

Generative Artificial Intelligence in the teaching activities of academic teachers and students

Miłosz Wawrzyniec Romaniuk, and Joanna Łukasiewicz-Wieleba

Abstract—The study aimed to learn about the experiences and opinions of students and academic teachers regarding the use of artificial intelligence in higher education. The question was answered to what extent and in what way do students and academic teachers of APS use AI in their studies and work? A diagnostic survey method was used, and original survey questionnaires were used. The study involved 58 academic teachers and 139 students. A significant number of academic teachers do not use artificial intelligence, and some of them express open disapproval of its use in education. These concerns include the negative impact of AI on the teaching process and the risks associated with verifying knowledge. A small number of lecturers use AI mainly to search for or create teaching materials. They use AI to prepare lesson plans, generate images, or make classes more attractive. In turn, some of them fear that AI may encourage students to abuse technology in the educational process. Most students declare that they do not use AI, and some are afraid of its inaccuracy and the possibility of making mistakes. Of the students who use AI, they mainly use it to search for information, simplify and correct their work, and create new materials. There is a clear discrepancy between the needs and goals of lecturers and students in the context of AI use. Lecturers perceive AI as a tool to support teaching, but with concerns about its ethical and practical application, while students treat AI as a tool to facilitate everyday learning tasks. The results suggest the need to implement training on the ethical use of AI and its full potential for both lecturers and students to prepare them for the upcoming technological changes in education.

Keywords—artificial intelligence; AI in teaching and learning; higher education; academic teachers; students

I. INTRODUCTION

ARTIFICIAL intelligence is "the ability of a digital computer or a robot-controlled computer to perform tasks commonly considered characteristic of human beings" [1, p. 33]. AI (artificial intelligence) is supposed to learn from experience, reason or generalize. Its feature is evolution, aimed at solving increasingly complex problems. This leads to a "revolution" that may include the automation of a significant number of human tasks [2].

Currently, the simplest division of AI is the distinction between narrow - this is AI designed to perform narrow, specialized tasks (e.g. information search) and general AI, which can learn and perform tasks analogous to those performed by humans [3]. The algorithms and learning methods used in generative AI are used, because of the popularization of free applications, to generate text, graphics, sound, and films as well as to collect and process information, and translation, by people representing most current professions. Its products stimulate

creativity, innovation, and critical thinking, increasing productivity and reducing working hours [4]. The growing range of services using AI, including bots performing marketing tasks or driverless autonomous cars, poses ethical dilemmas to society regarding responsibility for decisions and actions taken by AI [1]. Unlike AI which operates based on analyzing historical data and drawing conclusions based on it, generative AI is based on models such as GPT (Generative Pre-trained Transformer), which can create new, original content, similar to human creativity. GPT-4, one of the latest versions of this technology, can generate not only text responses but also engage in complex educational conversations, helping students understand complex issues. Thanks to the ability to train on huge data sets, AI is becoming a tool used in education to create personalized teaching materials, adaptive quizzes, or even automatic assessments of papers. In the context of higher education, these possibilities open the way to a more individualized approach to teaching, which promotes student activation and more effective knowledge acquisition. Generative AI is also used in the creation of synthetic educational data, which allows teachers to test and analyze different teaching methods before they are introduced into the curriculum [5, 6, 7].

It is currently emphasized that AI affects every area of human life and activity, including education, including higher education [8], and the competencies related to its use are crucial for the next generation [9].

Artificial intelligence supports various dimensions of education – from administration, through the teaching-learning process, to assessment and reporting of effects [10]. It provides many new possibilities in the sphere of education, but at the same time leaves humans with the choice between the knowledge provided by AI and the intuition or emotions that usually guide people's actions [1]. In generative AI projects, there were such tasks in the sphere of education as collecting data on students' progress, monitoring progress, predicting it, managing the learning process, including participating in tutoring for students [11]. What was a plan and project is now an educational reality, including diagnosis, expert system, and correction of the learning process individually for each user [12]. The main areas of AI application in education are individualization of the education process, including tracking progress, difficulties, and errors, providing feedback and adjusting the level of difficulty; writing support, checking the correctness of papers, detecting plagiarism; support for teachers in preparing and assessing lessons and evaluating educational

M.W. Romaniuk and J. Łukasiewicz-Wieleba are with The Maria Grzegorzewska University (e-mail: mromaniuk@aps.edu.pl, jlukasiewicz@aps.edu.pl).



processes, increasing the use of automation of selected educational processes to prepare students for life in a world dominated by algorithmic activities, training for teachers to increase their competences, including teachers of humanities, to pay attention to the consequences of AI "creativity" [1, 9].

The implementation of generative artificial intelligence in education is to be associated with increased productivity of education entities, increasing innovativeness, and integration with tasks related to management, finances or security [2]. Hence, it is predicted that thanks to generative artificial intelligence, the teacher's work will be more efficient, as it will take over the implementation of those activities that can be automated (including assessment, checking independence, and sending feedback). The time saved can be spent on strengthening work with students who require individualization (including inspiration or coaching) [13]. AI can also provide significant support for the education of people with disabilities, excluded due to their deficits [10].

The introduction of AI into education raises numerous ethical dilemmas that must be considered in the design and implementation of these technologies [14]. One of the most important aspects is the transparency of the algorithms used in teaching processes. AI-based software that assesses student progress must be understandable both to users and to those responsible for its implementation. The lack of such transparency leads to accountability issues, especially when systems make decisions based on student progress data, which can lead to unfair outcomes. The privacy of student data is another issue that requires special attention. As AI collects data on students' progress, preferences and behaviors, the question arises as to how this data is stored and who has access to it. A fundamental challenge is to protect this information from unauthorized access, as well as to ensure that this data is used only for educational purposes [15]. UNESCO proposes ethical guidelines that emphasize the sustainable and fair use of AI in education, emphasizing the importance of responsibility and fairness in the development of this technology [16].

The forecasts consider staff shortages, in the context of AI, which can not only support but even replace teachers at the level of automatic learning, including adjusting the level of difficulty, providing answers and information, or providing feedback [10].

Putting Chat GPT into general use has opened new challenges for universities and the entire educational sphere. The algorithm used by generative AI provides immediate answers to the questions asked. In this context, "independent learning and the previous methods of its verification are a thing of the past. The end of essays, written works and all exams near a computer connected to the network. The end of classic examination methods that reflect the essence of academic learning: reasoning, argumentation and deduction. Instead, examination methods that remain under strict supervision will become necessary: tests in a room without access to the network and oral exams." [17, pp. 15-16]. In particular, teachers do not have the tools to detect plagiarism or borrowing of text generated by GPT chat, because it is often coherent and perhaps written even better than a human would do. They are also not ready to track all bibliographic entries cited by AI, although some of them may not exist [18]. It is necessary to reformulate the approach to

checking knowledge and examining [19, 20, 21, 22].

In the context of rapidly developing AI technology in education, a key question concerns the role of teachers in modern education. The impact of AI on teaching is still controversial, mainly due to concerns that teachers may be replaced by algorithms in some tasks. However, AI has the greatest potential as a tool supporting teachers, not replacing them. Research indicates that AI can help automate routine tasks such as grading papers, monitoring student progress, or providing personalized feedback, which allows teachers to focus more on individual work with students [23, 24]. Teachers play an irreplaceable role in shaping soft skills, such as critical thinking, empathy, and interpersonal skills, which are not easy to replicate by algorithms. The mutual complementation of AI and teachers can bring significant benefits to the teaching process, but the key challenge will be to properly prepare the teaching staff for the effective use of new technologies [25, 26].

Personalization of the teaching process using AI is one of the most promising changes in higher education. AI enables the adaptation of didactic content to the individual needs of each student, based on the analysis of their results, learning style and progress in real-time. Learning algorithms analyze data collected during students' work and create personalized recommendations, which allows for the identification of areas requiring additional work, as well as for the provision of personalized feedback. An example of the application of such solutions is the use of AI in creating adaptive tests that adjust the level of difficulty of questions to the student's knowledge, which allows for a more precise diagnosis of skills [27]. Hence, individual learning paths are created, using online methods, which can lead to greater independence in selecting the student's learning content [28]. Moreover, such systems can support students with special educational needs by offering tools tailored to their requirements, which promotes integration and equalization of educational opportunities. Personalization using AI therefore has the potential to make the teaching process more effective, flexible and adapted to the diverse needs of students, which becomes particularly important in the context of remote and hybrid education [29]. The dynamic development of AI and its popularization in an increasing number of areas leads to the need to include it in curricula at subsequent levels of education, in both practical and ethical contexts, to increase social awareness of the possible consequences of its applications [30]. At the same time, the lack of AI incorporation into education, deliberate exclusion from the tools related to it, may reduce students' competitiveness on the market, therefore, to counteract this, appropriate educational activities should be undertaken as part of the study program [31].

II. METHOD

The current sphere of interest of researchers includes learning about AI, thanks to AI and with AI [32]. Undertaking research relating to the scope of AI use by the academic community is in line with current research trends. This thread appeared during research on the use of information technology in higher education [33, 34], but due to its extensiveness, it was separated and described separately.

The aim of the research was to learn about the experiences

and opinions of students and academic teachers employed at The Maria Grzegorzewska University in Warsaw, in the scope of the use of artificial intelligence in higher education teaching.

The question was sought “to what extent and in what way do students and academic teachers of the APS use AI in their studies and work?”

The diagnostic survey method was used, using an original tool - survey questionnaires, addressed to academic teachers and students. Open questions were coded. The research was conducted from December 2023 to February 2024.

The survey aimed at academic teachers involved 58 people, which is approximately 19% of the employed. The youngest person surveyed was 30 years old, and the oldest was 83 ($M = 46.5$; $Me = 45$; $Mo = 46$). Most respondents were women (50 people; 86%), and a minority were men (18 people; 14%). Most respondents had a doctoral degree (43 people; 74%), 7 people had a master's degree (12%), 7 people had a postdoctoral degree (12%), and 1 person had the title of professor (2%). The survey aimed at students involved 139 people, which is 3.3% of students. The youngest person surveyed was 18, and the oldest was 55 ($M = 24$; $Me = 22$; $Mo = 21$). Most respondents were women (115 people; 83%), with a minority of men (16 people; 12%) and people who did not want to answer the question about gender (8 people; 6%). Most respondents were first-year students (54 people; 39%). Second-year students accounted for 31% (43 people), third-year students 16% (23 people each), fourth-year students 8% (11 people) and fifth-year students 6% (8 people). More than four-fifths of respondents (114 people; 82%) were full-time students, and one-fifth (25 people; 18%) were part-time students. The survey was completed by one person from the Doctoral School.

III. RESULTS

Among academic teachers, 36 people declare that they do not use artificial intelligence. Among the respondents, there are people who very clearly emphasized their disapproval of this tool with the words: "It is enough that students use it, I have no intention of doing so"; "Suggesting that artificial intelligence should be allowed both in the teaching process and in the method of verifying knowledge is a very big misunderstanding". 2 people did not answer this question, two stated that they did not know how to answer this question, one stated that they did not know how to use it, and one that they were just thinking about it. 2 people declared that they had just started working with artificial intelligence. Lecturers emphasize that AI has enormous potential, although risky at various levels. This is illustrated by the statements: "I am only just starting to familiarize myself with it, but I see great potential in supporting teaching, especially at the conceptual level"; "I am still thinking about it. But I am not going to pretend that it is not an attractive tool. I am a bit afraid to introduce AI into classes because then students will DEFINITELY use it in connection with my colleagues' classes. I have some concerns because of others..."

Among the surveyed students, 79 people declared that they do not use AI, 4 people want to learn, 3 people did not answer, 2 stated that they were afraid of AI, and one - that they were not interested in it. The following statements appeared as justification for not using AI: "I do not use it, it is not a very reliable source - it sometimes makes mistakes"; "I do not use it,

these various chats scare me"; "I do not use it, but I know that the GPT chat is a popular method for preparing papers for classes among many students"; "I do not use it, I am against it".

Among the answers referring to the use of AI in the teaching/learning process, there is a clear discrepancy in the need to use tools among lecturers and students, which is related to the different educational goals set by these two groups.

Lecturers who use artificial intelligence (AI) mostly use it to create or search for teaching materials (11), including: finding arguments for group discussions, developing case studies, proposing additional materials, preparing a lesson outline, structuring the material, looking for ways to make the classes more attractive, generating images.

As part of their work in class (5), they point out the ethical dimensions of using AI, generate answers to ad hoc questions, ask students to search for information during classes, show the possibilities that AI offers, and discuss the credibility of sources.

In checking knowledge, AI helps in preparing a test (2) and checking the linguistic correctness of lesson plans. This is how one of the respondents says: "When I'm very tired and I have a lot of work ahead of me, I ask ChatGPT to check my lesson plans in terms of style and linguistic correctness".

Apart from teaching, AI is helpful in translation (proofreading) (2).

TABLE I
USAGE OF ARTIFICIAL INTELLIGENCE
BY LECTURERS

Usage	Number of indications
Searching or creating materials for classes	11
Working in class	5
Checking knowledge	3
Translations	2

Teachers who use AI in their work emphasize the importance of keeping up with changes in technology "I think it is worth paying attention to the development of AI and related tools, because the (r)evolution of AI will soon change the face of all education quite radically and we should not be left behind, i.e. not be able to use it and use it for our didactic purposes!" and preparing students for the skills of working with AI "I believe that students should undergo mandatory training in the ethical use of GPT and AI chats". Students use AI in the learning process, primarily for research and new inspirations.

TABLE II
USAGE OF ARTIFICIAL INTELLIGENCE
BY STUDENTS

Usage	Number of indications
Searching for information, inspiration, materials	45
Simplifying/correcting work	17
Creating new materials	12
Other	7

Among the 50 students who use AI, 43 use it to search for: information (15), inspiration (6), questions and answers (5), problem-solving (3), as well as to check knowledge (3), explain concepts (3), find articles (2), ideas (2), examples (2) and

lectures, databases, other points of view, bibliographies.

19 people use AI to simplify their work or correct it. They summarize long texts (4), paraphrase (3), find errors (2), develop issues (2), use synonyms (2), translate texts, solve simple language tasks, develop exam topics, and substantively improve texts.

12 people create new materials using AI: work plans (3), lists of the most important information (2), presentations (2), written works (2), graphics (2) and book reviews.

Among other answers (7), there were: for learning (2) and discussion, support, colloquium, and notes.

Students, commenting on the use of AI, noticed its shortcomings: "I constantly ask questions to the GPT Chat, but it has many shortcomings, so I try to check every piece of information acquired there, I ask for verification of the credibility of the data, expansion of given issues. In short, it allows me to get an outline or directs me to where I could look for further information/on what topic. It is never a reliable source. When asked many times to confirm the authenticity of sources, he corrected himself that such "do not exist". This is a flaw of the tool, which requires critical thinking and the risk of errors "If a person uses such possibilities in an incompetent way, it can lead to low quality of works/content, etc.". But they also notice that AI makes their work easier "Sometimes I ask artificial intelligence to help me shorten my several-page notes into a note that will list things from point to point. I only do it to save time."

IV. DISCUSSION

The analyzed results show that the respondents identify artificial intelligence narrowly as Chat GPT, ignoring its other categories. At the same time, both in the group of lecturers and students, there is a large group of people who do not use and declare that they will not use AI, considering this tool dangerous and undesirable in education. The statements of this part of the respondents are laced with emotions that can be explained as an expression of broader concerns, which refer, among others, to the fact that AI will learn faster than humans and will soon exceed the capabilities of humans, posing an existential threat to them. More immediate threats also remain, such as potential job loss (including the replacement of teachers by AI [35], exposing people to manipulation, using their image or user-created works, falsifying information (hallucinations) and leading to erroneous conclusions, exposure to deepfakes in private, professional and political life, etc. [36] and in terms of data security, privacy, erroneous results considered correct, including those that reinforce stereotypes and prejudices, plagiarism [35], and the lack of effective tools to deal with it [37]. These are phenomena that may discourage people from attempting to incorporate AI into their teaching/learning activities. These concerns are consistent with the broader discussion in the literature on the risks associated with the misuse of AI in education [26, 27]. These concerns may also result from a lack of understanding of the technology and its potential benefits. As emphasized by Holstein, McLaren and Alevén (2022), a key challenge for implementing AI in education is preparing teachers to use these tools and eliminating the fear of technology. The results of the study

suggest that for some lecturers AI may be perceived as too risky, which may lead to a delay in its adoption. In this context, educational institutions need to invest in training in the ethical and effective use of AI, in accordance with UNESCO recommendations (2021). There is also a need for methodological guidelines for teachers, which will allow them to incorporate AI appropriately into their classes [38]. The use of AI in research work should be included in the education process of doctoral students, as until recently they did not declare it as a key competence in the field of ITC [39].

However, forecasts of further technological development emphasize that among the skills that will soon be desired in employees are both the ability to think creatively and analytically, as well as competences related to the use of technology, in particular, flexibility in adapting to automation and artificial intelligence [40]. Therefore, the very scope of teachers' and students' declarations regarding the ways and purposes of using AI is not surprising. AI is a tool for searching for information and inspiration, creating materials, including graphic materials, simplifying and correcting texts, enriching work in classes, and checking students' progress. What is surprising is the fact that lecturers do not take actions using AI more broadly, particularly in individualizing the process of their own and students' education [11]. Studies show that students of social sciences and humanities have a less positive attitude towards AI, compared to students of science [41]. At the same time, however, some students are interested in using AI capabilities, especially in the context of facilitating or accelerating work. The responses of The Maria Grzegorzewska University students regarding the tasks they notice and perform with the GPT chat are consistent with the declarations of students from other universities, in particular, there is a declaration of searching for information, shortening or paraphrasing, and creating work plans [42].

Currently, reports indicate that AI should not completely replace teachers, as they are responsible for the scope of its use, including ethical issues, safety or actual benefits associated with AI in education [9]. The introduction of legal solutions by the European Parliament in March 2024 allows for the development of AI but also limits its use in areas that are potentially dangerous to people (e.g. in the field of subliminal influences, assessment of citizens - social scoring) [43].

Education is a space in which dangers are particularly noticeable in the field of ethics of using AI and limitations of interpersonal relations, its availability mainly to educated people and from wealthier countries [9] or succumbing to a passing fashion, which may only seemingly increase the effectiveness of education. Especially with the awareness that technologies change very quickly, research on their importance for education is often financed by companies that produce specific technological solutions, and although technology provides support for education, it also excludes many people [9].

An important direction of further research should be to deepen the analysis of attitudes and concerns related to AI in education, especially in the context of ethics and sustainable development of technology. There is a need to study how AI affects

interpersonal relationships in education and what the long-term effects of its implementation may be, not only for the teaching process but also for the development of students' social and emotional competences. Therefore, it is important that future research also considers the psychological and sociological aspects related to the introduction of AI to education, especially in the context of changes in the structure of the labor market and the evolution of professional competences. Another direction of research may be an in-depth analysis of methods of implementing AI inclusively, considering the needs of various social groups, in particular people who are digitally excluded or come from less privileged backgrounds. UNESCO research (2023) emphasizes that AI in education may contribute to deepening inequalities if appropriate support mechanisms are not implemented. An important area of research may also be the analysis of the impact of legal regulations, such as those introduced by the European Parliament, on the development and implementation of AI in educational systems.

In summary, further research should focus on opportunities and threats for universities [23], including education and the development of competences related to the use of AI, analysis of ethical aspects of its use, and development of strategies that will enable sustainable and responsible implementation of AI in education. The threats related to the abuse of AI by students, such as generating term papers or diploma theses, are real. Clear positions of universities and legal regulations in this area are needed, as well as appropriate tools to detect similar violations of academic integrity. On the other hand, AI support should not be abandoned, but its use in supporting the educational process should be developed. This requires competences, both among lecturers and students, the development of which should be the subject of the university's interest, and which should be introduced into the scope of education related to information technologies at the earliest stages of education. AI changes the teaching and learning process, so research is needed to reveal the impact of AI use on such features as independence, critical thinking or the ability to solve problems by people using it. The impact of the dynamically developing AI industry on education in a broad sense should be closely monitored.

V. LIMITATIONS

It should be noted that the dynamics associated with the use of AI are very high, therefore the presented results have informational value, but if the research is repeated – it is possible to obtain completely different answers, due to the increasing popularity of generative AI.

REFERENCES

[1] J. Fazlagić, "Projektowanie edukacji wobec wyzwań sztucznej inteligencji," *Kwartalnik edukacyjny* 1-2(108-109), pp. 33-39, 2022.

[2] M. Keskin and İ. Saralar-Aras, "Empowering Middle School Minds: Harnessing Artificial Intelligence for Innovative Mathematics Education," in *Current Academic Studies in Technology and Education 2023*, Istanbul, ISRES Publishing, 2023.

[3] S. Russell and N. Peter, *Artificial Intelligence: A Modern Approach*, Hoboken, NJ, USA: Pearson Education, Inc., 2016.

[4] O. Fink and J. Weissenberg, "Top 10 Emerging Technologies of 2023," *World Economic Forum*, 2023.

[5] T. B. Brown, B. Mann, N. Ryder, M. Subbiah and J. Kaplan, "Language

Models are Few-Shot Learners," arXiv preprint, p. 2005.14165, 2020.

[6] R. Bommasani, D. A. Hudson, E. Adeli, R. Altman and S. Arora, "On the Opportunities and Risks of Foundation Models," arXiv preprint, p. 2108.07258, 2021.

[7] H. Touvron, T. Lavril, G. Izacard, X. Martinet and M.-A. Lachaux, "LLaMA: Open and Efficient Foundation Language Models," arXiv preprint, p. 2302.13971, 2023.

[8] K. Pelletier, M. McCormack, J. Reeves, J. Robert, N. Arbino, w. Al-Freih, C. Dickson-Deane, C. Guevara, L. Koster, M. Sanchez-Mendiola, L. Skallerup Besette and J. Stine, "2022 EDUCAUSE Horizon Report Teaching and Learning Edition," EDUC22, Boulder, CO, 2022.

[9] UNESCO, "Global Education Monitoring Report Summary 2023: Technology in education: A tool on whose terms?," UNESCO, Paris, 2023.

[10] M. Burns, "Technology in Education: Background Paper for 2023 Global Education Monitoring Report," UNESCO, 2021.

[11] B. Williamson, *Big Data in Education. The Digital Future of Learning, Policy and Practice*, Los Angeles–London–New Delhi: Sage, 2017.

[12] D. Siemieniecka, "Technologie w edukacji 4.0," *Przegląd Badań Edukacyjnych* 34, p. 227–250. <http://dx.doi.org/10.12775/PBE.2021.027>, 2021.

[13] J. Bryant, C. Heitz, S. Saurabh and D. Wagle, *How artificial intelligence will impact K12 teachers*, New York: McKinsey & Company, 2020.

[14] L. Floridi, J. Cowlis, M. Beltrametti, R. Chatila and P. Chazerand, "AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations," *Minds and Machines*, vol. 28, pp. 689-707, 2018.

[15] A. Jobin, M. Ienca and E. Vayena, "The global landscape of AI ethics guidelines," *Nature Machine Intelligence*, vol. 1, pp. 389-399, 2019.

[16] UNESCO, *AI and education: guidance for policy-makers*, Paris: United Nations Educational, Scientific and Cultural Organization, 2021.

[17] L. Stranegard, "Generatywna sztuczna inteligencja – zagrożenie czy szansa dla uczelni?," *Krytyka Prawa*, vol. 15, no. 2, pp. 15-18, 2023.

[18] A. Jungheer, "Using ChatGPT and Other Large Language Model (LLM) Applications for Academic Paper Assignments," *SocArXiv Papers*, p. <https://doi.org/10.31235/osf.io/d84q6>, 2023.

[19] M. W. Romaniuk and J. Łukasiewicz-Wieleba, "Zdalna edukacja kryzysowa w APS w okresie pandemii COVID-19. Proces egzaminowania w trybie zdalnym i stacjonarnym - porównanie," *Warszawa*, 2021. <https://doi.org/10.13140/RG.2.2.18440.55045>

[20] M. W. Romaniuk and J. Łukasiewicz-Wieleba, "Remote and Stationary Examinations in the Opinion of Students," *International Journal of Electronics and Telecommunications*, vol. 68, no. 1, pp. 69-75, 2022. <https://doi.org/10.24425/ijet.2022.139850>

[21] M. W. Romaniuk and J. Łukasiewicz-Wieleba, "Academic Lecturers Towards the Students' Examining. Similarities and Differences of Stationary and Remote Exams in the Pandemic Era," *International Journal of Electronics and Telecommunications*, vol. 68, no. 1, pp. 63-68, 2022. <https://doi.org/10.24425/ijet.2022.139849>

[22] M. W. Romaniuk and J. Łukasiewicz-Wieleba, "Challenges of administering university examinations remotely during the COVID-19 pandemic," *E-Mentor*, vol. 90, no. 3, pp. 22-31, 2021. <https://doi.org/10.15219/em90.1519>

[23] K. Holstein, B. M. McLaren and V. Alevan, "Designing for Complementarity: Teacher and Student Needs for Orchestration Support in AI-Enhanced Classrooms," in *Artificial Intelligence in Education: 20th International Conference, AIED 2019, Chicago, IL, 2019*.

[24] K. Holstein and V. Alevan, "Designing for human–AI complementarity in K-12 education," *AI Magazine*, vol. 43, no. 2, pp. 239-248, 2022.

[25] R. Luckin, W. Holmes, M. Griffiths and L. B. Forcier, *Intelligence Unleashed. An argument for AI in Education.*, London: Pearson, 2016.

[26] C. Fadel, W. Holmes and M. Bialik, *Artificial Intelligence In Education: Promises and Implications for Teaching and Learning*, Center for Curriculum Redesign, 2019.

[27] O. Zawacki-Richter, V. I. Marín, M. Bond and F. Gouverneur, "Systematic review of research on artificial intelligence applications in higher education – where are the educators?," *International Journal of Educational Technology in Higher Education*, vol. 16, p. 39, 2019.

[28] M. Firat, "How Chat GPT Can Transform Autodidactic Experiences and Open Education?," *OSF Preprints*, p. <https://doi.org/10.31219/osf.io/9ge8m> 2023

[29] S. Hopcan, E. Polat, M. E. Ozturk and L. Ozturk, "Artificial intelligence in special education: a systematic review," *Interactive Learning Environments*, vol. 31, no. 10, pp. 7335-7353, 2023.

[30] S. Kuruliszwili, "Sztuczna inteligencja. Nowe wyzwanie edukacyjne," *Problemy Opiekuńczo-Wychowawcze* 10, pp. 28-40. DOI:

- 10.5604/01.3001.0015.6653, 2021.
- [31] K. I. Raszyd, A. Wesołowska and K. Tomaszewska, "Sztuczna Inteligencja w nauce – jak studenci wykorzystują AI w edukacji wyższej," *Akademia Zarządzania*, vol. 8, no. 3, pp. 373-400, 2024.
- [32] T. Wang and E. C. Cheng, "Towards a tripartite research agenda: A scoping review of artificial intelligence in education research," in *Artificial intelligence in education: Emerging technologies, models and applications*, Springer, 2022, pp. 3-24. https://doi.org/10.1007/978-981-16-7527-0_1
- [33] M. W. Romaniuk and J. Łukasiewicz-Wieleba, "Information technologies in higher education teaching in the opinions of academic teachers," *International Journal of Electronics and Telecommunications*, vol. 70, no. 3, pp. 772-779, 2024. <http://dx.doi.org/10.24425/ijet.2024.149608>
- [34] M. W. Romaniuk and J. Łukasiewicz-Wieleba, "Information technology in teaching and learning process at higher education institutions in students' opinions," *International Journal of Electronics and Telecommunications*, vol. 70, no. 3, pp. 767-772, 2024. <https://doi.org/10.24425/ijet.2024.149531>
- [35] M. A. Cardona, R. J. Rodriguez and K. Ishmael, "Artificial Intelligence and the Future of Teaching and Learning," *Office of Educational Technology*, Washington, 2023.
- [36] H. S. Lin, "The Stanford Emerging Technology Review 2023. A Report on Ten Key Technologies and Their Policy Implications," *Stanford University*, Stanford, California, 2023.
- [37]
- M. Porwoł, "Czy sztuczna inteligencja zmienia sposób myślenia o plagiacie w kontekście rzetelności akademickiej?," *Eunomia - Rozwój Zrównoważony*, vol. 104, no. 1, pp. 57-69, 2023.
- [38] S. Laato, B. Morschheuser, J. Hamari and J. Björne, "AI-Assisted Learning with ChatGPT and Large Language Models: Implications for Higher Education," in *EEE International Conference on Advanced Learning Technologies (ICALT)*, Orem, UT, USA. <https://doi.org/10.1109/ICALT58122.2023.00072>, 2023.
- [39] M. W. Romaniuk, A. Szarfenberg, I. Pawłowska and K. Choszczyk, "Doctoral Theses in the Digital Age – ICT use by Social Sciences PhD Students of The Maria Grzegorzewska University," *International Journal of Electronics and Telecommunications*, vol. 70, no. 1, pp. 199-204, 2024. <https://doi.org/10.24425/ijet.2024.149531>
- [40] S. Zahidi, "The Future of Jobs Report 2023," *World Economic Forum*, <https://www.weforum.org/publications/the-future-of-jobs-report-2023/in-full/>, 2023.
- [41] A. Franczyk and A. Rajchel, "Postawy studentów wobec ChatGPT w edukacji," *Horyzonty Wychowania* 23(65), pp. 89-101. <https://doi.org/10.35765/hw.2024.2365.10>, 2024.
- [42] P. Cabała, K. Kwiatkowska, K. Woźniak and M. Zakrzewska, "Opinie studentów wobec możliwości i ograniczeń wykorzystania systemu ChatGPT," *e-mentor*, vol. 102, no. 5, pp. 48-56, 2023.
- [43] "Serwis Rzeczypospolitej Polskiej," 15 03 2024. [Online]. Available: <https://www.gov.pl/web/cyfrizacja/przelomowe-przepisy-dotyczace-sztucznej-inteligencji--parlament-europejski-przyjal-rozporzadzenie>