UDC 37.026:004.85

Sabrina Bacher
Doctor of Philosophy, Senior Lecturer at the
Department of Teacher Education and School Research
Leopold Franzens University Innsbruck, Innsbruck city, Austria
ORCID ID 0000-0003-4004-6989
sabrina.bacher@uibk.ac.at

Kateryna Binytska
Doctor of Pedagogical Sciences, Professor,
Professor of the Department of Pedagogy, Khmelnytskyi Humanitarian-Pedagogical Academy,
Khmelnytskyi city, Ukraine
Dr. Hab., Professor, Professor of the Department of Pedagogy, Faculty of Humanities and Social Sciences, University of Bielsko-Biala, Bielsko-Biala, Poland
ORCID ID 0000-0002-2111-5275
rfn.yz87@gmail.com

Christian Kraler
Habilitated Doctor, Professor
Professor of Department of Teacher Education and School Research
Leopold Franzens University Innsbruck, Innsbruck city, Austria
ORCID ID 0000-0001-7333-5002
christian.kraler@uibk.ac.at

Iurii Shcherbiak
Professor of the Department of Information and Socio Cultural Activity, Doctor of Pedagogy,
West Ukrainian National University Ternopil City, Ternopil, Ukraine
Katolícka univerzita v Ružomberku
Ružomberok, Slovakia
ORCID ID 0000-0002-5870-4188
cherbiak@ukr.net

DIDACTICS IN THE CONTEXT OF THE INTRODUCTION OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Abstract. The article examines the views of students majoring in pedagogy on the problem of changes in teaching didactics in the era of artificial intelligence (AI). Our research is based on the idea that understanding the views of today's pedagogy students is crucial, as they are the future educators who will be at the forefront of implementing AI-driven teaching strategies. In our study, we used a comparative method to compare ChatGPT responses with student opinions, giving us a unique opportunity to explore the convergence or divergence of views. Through this study, we aim to identify the prospects and threats of using AI opportunities from the perspective of pedagogical students to clarify the question 'How to improve the professional training of future teachers?' to 'arm them' with the skills and knowledge necessary to use AI effectively and ensure that the next generation of teachers is well prepared to navigate the expanding AI-enabled educational environment and be leaders in education. The study was conducted in May 2024, during which the experiment participants (ChatGPT generator software and 62 master's majoring in pedagogy at Khmelnytsky Humanitarian and Pedagogical Academy and Western Ukrainian National University) were asked two research questions. We used an open-ended, explanatory, free-writing approach to encourage emotional expression and creativity, following the micro-article structure in the students' responses. Qualitative content analysis of the data was conducted using MAXQDA software through triangulated coding with three coders, and main and subcategories were derived inductively. The obtained results demonstrate the opportunities and challenges of using artificial intelligence in teaching didactics, actualise the need to develop and implement adaptive approaches to teaching didactics, and also, in the course of the survey, we received recommendations to meet the growing educational needs of students of pedagogical specialities. The study contributes to the pedagogical discourse on academic innovation, guides the development of didactic approaches to meet the challenges of implementing artificial intelligence models, and highlights the transformative potential of AI in teacher education. Our research lays the foundation for a deeper study of the consequences

© Sabrina Bacher, Kateryna Binytska, Christian Kraler, Iurii Shcherbiak, 2025.

of integrating artificial intelligence into education and its potential implications for the development of teaching didactics.

Keywords: didactic; Artificial Intelligence; students majoring in pedagogy; perspectives; challenges; transformative potential.

1. INTRODUCTION

The current transformation into a digital society potentially transmutes Homo Sapiens into "Homo Digitalis" [1]. The “new renaissance” [2] of Artificial Intelligence (AI) has initiated a paradigm shift in various sectors, with education being no exception [3]. As AI technologies become increasingly integrated into educational environments, the didactics of teaching needs to evolve to meet new demands and opportunities [4]. This transformation not only impacts instructional methods and learning experiences but also requires a re-evaluation of teacher education programs to prepare future educators for this dynamic landscape [5].

The ongoing dynamic development necessitates that teachers continually engage in professional education, master new digital competencies and technologies, independently acquire knowledge and skills, and think flexibly and critically [6]. The societal demand for such adaptable and skilled teachers is a driving force behind the reform of Ukraine's education system. This reform process aligns with the country's integration into the single European higher education area and marks a transition to a new educational paradigm. It shifts away from the mechanical presentation of educational material and mere accumulation of knowledge towards managing students' independent educational activities, focusing on their inclinations and abilities with the help of digitalisation [7].

By examining the insights of Ukrainian teacher education students, this study contributes to the ongoing discourse on educational innovation and the essential adaptations required in didactics and methodology. It seeks to provide a comprehensive understanding of the perceived benefits, challenges, and necessary competencies related to integrating AI in teaching, ultimately guiding the development of more responsive and future-ready didactical approaches.

2. THEORETICAL BACKGROUND

The history of AI began in the mid-20th century, with the field being officially founded in 1956 during the Dartmouth Conference, where the term "artificial intelligence" was coined. Early AI research focused on problem-solving and symbolic methods, with pioneers like John McCarthy, Marvin Minsky, and Allen Newell, who made significant contributions [8]. During the 1960s and 1970s, AI research achieved notable milestones, such as developing the first expert systems and creating early neural networks [9]. A first success was a comparatively simple program called ELIZA, designed by Josef Eizenbaum in 1966. It was capable of engaging humans in a conversation in the style of the communication model of Carl Rogers. Programs like this are now called chatbots. However, limited computational power and insufficient data often hampered progress, leading to “AI winters” periods where funding and interest in AI research decreased [10]. The 1980s saw a resurgence with advances in machine learning and the success of commercial expert systems, which was even addressed and explored by UNESCO [11]. The breakthrough came at the edge of the 21st century with big data, improved algorithms, and powerful computing resources, leading to rapid advancements in AI capabilities [12]. Today, AI permeates various sectors, from healthcare to finance, and continues to evolve, driven by ongoing innovations in deep learning, natural language processing, and robotics [13]. AI also significantly influences education, which requires a fundamental rethinking, particularly in didactics [14]. Therefore, educators need to reconsider

their approaches to teaching and embrace new pedagogical strategies that leverage the capabilities of AI [15; 16].

AI offers numerous advantages for teaching, which can significantly enhance both instructional methods and student learning experiences. One of the benefits of AI for education is the ability to provide personalised learning. AI can analyse student data to tailor educational content and pace according to each learner's strengths and weaknesses [17]. Additionally, AI-powered tools can automate routine tasks such as grading and administrative work, which allows teachers to focus more on direct interaction and creative teaching strategies. Intelligent tutoring systems and virtual assistants can offer immediate feedback and support to students outside of classroom hours, promoting continuous and life-long learning [18]. Furthermore, AI can facilitate more engaging and interactive learning environments through adaptive learning platforms and immersive technologies like virtual reality (VR) and augmented reality (AR). These tools can make complex concepts more accessible and stimulate student interest [19]. Thus, integrating AI into teaching can lead to more efficient, personalised, and engaging educational experiences, ultimately improving student outcomes.

However, AI also has its downsides with relation to to education. According to the European Union Artificial Intelligence Act [20], the educational use of AI technologies is classified as high-risk. This classification is particularly relevant when automated decisions determine access to academic institutions, such as assessing whether an applicant meets admission requirements. The high-risk designation underscores the need for stringent oversight and ethical considerations to ensure that AI applications in education are fair and transparent and do not perpetuate biases or inequalities [21]. Additionally, several other notable drawbacks need to be addressed. One significant concern is data privacy and security. The collection and analysis of vast amounts of student data required for personalised learning raise risks related to the misuse or breach of sensitive information [22]. Furthermore, the reliance on AI can exacerbate the digital divide, where students in underfunded schools may lack access to advanced technologies, which can further widen educational injustice [23]. There is also the risk of over-dependence on AI, which can erode critical human elements in education, such as empathy, creativity, and nuanced understanding that human teachers provide [24]. Moreover, implementing AI in classrooms can be costly and complex, as it may require substantial investment in infrastructure and ongoing maintenance, which may not be feasible for all educational institutions [25]. Another downside is integrating AI in classroom settings, as it requires teachers to acquire trust, willingness, and new skills to adapt to new technologies, which can be challenging and time-consuming and potentially lead to resistance or inadequate use of AI tools [26].

The development of generative AI fundamentally impacts didactics and methodology significantly. Generative AI refers to AI systems that create new content, such as text, images, or even entire virtual environments, based on patterns learned from existing data. In education, generative AI opens new possibilities for creating personalised learning experiences, adapting instructional materials to individual student needs, and fostering creativity. Generative AI can help students receive prompt feedback on their work and reduce teachers' workload [27]. The chatbox and virtual assistant ChatGPT started the AI boom and is currently (in Spring 2024) the most prominent generative AI program [28]. ChatGPT is a sophisticated language model based on the GPT (Generative Pre-trained Transformer) architecture, which OpenAI developed. Launched in November 2022, ChatGPT represents a significant advancement in natural language processing, as it can generate human-like text based on the input it receives. By January 2023, it had become the fastest-growing consumer software application in history, gaining over 100 million users and contributing to the growth of OpenAI's current valuation of $86 billion [29]). Trained on a diverse dataset from the internet, ChatGPT can perform various tasks (e.g., answering questions, generating text, language translation, language correction,

creative writing, providing explanations, summarisation, research, conversational dialogue, personal assistance, etc.). Its applications span various domains, including customer service, content creation, and educational support. However, despite its impressive capabilities, ChatGPT also faces challenges, such as generating accurate and reliable information and ethical concerns (e.g., misinformation, bias and discrimination, lack of accountability, transparency and explainability, shortage of privacy and data security, impacts on human employment, especially in customer service and support roles, etc.) [30]. Last but not least, ChatGPT is a stochastic parrot.

3. RESEARCH METHODS

As an initial step, we presented our research questions to the generative software application ChatGPT: (1) "According to your opinion, how *will* the didactics of teaching change due to the rise of Artificial Intelligence?" and (2) "According to your opinion, how *should* the didactics of teaching change due to the rise of Artificial Intelligence?". This approach lays the groundwork for analysis, providing a foundational reference point. By soliciting ChatGPT's responses regarding the changes in didactics due to AI, we seek to glean valuable insights into how AI perceives its role and impact in education. This initial step enables us to establish a baseline understanding of ChatGPT's perspective on the topic, which can then be juxtaposed with the responses from human participants. A comparative analysis promises to shed light on the similarities and differences in viewpoints between AI and human participants and to offer a comprehensive understanding of the implications of AI on the didactics of teaching.

Subsequently, we asked the same questions to the study participants by employing an open, explanatory, free-writing approach to encourage emotional expression and creativity, following the structure of micro-articles. The sample comprised 62 Ukrainian students majoring in pedagogy at the Master's level, with 23 from the Khmelnytskyi Humanitarian-Pedagogical Academy in Khmelnytskyi and 39 from the West Ukrainian National University in Ternopil City. Data collection took place in May 2023 during the course. The data was analysed with the aid of the software MAXQDA. A qualitative content analysis was conducted through triangulated coding with three coders, and main and subcategories were derived inductively.

4. RESEARCH RESULTS

ChatGPT's insights with those of students provide a unique opportunity to explore the convergence or divergence of viewpoints, identify common themes, and discern areas of agreement or discrepancy. This lays the groundwork for deeper exploration into the implications of AI integration in education and its potential consequences for the didactics of teaching. Initially, we presented the same questions to the generative software application ChatGPT as those later posed to the participants. We first asked ChatGPT to answer question 1, "According to your opinion, how *will* the didactics of teaching change due to the rise of Artificial Intelligence?" as demonstrated in Figure 1:

Question 1: According to your opinion, how will the didactics of teaching change due to the rise of Artificial Intelligence? (Please write about half a page):

ChatGPT:

The rise of Artificial Intelligence (AI) is poised to significantly transform the didactics of teaching, introducing a more personalized, efficient, and data-driven approach to education. One of the most profound changes will be the customization of learning experiences. AI can analyze vast amounts of data to understand individual students' strengths, weaknesses, and learning styles, enabling educators to tailor instruction and

resources to meet each student's unique needs. This personalized learning approach can help ensure that all students progress at their own pace, potentially reducing disparities in educational outcomes.

Moreover, AI will enhance the efficiency of administrative tasks, allowing teachers to focus more on instruction and less on paperwork. Automated grading, for example, can save time and provide immediate feedback, while intelligent tutoring systems can offer additional support to students outside of classroom hours. These systems can provide practice problems, explanations, and even detect when a student is struggling, offering hints or alternative explanations to help them understand the material.

In addition, AI can facilitate more effective and engaging learning environments through the use of adaptive learning platforms, virtual reality (VR), and augmented reality (AR). These technologies can create immersive and interactive experiences that make complex concepts easier to grasp and more engaging for students. For instance, a history lesson can be transformed into an interactive VR experience, allowing students to explore ancient civilizations in a more tangible and impactful way.

AI also enables the use of advanced analytics to improve educational strategies. Educators can leverage data on student performance and engagement to refine curricula and teaching methods continuously. Predictive analytics can identify at-risk students early, allowing for timely interventions that can improve retention and success rates.

However, the integration of AI in education also raises important ethical and practical considerations. Issues of data privacy, the digital divide, and the need for teachers to adapt to new technologies must be addressed to ensure equitable access and effective use of AI tools. Professional development for teachers will be crucial, equipping them with the skills and knowledge to integrate AI effectively into their teaching practices.

In conclusion, AI has the potential to revolutionize the didactics of teaching by enabling more personalized, efficient, and engaging learning experiences. As these technologies continue to evolve, the educational landscape will need to adapt, balancing innovation with ethical considerations to maximize the benefits for all students.

Figure 1: ChatGPT's response to research question 1.

The main points ChatGPT referred to concerning question 1 include the following:

- Personalized Learning: AI can analyse individual student data to tailor instruction to each student's needs, which can help students progress at their own pace and reduce educational disparities.
- Administrative Efficiency: AI can streamline administrative tasks like grading, freeing teachers to focus more on instruction. Automated systems can also provide immediate feedback and additional support.
- Engaging Learning Environments: AI-powered adaptive platforms, VR, and AR can create immersive experiences, making complex concepts easier to understand and more engaging.
- Advanced Analytics: AI can use data to refine curricula and teaching methods, and predictive analytics can identify at-risk students for early intervention, which may improve retention and success rates.
- Ethical Considerations: Integrating AI in education raises data privacy issues, the digital divide, and teacher training needs. Addressing these is crucial for equitable and effective use of AI.

As a second step, we asked ChatGPT to answer the second question: "In your opinion, how should the didactics of teaching change due to the rise of Artificial Intelligence?" as illustrated in Figure 2.

Question 2: According to your opinion, how should the didactics of teaching change due to the rise of Artificial Intelligence? (Please write about half a page):

ChatGPT:

In response to the rise of Artificial Intelligence (AI), the didactics of teaching should evolve to harness the potential of AI while addressing the associated challenges. A fundamental shift towards more personalized and student-centered learning approaches is necessary. AI can enable this by analyzing data on individual learning patterns, strengths, and areas needing improvement. Consequently, educators should leverage AI to design customized learning paths, offering differentiated instruction that caters to each student's unique needs and pace of learning.

Furthermore, the role of the teacher should transition from being the primary source of knowledge to a facilitator of learning. Teachers can use AI tools to provide real-time feedback and support, freeing up their time to engage more deeply with students through mentoring, collaborative projects, and critical thinking exercises. This shift will require professional development programs to equip teachers with the skills to effectively integrate AI into their teaching practices and to interpret and act on data insights provided by AI systems.

Additionally, the curriculum should be updated to include digital literacy and AI literacy, preparing students for a future where these technologies are ubiquitous. This involves teaching students not only how to use AI tools but also understanding their underlying principles, ethical considerations, and potential societal impacts. Critical thinking and problem-solving skills will be more important than ever, as students need to navigate and evaluate the vast amounts of information provided by AI.

Collaborative and project-based learning should be emphasized to foster skills that AI cannot easily replicate, such as creativity, teamwork, and emotional intelligence. AI can support these approaches by facilitating group work, tracking progress, and providing resources tailored to group dynamics and project requirements.

Moreover, educational institutions should prioritize equitable access to AI technologies, ensuring that all students benefit regardless of their socio-economic background. Addressing the digital divide is crucial to prevent exacerbating existing inequalities in education.

In conclusion, the didactics of teaching should evolve to incorporate AI in ways that enhance personalized learning, redefine the teacher's role, update curricula to include AI literacy, and promote equitable access to technology. By doing so, education can become more adaptive, inclusive, and effective in preparing students for a future shaped by AI.

Figure 2: ChatGPT's response to research question 2.

The main points ChatGPT referred to concerning question 2 include the following:

- Personalized Learning: AI should analyse individual learning patterns, strengths, and areas for improvement, which may enable customised learning paths and differentiated instruction.
- Teacher's Roles: Teachers should transition from knowledge sources to facilitators by using AI tools to provide real-time feedback and support. Professional development is essential for teachers to integrate AI effectively and interpret data insights.
- Updated Curriculum: Curricula should include digital and AI literacy, teaching students how to use AI tools, understand their principles, and consider ethical and societal impacts. Critical thinking and problem-solving skills are crucial.
- Collaborative Learning: Teachers should emphasise collaborative and project-based learning to develop creativity, teamwork, and emotional intelligence. AI can facilitate group work and track progress.

- Equitable Access: Educative administrators should ensure all students have access to AI technologies, which addresses the digital divide to prevent exacerbating educational inequalities.

In a second step, we asked 62 Ukrainian students majoring in pedagogy to answer the same questions using a free-writing approach. We then analysed the content of the responses qualitatively [13] and inductively derived main and subcategories. This method ensured a comprehensive and nuanced understanding of the students' perspectives on how the didactics of teaching *will* and *should* change due to the rise of Artificial Intelligence.

From the inductive qualitative analysis of the texts, the following results emerged: A total of 706 codes were identified, which could be categorized into five main categories, which are (1) "positive effects" (87 codes), (2) "negative effects" (29 codes), (3) "neutral attitudes" (21 codes), (4) "changes in didactics" (59 codes), and (5) "recommendations" (73 codes). These main categories were derived from thematic subcategories in which the individual codes are found. The main categories and subcategories are illustrated in Figure 3 using a Code Cloud:

Figure 3: Presentation of the research results via a Code-Cloud.

The category "positive effects" and its subcategories are shown in green in this representation. “Negative effects” are shown in red, “neutral attitudes” in grey, “changes in didactics” in orange, and "recommendations" in purple. The larger the font size of a category or subcategory, the more codes it contains.

In the following sections, the content of the main categories will be summarised to provide a deeper insight into the results of the study:

4.1. Positive Effects

Most students majoring in pedagogy identified several positive effects of AI in the didactics of teaching, highlighting various beneficial aspects, as illustrated with the example below:

“AI has great potential in the personalisation of learning. An individual approach to each student can become more accessible thanks to AI tools that analyze information about each student and provide personalised recommendations for optimal learning. In addition, we will be able to use interactive technologies that engage students in learning. This can include game elements, chatbots for language practice, and virtual assistants that help learners in real-time.” (Text 13)

The participants noted that AI can facilitate global collaboration, as they enabling students and educators worldwide to connect and share resources seamlessly. Additionally, AI improves learning content by providing personalized and adaptive materials that cater to individual learning needs. Students majoring in pedagogy also emphasised enhancing collaborative and inquiry-based learning experiences, where AI tools support group work and stimulate critical thinking. Immediate feedback provided by AI systems helps students understand concepts more quickly and accurately, thereby improving the learning process. AI also aids in teaching by increasing efficiency, allowing teachers to focus more on interactive and creative tasks. The improvement in assessment techniques, enabled by AI's ability to analyze vast sets of data, helps in tracking student progress and identifying areas for improvement. These positive attitudes reflect the participants' belief that AI can significantly support and enhance the role of teachers.

4.2. Negative Effects

The majority of prospective teachers also emphasised the adverse effects of AI in didactics teaching by pointing out various limitations and concerns, as exemplified by the following quote:

"In my opinion, artificial intelligence can have a negative effect on the didactics of learning, because the daily use of artificial intelligence reduces the interaction with real people, which in a certain way can lead to the degradation and deficit of emotional intelligence. While AI can be an invaluable tool for learning, one of its biggest drawbacks is its lack of interaction with real people." (Text 25)

Students majoring in pedagogy emphasised that AI cannot replace real communication and human contact, essential for building relationships and understanding students' emotional needs. Additionally, AI cannot express emotions, which makes it less effective in providing the empathetic support that teachers offer. The participants also expressed scepticism about AI's ability to teach better than human educators by highlighting a general lack of confidence in AI's capabilities. They raised concerns about potential biases inherent in AI systems, which can perpetuate and even exacerbate existing inequalities. There is also a fear of over-reliance on technology, which might diminish essential human skills and interactions. The potential for AI to replace teachers and other educational staff was a significant worry, raising ethical and social considerations about the future of the teaching profession. These negative attitudes reflect the students' caution and concern regarding the extensive integration of AI in education.

4.3. Neutral attitudes

Some of the participants expressed neutral attitudes towards AI in the didactics of teaching, as portrayed in the following example.

"In my opinion, teaching will not change in any way, because teachers act according to their own programme. Artificial intelligence can help in forming opinions and finding ideas, but it is not an accurate source of correct information that can be used in teaching." (Text 39)

Students majoring in pedagogy acknowledged that AI integration will significantly alter traditional teacher-student dynamics and highlighted the need to develop essential 21st-century skills like critical thinking, creativity, collaboration, adaptability, and digital literacy. They recognized AI's potential to enhance learning through interactive activities, but also noted that implementing AI requires new skills and training for educators. While AI offers opportunities to make learning more effective and accessible, there are also challenges and ethical considerations to address. The participants suggested that AI could complement traditional teaching methods rather than replace them, helping teachers improve their skills and providing

tools for lifelong learning. However, they also noted that the impact of AI depends on how it is used and its users' moral and educational qualities.

4.4. Changes in didactics

Most participants highlighted several ways in which AI changes the didactics of teaching, emphasising transformative shifts in educational practices, as illustrated by the following quote:

"So, first of all, didactics will use existing now fundaments, though it will change at the outer level, which means teachers will rely on materials produced by AI. It also has a huge potential to change the way we learn making materials more personalized, attractive, and accessible for every student. On the other hand, teachers will be careful not to overuse Artificial Intelligence because it leads to a lack of critical thinking and creative skills. Critical thinking is becoming increasingly important, and in an age where misinformation spreads rapidly, the danger of developing lazy minds and non-critical thinkers is a danger to society in general." (Text 52)

Students majoring in pedagogy noted that AI facilitates the creation of immersive learning environments, where virtual and augmented reality technologies can simulate real-world scenarios and enhance experiential learning. AI also enables personalized and adaptive learning, tailoring educational content to meet individual students' unique needs and learning paces. This customisation helps address diverse learning styles and improve overall engagement and understanding. Moreover, the role of the teacher is evolving due to AI integration. Teachers are transitioning from traditional instructors to facilitators and guides who leverage AI tools to enhance student learning experiences. This shift allows teachers to focus more on mentoring, providing emotional support, and fostering critical thinking skills, while AI handles routine tasks such as grading and data analysis. These changes reflect a significant evolution in teaching methodologies, driven by the capabilities and potential of AI technology.

4.5. Recommendations

The prospective teachers offered several recommendations on how to effectively incorporate AI into the didactics of teaching, as exemplified by the following quote:

"First of all, teachers need to pay more attention to where students get their information from, whether they use AI capabilities well or only refer to artificial intelligence. Next, teachers also need to learn more about artificial intelligence, not to ignore or avoid it, but to learn more. After all, modern teachers need to be aware of all innovations, especially those that are actively used by students or pupils." (Text 32)

The participants suggested rethinking assessment practices to better align with the capabilities of AI and advocated for a reevaluation of traditional methods to include more dynamic and formative assessments. Transparency and accountability were emphasized as crucial, ensuring that AI systems operate ethically and without bias. The development of digital literacy skills was identified as essential for both students and educators to effectively navigate and utilize AI technologies. Students majoring in pedagogy recommended maintaining a balance between the use of AI and human collaboration and recognized the importance of interpersonal interactions in education. Additionally, they stressed the necessity of lifelong learning and professional development for educators to stay updated on the latest AI tools and methods. These recommendations reflect a proactive approach to integrating AI in education by aiming to enhance its benefits while mitigating potential drawbacks.

5. DISCUSSION.

A noticeable observation emerges after comparing the initial step of posing the same questions to both ChatGPT and the participants. In response to question 1, "How *will* the

didactics of teaching change due to the rise of Artificial Intelligence?" ChatGPT and the sample of students majoring in pedagogy offer several similar ideas. However, when considering question 2, "How *should* the didactics of teaching change due to the rise of Artificial Intelligence?", the responses between ChatGPT and the students differ significantly. While ChatGPT provides simple answers, the students majoring in pedagogy offer more reflective and thoughtful insights. The participants recommended strategies, including rethinking assessment practices to align with AI capabilities for more dynamic and formative assessments, emphasizing transparency and accountability to ensure ethical AI operation, and fostering digital literacy skills for effective AI utilization. Additionally, they highlighted the importance of maintaining a balance between AI use and human collaboration, lifelong learning, and professional development so that educators can stay abreast of AI advancements. These recommendations reflect a proactive approach to integrating AI in education, aiming to maximise benefits while addressing potential challenges.

The study delved into the perceptions of students majoring in pedagogy regarding the impact of AI on the didactics of teaching, revealing a spectrum of perspectives ranging from positive effects to negative concerns, alongside neutral attitudes and recommendations. It elucidated the nuanced landscape of AI's impact on education and emphasized the importance of careful consideration and proactive strategies to leverage its benefits while addressing potential challenges. Positive effects underscored AI's potential to foster global collaboration, enhance learning content through personalization, and improve teaching efficiency and assessment techniques. Conversely, negative concerns revolved around AI's limitations in replacing human aspects such as live communication and emotional expression, fears biases, over-reliance on technology, and the potential replacement of teachers. Neutral attitudes acknowledged AI's potential while emphasising the need for educator training and ethical considerations. Changes in didactics highlighted the emergence of immersive learning environments, personalized learning experiences, and an evolving role for teachers. Recommendations aimed at effectively integrating AI into teaching practices underscored the importance of rethinking assessment methods, promoting transparency, developing digital literacy skills, balancing AI and human collaboration, and prioritising ongoing professional development.

By comparing the number of codes that contained a value (positive – neutral – negative), it is evident that the majority of these codes (64%) reflected a positive attitude towards AI and the didactics of teaching. In contrast, 21% of the codes expressed negative sentiments. Additionally, 15% of the codes were neutral, engaging in a discourse that considered both positive and negative aspects, as demonstrated in Figure 4:

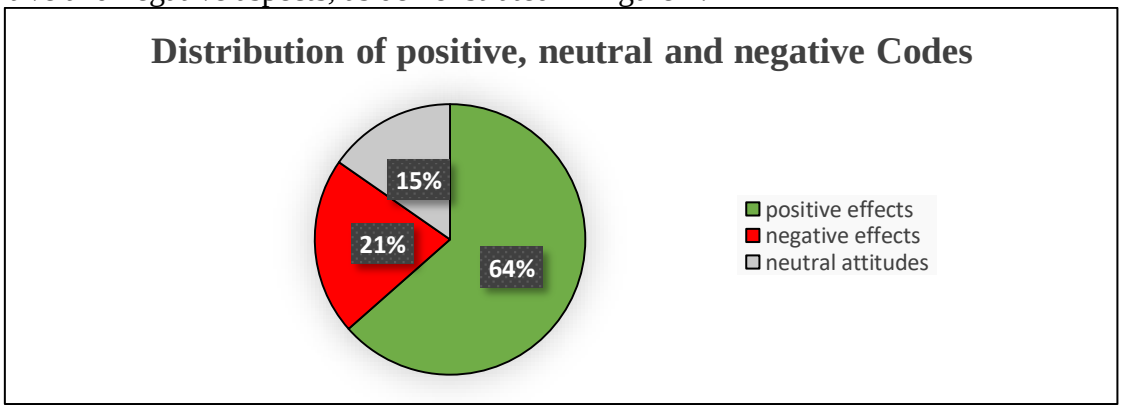

Figure 4: Distribution of value codes.

While a number of concerns were raised, the students' overall attitude towards AI is rather positive. This shows a general optimism about the potential benefits of AI in enhancing

educational practices despite acknowledging some drawbacks. Thus, the participants' positive attitudes towards the impact of AI on teaching seem to outweigh their fears.

A limitation of the study is that we could not ensure whether students used technical aids when answering the two questions, as the students used their own computers and some of the data collection took place virtually, albeit during class time. Approximately 25% of the texts indicated that they may have been supported by AI. This conclusion is drawn from the structure and content of the texts. Especially with free-writing approaches, elaborate text structures are rather uncommon, making AI-generated texts easily identifiable. These texts exhibited significant similarity to the texts generated by us using AI (see above).

6. CONCLUSION AND OUTLOOK.

This study provided a comprehensive examination of teacher education students' perceptions of AI's impact on the didactics of teaching. The study highlighted a spectrum of viewpoints, from the positive potential of AI in enhancing global collaboration, personalized learning, and teaching efficiency, to concerns about its limitations in replicating human interaction, potential biases, the risk of over-reliance on technology, and other ethical considerations. Overall, the participants' positive attitudes towards the impact of AI on teaching surpassed their fears. The prospective teachers agreed that while AI can significantly transform teaching methods through immersive and personalized learning experiences, it also necessitates a redefined role for teachers and proper teacher education. To effectively integrate AI in education, the participants recommended rethinking assessment methods, promoting transparency, developing digital literacy, balancing AI with human collaboration, and prioritizing ongoing professional development. Ultimately, they underscored the need for thoughtful and proactive approaches to leverage AI's benefits while mitigating its challenges, ensuring a balanced and effective educational environment. These findings are essential for the ongoing development of strategies to effectively integrate AI into schools, teaching, and teacher training.

Future research could delve deeper into several aspects of AI in education to build on the findings of this study. One avenue could be longitudinal studies that track the long-term effects of AI integration on student outcomes and teacher effectiveness. Additionally, comparative studies across different educational contexts and levels, such as primary, secondary, and higher education, could provide insights into how AI's impact varies by different settings. Further studies could also explore the development and efficacy of specific AI tools and platforms, as well as examine their strengths and weaknesses in real-world classrooms. Further investigating AI's ethical implications in education would be crucial, particularly in ensuring equity and fairness. Moreover, studies focusing on teacher training programs tailored to AI integration could offer valuable guidelines for preparing educators for a technology-enhanced teaching environment. To foster a holistic understanding of AI's role in shaping the future of education, it is necessary to conduct interdisciplinary research that combines insights from educational sciences, technology, psychology, and ethics.

REFERENCES (TRANSLATED AND TRANSLITERATED)

[1] Montag, Ch. (2018). "Homo Diditalis", in Smartphones, soziale Netzwerke und das Gehirn, *Springer Essentials*, 2018. (in English)

[2] Tan, K.-H., Lim, B. P. "The Artificial Intelligence Renaissance: Deep Learning and the Road to Human-Level Machine Intelligence", *APSIPA Transaction on Signal and Information Processing, 7*(1), pp. 1-19, 2018. doi: https://doi.org/10.1017/ATSIP.2018.6**.** (in English)

[3] M. Gentile, G. Città, S. Perna, and M. Allegra "Do we still need teachers? Navigating the paradigm shift of the teacher's role in the AI era", Frontiers in Education 8 (1), pp. 1-14, 2023. https://doi.org.10.3389/feduc.2023.1161777. (in English)

[4] L. Chen, P.Chen, Z. Lin "Artificial Intelligence in Education: A Review", *IEEE Access*, 8 (1), pp. 75264-75278. 2020. https://doi.org10.1109/ACCESS.2020.2988510.

[5] C. Fissore, F. Floris, M. M.Conte, M. Sacchet "Teacher Training on Artificial Intelligence in Education" in: Sampson, D.G., Ifenthaler, D., Isaías, P. (eds) Smart Learning Environments in the Post Pandemic Era. Cognition and Exploratory Learning in the Digital Age. Springer, Cham, 2024. https://doi.org/10.1007/978-3-031-54207-7_13. (in English)

[6] Ng D. T. K., Leung J. K. L., Su J., Ng R.C.W., Chu S.K.W. "Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world", *Educational Technology Research and Development, 71*(1), pp. 137-161, 2023. https://doi.org/10.1007/s11423-023-10203-6 (in English)

[7] I. V. Vakulenko "Computer-oriented system of managing independent work of students of pedagogical universities in the process of teaching computer science", Dissertation for the degree of Candidate of Pedagogical Sciences. National Pedagogical Dragomanov University, Kyiv, 2021. (in Ukrainian)

[8] R. Cordeschi "AI Turns Fifty: Revisiting its Origins", *Applied Artificial Intelligence, 21* (4–5), pp. 259–279, 2007. https://doi.org/10.1080/08839510701252304. (in English)

[9] M. Minsky, "*Theory of Neural-Analog Reinforcement Systems and Its Application to the Brain Model Problem*", Princeton, 1954. (in English)

[10] B. Dellot, F. Wallace-Stephens "*The Age of Automation. Artificial Intelligence, robotics and the future of low-skilled work*", RSA Action and Research Centre, 2017. [Online]. Available: https://www.thersa.org/globalassets/pdfs/reports/rsa_the-age-of-automation-report.pdf. (in English)

[11] UNESCO European Center for Higher Education "*The Advent of Artificial Intelligence in Higher Education*" UNESCO Publishing, 1989. [Online]. Available: https://unesdoc.unesco.org/ark:/48223/pf0000085939 (in English)

[12] S. Grubaugh, G. Levitt "Artificial Intelligence and the Paradigm Shift: Reshaping Education to Equip Students for Future Careers", *The International Journal of Social Sciences and Humanities Invention 10* (6), pp. 7931-7941, 2023. https://doi.org/10.18535/ijsshi/v10i06.02. (in English)

[13] G.E. Moore, "Cramming More Components Onto Integrated Circuits", Electronics 38, No. 8, 114, 1965. (in English)

[14] I. Roll, & R. "Wylie, Evolution and Revolution in Artificial Intelligence in Education", *International Journal of Artificial Intelligence in Education, 26* (1), pp. 582–599, 2016. https://doi.org/10.1007/s40593-016-0110-3. (in English)

[15] M. Mavrikis, M. Cukurova, D. Di Mitri, J.Schneider and H. Drachsle, "A short history, emerging challenges and co-operation structures for Artificial Intelligence in education", Bildung und Erziehung, 74 (3), pp. 249-263, 2021. https://doi.org/10.13109/buer.2021.74.3.249. (in English)

[16] K. Zhang, A. Ayse Begum, "AI technologies for education: Recent research & future directions", Computers and Education: Artificial Intelligence, vol. 2, 2021. https://doi.org/10.1016/j.caeai.2021.100025. (in English)

[17] O. Rütti-Joy, G.Winder, and H. Biedermann, "Teacher Educator Professionalism in the Age of AI: Navigating the new LanBiedermann", *dscape of Quality Education*, IntechOpen, 2024. https://doi.org/10.5772/intechopen.1005030. (in English)

[18] O. Tapalova, Zhiyenbayeva, N. "Artificial Intelligence in Education: AIEd for Personalised Learning Pathways", *Electronic Journal of e-Learning, 20* (5), pp. 639-653, 2022. (in English)

[19] K.G. Srinivasa, M. Kurni, K. Saritha, "Harnessing the Power of AI to Education", In *Learning, Teaching, and Assessment Methods for Contemporary Learners*, Springer Texts in Education, pp. 311-342, 2022. https://doi.org/10.1007/978-981-19-6734-4_13. (in English)

[20] A. M. Al-Ansi, M. Jaboob, A. Garad, A. Al-Ansi, "Analyzing augmented reality (AR) and virtual reality (VR) recent development in education",*Social Sciences & Humanities Open, 8* (1), pp. 1-10, 2023. (in English)

[21] European Parliament. EU AI Act: first regulation on artificial intelligence, 2023. [Online]. Available: https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence (in English)

[22] Draft Instructional and methodological recommendations on the introduction and use of artificial intelligence technologies in general secondary education institutions, 2023

[Online]. Available: https://mon.gov.ua/storage/app/sites/1/news/2024/05/21/Instruktyvno.metodychni.rekomendatsiyi.shchodo.SHI.v.ZZSO-22.05.2024.pdf. (in Ukrainian)
[23] D. M. Berry, "The Limits of Computation: Joseph Weizenbaum and the ELIZA Chatbot", *Weizenbaum Journal of the Digital Society*, 3 (3), pp. 1-24, 2023. (in English)
[24] F.Pedro, M. Subosa, A. Rivas, P. Valverde, "Artificial intelligence in education: Challenges and opportunities for sustainable development", UNESCO Publishing. 2019. [Online]. Available: https://unesdoc.unesco.org/ark:/48223/pf0000366994 (in English)
[25] K. Facer, N. Selwyn *"Digital technology and the futures of education – towards 'non-stupid' optimism"*, UNESCO Futures of Education, 2021. [Online]. Available: https://unesdoc.unesco.org/ark:/48223/pf0000377071 (in English)
[26] M. Salah, F. Abdelfattah, H. Alhalbusi, Al. Mukhaini, "Me and My AI Bot: Exploring the 'AIholic' Phenomenon and University Students' Dependency on Generative AI Chatbots - Is This the New Academic Addiction?. *Research Square*, pp. 1-35, 2024 (preprint). (in English)
[27] D.Schiff, "Out of the laboratory and into the classroom: the future of artificial intelligence in education. *AI & Society. 36* (1), pp. 331-348, 2021. https://doi.org/10.1007/s00146-020-01033-8. (in English)
[28] T. Nazaretsky, M. Ariely, M. Cukurova, G. Alexandron, "Teachers' trust in AI-powered educational technology and a professional development program to improve it", *British Journal of Educationan Technology (BJET), 53* (4), pp. 914-931, 2022. https://doi.org/10.1111/bjet.13232. (in English)
[29] M. Alier, F. J. García-Peñalvo, J. D. Camba, "Generative Artificial Intelligence in Education: From Deceptive to Disruptive", *International Journal of Interactive Multimedia and Artificial Intelligence, 8* (5), pp. 5-14, 2024. https://doi.org/10.9781/ijimai.2024.02.011. (in English)
[30] Weise, K., Metz, C., N.Grant, N. Isaac, "Inside the A.I. Arms Race That Changed Silicon Valley Forever", *New York Times*, 2023, Dec. 12. [Online]. Available: https://www.nytimes.com/2023/12/05/technology/ai-chatgpt-google-meta.html (in English)
[31] C. Metz, T. Mickle, "OpenAI Completes Deal That Values the Company at $80 Billion", *The New York Times*, 2024, Feb. 16. [Online]. Available: https://www.nytimes.com/2024/02/16/technology/openai-artificial-intelligence-deal-valuation.html. (in English)

Матеріал надійшов до редакції 02.07.2024р.

ДИДАКТИКА В УМОВАХ ВПРОВАДЖЕННЯ ШТУЧНОГО ІНТЕЛЕКТУ В ОСВІТІ

Сабріна Бахер
доктор філософії, старший викладач кафедри педагогічної освіти та шкільних досліджень
кафедри педагогічної освіти та шкільних досліджень
Університет Леопольда Франценса в Інсбруку,
м. Інсбрук, Австрія
ORCID ID 0000-0003-4004-6989
sabrina.bacher@uibk.ac.at

Катерина Біницька
доктор педагогічних наук, професор, професор кафедри педагогіки, Хмельницька гуманітарно-педагогічна академія
м. Хмельницький, Україна
доктор педагогічних наук, професор, професор кафедри педагогіки,
Соціально-гуманітарний факультет, Бельсько-Бяльський університет
м. Бельсько-Бяла, Республіка Польща
ORCID ID 0000-0002-2111-5275
rfn.yz87@gmail.com

Крістіан Кралер
Габілітований доктор, професор
професор кафедри педагогічної освіти та шкільних досліджень
Університет Леопольда Франценса в Інсбруку
м. Інсбрук, Австрія
ORCID ID 0000-0001-7333-5002
christian.kraler@uibk.ac.at

Юрій Щербяк
професор кафедри інформаційної та соціокультурної діяльності, доктор педагогічних наук,
Західноукраїнський національний університет, м. Тернопіль, Україна
Католицький університет в Ружомберку
м. Ружомберок, Словаччина
ORCID ID 0000-0002-5870-418
cherbiak@ukr.net

Анотація. У статті проведено дослідження поглядів студентів педагогічних спеціальностей на проблему змін в дидактиці викладання в епоху штучного інтелекту (ШІ). В основу для проведення дослідження нами обрано ідею, що розуміння поглядів сучасних студентів педагогічних спеціальностей має вирішальне значення, оскільки це майбутні педагоги, які будуть в авангарді впровадження стратегій викладання керованих ШІ. У нашому дослідженні ми використали метод порівняння, коли ми порівнювали відповіді ChatGPT з думками студентів, що дало нам унікальну можливість дослідити збіги або розбіжності точок зору. Завдяки цьому дослідженню ми прагнемо визначити перспективи та загрози використання можливостей ШІ з точки зору студентів педагогічних спеціальностей з метою з'ясування питання «як покращити професійну підготовку майбутніх педагогів?», щоб «озброїти їх» навичками та знаннями, необхідними для ефективного використання ШІ та забезпечити якісну підготовку наступного покоління вчителів, здатних орієнтуватися в освітньому середовищі, яке розширюється за рахунок ШІ, та бути лідерами в освіті. Дослідження, під час якого учасникам експерименту (програмі-генератору ChatGPT та 62 слухачам магістратури педагогічних спеціальностей Хмельницької гуманітарно-педагогічної академії та Західноукраїнського національного університету) було поставлено два дослідницькі питання, було проведено в травні 2024. Ми застосували відкритий, пояснювальний підхід вільного письма, щоб заохотити емоційне вираження та творчість у відповідях студентів з дотриманням структури мікростатей. Якісний контент-аналіз даних проводився за допомогою програмного забезпечення MAXQDA шляхом тріангуляційного кодування з трьома кодувальниками, а основні та підкатегорії виводилися індуктивно. Отримані результати демонструють можливості і виклики використання штучного інтелекту в дидактиці викладання, актуалізують потребу в розробці та впровадженні адаптивних підходів до дидактики викладання. Також розроблено рекомендації щодо задоволення зростаючих освітніх потреб студентів педагогічних спеціальностей у результаті опитування. Проведене дослідження робить внесок у педагогічний дискурс про освітні інновації та спрямовує розвиток дидактичних підходів з урахуванням викликів впровадження моделей штучного інтелекту, а також доводить трансформаційний потенціал ШІ в педагогічній освіті. Проведене нами дослідження закладає основу для глибшого вивчення наслідків інтеграції штучного інтелекту в освіту та її потенційних наслідків для розвитку дидактики викладання.

Ключові слова: дидактика; штучний інтелект; студенти педагогічних спеціальностей; перспективи; виклики; трансформаційний потенціал.

This work is licensed under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.