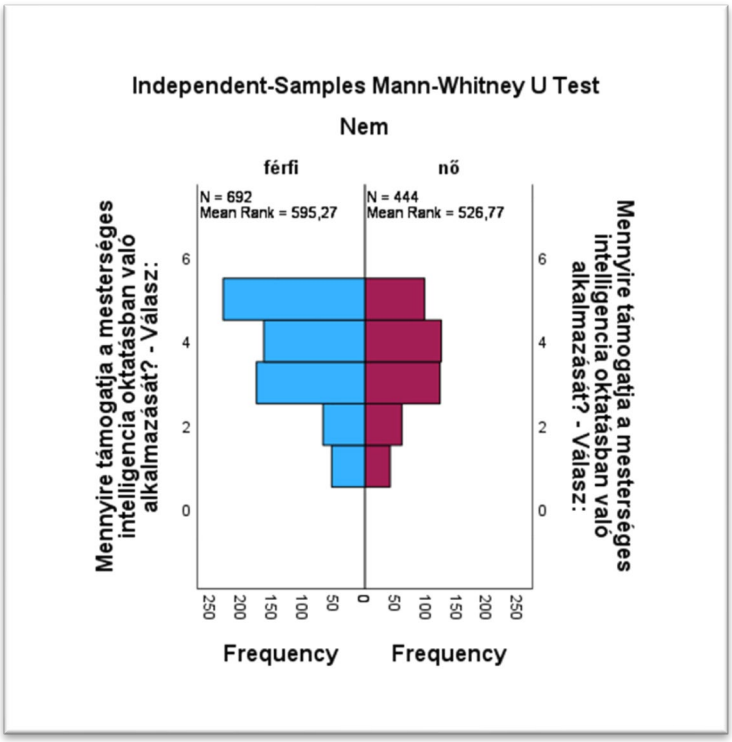


Table 2. The support of artificial intelligence in education from the viewpoint of Alumni or Students

			Alumni	Student	Total
How much do you support the use of artificial intelligence in education?	1	n	10	85	95
		%	9,0	8,2	8,3
	2	n	8	120	128
		%	7,2	11,6	11,2
	3	n	37	263	300
		%	33,3	25,5	26,2
	4	n	33	258	291
		%	29,7	25,0	25,5
	5	n	23	306	329
		%	20,7	29,7	28,8
Total		n	111	1032	1143
		%	100,0	100,0	100,0

Source: TKBS, the authors' own editing; Crosstabulation

The second questionnaire data was also analyzed using the SPSS statistical program. During the analyses, we used descriptive statistics (e.g., means, standard deviations, mode values) to characterize the data, correlation analysis to explore the relationships between individual variables, and variance analysis to examine the differences between groups. We also examined the dimensions of creativity separately, based on the TKBS scale, comparing them with the use of MI tools in the classroom to find specific correlations in this area.

It is important to emphasize that in the case of all background variables, it was clear that the area most in need of improvement was impatience, while the strongest area was playfulness. This is true even though men scored lower on average than women in this area (Table 3, Table 4).

Table 3. The relationship between the subscales of creativity by the programs

Program	Full-time		Part-time	
N (capita)	76		56	
Scale:	m	σ	m	σ
NON	10,58	3,74	11,96	3,25
KOM	14,25	4,28	16,11	3,11
KOC	13,55	4,24	14,63	3,67
GON	12,73	3,26	13,52	2,64
TÜR	8,33	3,70	8,59	3,21
ÖNÉ	13,70	4,51	14,36	3,35
DOM	14,24	5,21	16,04	3,59
KÍV	15,97	3,48	17,34	2,68
ENE	12,33	4,11	14,40	3,44
ERE	14,28	3,86	15,52	3,70
KIT	14,17	4,40	17,05	3,97
JÁT	17,83	2,29	18,46	2,85
TKBS Total	161,86	30,16	177,96	19,39

Source: TKBS, the authors' own editing; correlation/ variance analysis

Table 4. The relationship between the subscales of creativity by genders

Gender	Man		Woman	
N (capita)	63		69	
Scale:	m	σ	m	σ
NON	11,85	2,80	10,56	4,10
KOM	15,05	3,79	15,03	4,07
KOC	14,37	3,81	13,68	4,22
GON	12,83	3,02	13,28	3,04
TÜR	7,70	3,07	9,12	3,74
ÖNÉ	14,03	3,75	13,93	4,34
DOM	15,54	3,96	14,51	5,21
KÍV	16,92	3,30	16,22	3,13
ENE	13,30	4,13	13,12	3,82
ERE	15,21	3,62	14,43	4,00
KIT	14,89	4,79	15,86	4,18
JÁT	18,36	2,66	17,86	3,10
TKBS Total	169,97	23,81	167,74	30,07

Source: TKBS, the authors' own editing; correlation/ variance analysis

4. Discussion and Limitations

The results of the research confirm that the integration of artificial intelligence into classroom teaching can have a positive impact on learning processes, especially on the development of creativity. Based on questionnaire surveys, the majority of teachers and students alike recognize the benefits of AI's personalized feedback and adaptive learning opportunities, which are consistent with

the main principles of constructivist learning theory and self-determination theory. AI supports students' autonomy and sense of competence while facilitating the development of learning paths tailored to their different needs.

At the same time, the research highlighted several critical factors that influence the acceptance of AI in education, including along the dimensions of the Technology Acceptance Model (TAM): in addition to perceived usefulness and usability, the digital competence of educators and the existence of technological infrastructure are fundamental prerequisites. Ethical concerns such as data protection and algorithmic transparency also play an important role in building trust.

The research has certain limitations. The sample size in the second study partially limits the generalizability of the results. In addition, although the TKBS creativity measurement tool is validated, it only examines certain dimensions of creativity according to an interpretive framework, so it does not necessarily cover all relevant aspects. Finally, the focus of the study was limited to national higher education institutions, so the results may not be applicable at the international level.

5. Conclusions and Future Work

The application of artificial intelligence in classroom teaching offers promising opportunities for developing creativity and personalizing learning processes. The results obtained in this study show that the acceptance of AI technologies is closely related to the technological competence of teachers and students, the usability of the systems used, and the support of the educational environment.

Future research should involve broader and more diverse samples to obtain a more accurate picture of the possibilities and limitations of AI integration in education. Furthermore, longer-term, longitudinal studies may be needed to explore the sustainability and developmental dynamics of AI's effects. Ethical issues, particularly data protection and transparency aspects, require further in-depth analysis to ensure that the use of AI is not only effective but also responsible.

Finally, it is recommended that teachers and students receive ongoing training and support in the use of AI technologies so that integration is not only a technological success but also a pedagogical one. Educational institutions need to develop frameworks at a strategic level that ensure the ethical and effective use of AI, thereby promoting the sustainable development of learning quality and creativity.

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