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GENERATIVE TOOLS OF AI IN EDUCATION

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Abstract. Since generative tools of Artificial Intelligence appeared in education, ongoing discussion arose. Still, higher education institutions argue if generative tools can be used, and if yes, what exactly can be accepted. The purpose of this study is to investigate for what exactly students use the generative tool Chat GPT in their studies, as well as to determine if there is a statistically significant difference between students representing different fields of study in terms of usage of Chat GPT in general, as well as in evaluation of the knowledge. The objectives of the study are to research recent scientific findings, as well as to analyze the results of the survey created by authors, which was distributed in Latvia, Lithuania, Ukraine, Bulgaria and Uzbekistan. Methods of the study are analysis of the recent findings and statistical analysis of the survey. To test hypotheses, the authors employed the Kruscal-Wallis non-parametric test for both hypotheses, where authors tested if there are statistically significant differences between answers of students from different education fields. The final results highlight the use of Chat GPT by students in higher education.

Keywords: artificial intelligence, generative tool, education, university.

JEL Classification: A20, I20, I23.

1. Introduction

Artificial intelligence (AI) generative tools like Chat GPT and others rised serious discussion in the scientific and academic society. In scientific society researchers are discussing ethical use of generative tools while conducting research, while academic society is concerned about the same – is usage of generative tools of AI ethical by students.

Artificial intelligence (AI) has been a subject of interest for many years, but its recent integration into education has become more pronounced. Tools such as Chat GPT and others are rapidly altering the learning landscape for both students and educators. With assignments now completable in seconds using generative AI applications, it's imperative for higher education institutions (HEIs) to adapt by introducing new environments with tailored tools and techniques. These generative tools not only inspire students and fuel creativity but are increasingly utilized by students to fulfill assignments – a reality that cannot be disregarded. Nonetheless, grasping the specifics and potential of AI tools can revolutionize the educational process, ushering it into a more dynamic and engaging realm. Embracing fresh perspectives on learning can mutually benefit both students and educators, provided that these tools are implemented and utilized effectively.

The purpose of this study is to investigate for what exactly students use the generative tool Chat GPT in their studies, as well as to determine if there is a statistically significant difference between students representing different fields of study in terms of usage of Chat GPT in general, as well as evaluation of the knowledge.

Authors of the paper intend to conduct cross-country analysis of the usage of Generative tools of AI such as Chat GPT by students of higher education.

The objectives of the study are to research recent scientific findings, as well as to analyze the survey created by authors. Methods of the study are analysis of the recent findings and statistical analysis of the survey. To test hypotheses, the authors employed the Kruscal-Wallis non-parametric test for both hypotheses, where authors tested if there are statistically significant differences between answers of students from different education fields.

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In the second section of the paper, understanding of the artificial intelligence is highlighted, while in the third section, authors discussed scientific findings on the history of artificial intelligence, to highlight it from the very beginnings. Fourth section of the paper is dedicated to the analysis of recent scientific findings related to the artificial intelligence in the education, while fifth section is methodology and in the last section, results are discussed.

2. Understanding artificial intelligence (AI) and generative tools of AI

One of the definitions of AI is written by McCarthly in 2004 – "It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable". (McCarthy, 2007). Currently, IBM utilizes the same definition to elucidate the concept of AI.

Nevertheless, the concept of generative chatbots, such as ChatGPT, is not novel. The notion of interacting with computers using language dates back to the early days of computing and AI research. One of the most renowned examples of a chatbot is ELIZA, developed by Weizenbaum and McCarthy in the 1970s (Weizenbaum & McCarthy, 1997).

In their analysis published in the Harvard Business Review, Eapen et al. (2023) examine the ways in which generative AI tools can enhance human creativity. They argue that such tools have the capacity to encourage divergent thinking, challenge biases in expertise, and aid in the evaluation of ideas. Importantly, they emphasize that the potential of generative AI lies in assisting humans to create innovative solutions, rather than replacing them altogether (Eapen et al., 2023).

However, within the scientific community, there is ongoing debate about the possibility of AI replacing humans. Dwivedi and colleagues, in their recent research, discuss how negative AI can enhance productivity but also has the potential to replace human employees. The authors stress the critical importance of policies governing the implementation of AI (Dwivedi et al., 2023). However, discussions surrounding generative AI tools such as ChatGPT inevitably give rise to ethical considerations. Stahl and Eke (2023), in their recent research, delve into these ethical concerns, ranging from social justice and environmental issues to cultural identity and individual autonomy. The authors emphasize that the ethical discourse surrounding generative AI extends far beyond conventional concerns about authorship, often associated with such tools (Stahl & Eke, 2023).

Top of Form

Definitely, it should be noted that artificial intelligence nowadays is part of our life, which cannot be ignored. However, since the launch of Chat GPT, this topic emerged in the scientific and educational society, despite the fact that concept of generative tools (Chatbots) is definitely not novel.

3. History of using AI

Humans have perennially sought methods to enhance their ability to make precise and far-reaching predictions, a quest at the heart of intelligence's essence. This pursuit is pivotal, as the ability to forecast future events with accuracy fundamentally underpins Homo sapiens' dominance over other species, emphasizing the critical role of sophisticated and future-oriented predictions (Harari, 2022). Such predictive prowess necessitates the development of complex information representation systems (Deacon, 1997). This understanding lead to the necessity for construction of intricate models capable of statistical, mirroring, and reinforcement learning, among other types (Hawkins & Blakeslee, 2007) mimicking biological brains. This not necessarily means that artificial intelligence based on artificial neural networks must mimich the biological brain, LeCun gives this justification and a nice overview of the deep learning here (LeCun et al., 2015).

Throughout history, all domains of human activity have essentially acted as repositories of models or methodologies aimed at predicting outcomes, whether in chemistry, physics, mathematics, biology, or other fields (Kuhn, 1962). The adage "foreknowledge equals power" encapsulates the belief that mastery over future events confers the ability to govern outcomes (Machiavelli, 2012), positioning knowledge as the ultimate tool of dominion. Given the biological brain's unparalleled efficiency in this regard, it follows logically to aspire to the creation of an artificial counterpart. Such an endeavor aims not just at replicating the brain's predictive capabilities but at transcending them, potentially culminating in the singularity – a future point where artificial intelligence outpaces human intelligence, leading to unforeseeable changes in society and technology (Kurzweil, 2005).

The inception of early computational machines in the 1940s, such as the ENIAC (Electronic Numerical Integrator and Computer) in 1945, marked the dawn of the digital computing era, laying the groundwork for future AI developments (Goldstine & Goldstine, 1946). The 1950s and 1960s saw pioneering theoretical contributions, notably from Turing (1950), who proposed the idea that machines could simulate human intelligence, a concept articulated in his seminal paper (Turing, 1950).

The field experienced its first major challenges during the "AI winters" of the 1970s and 1980s, periods characterized by skepticism and reduced funding due to the initial overselling of AI's capabilities. Despite these setbacks, the late 20th century witnessed crucial advancements that reignited interest and progress in AI research.

A pivotal moment came with the development of the neocognitron by Fukushima in the 1980s, a precursor to modern deep learning architectures, introducing hierarchical, multi-layered neural networks capable of pattern recognition (Fukushima, 1980).

The resurgence of neural networks and machine learning was further propelled by significant contributions, including the introduction of backpropagation a key algorithm enabling the training of deep neural networks, as well as later advancements made by LeCun et al. in 1989 (LeCun, et al., 1989). This period also saw the development of the concept of deep learning networks by Hinton and Salakhutdinov (2006), which emphasized the importance of deep architectures in achieving higher levels of abstraction and performance in AI tasks (Hinton & Salakhutdinov, 2006). Bottom of Form

As it is seen from the analysis of the literature, artificial intelligence is definitely not something new, however, since the launch of Chat GPT, serious scientific discussion arised, as it can influence many aspects of the daily life. However, despite the serious concerns on the negative influence, there are a lot of positive aspects of usage of Chat GPT, however, if used properly and ethically. Now, we can see, that development of AI for the past 80 years brought us an amazing possibility to see the transformation of the world through the artificial intelligence, where transformation of education is definitely not an exception.

4. Artificial intelligence in education

Generative artificial intelligence (AI) holds significant promise in transforming the landscape of education, with tools like ChatGPT, a large language model (LLM), emerging as particularly noteworthy assets. Notably, generative AI has been lauded for its capacity to personalize learning experiences, a sentiment echoed by Farrokhnia et al. (2023), who highlight its potential in tailoring learning materials such as practice problems, study guides, and feedback to individual student needs (Farrokhnia et al., 2023).

Another compelling advantage of leveraging generative AI in education is its ability to extend support beyond traditional classroom settings. Generative AI, through the creation of chatbots, can offer students additional assistance and guidance, particularly beneficial for those encountering challenges outside of regular class hours (Ooi et al., 2023).

Despite its transformative potential, integrating generative AI into education presents its fair share of challenges. Ensuring the accuracy and reliability of generated content remains a pressing concern (Glaser, 2023), alongside ethical considerations such as preventing cheating and plagiarism, as well as addressing potential job displacement among educators (Dwivedi et al., 2023). Establishing ethical guidelines and educating students about their implications is crucial for navigating these complexities (Susarla et al., 2023).

In the realm of education, ChatGPT and similar generative AI tools offer multifaceted benefits. They facilitate personalized and efficient learning experiences by adapting to individual needs and providing tailored support. Furthermore, they streamline the feedback process for educators, enhancing overall learning outcomes. ChatGPT serves various roles in education, including information provision, fostering debates, supporting self-directed learning, and generating content for course materials. Hamid et al. (2023) provide an optimistic perspective, highlighting the efficacy of ChatGPT in fostering collaboration, motivation, and comprehension of study subjects. According to their research, ChatGPT proves to be a beneficial resource that enriches the learning experience and has the potential to replace conventional approaches (Hamid et al., 2023). Scholars such as Farhi et al. (2023) offer a detailed examination of student perspectives. Their research underscores the multifaceted ways in which students utilize ChatGPT, spanning from collaborative learning to the enhancement of motivation. This variability in usage patterns illustrates ChatGPT's adaptability across diverse educational settings (Farhi et al., 2023).

However, alongside these benefits, there exist pertinent challenges. The efficacy of such technology in educational contexts remains largely untested, with potential limitations in the quality of data AI chatbots rely on. Ethical considerations surrounding privacy, bias, and safety must also be carefully addressed during implementation (AL-Smadi, 2023).

Addressing these challenges and undertaking further research are paramount to ensure that generative AI enhances learning experiences for all students. In this survey paper, authors delve into the historical evolution of generative AI models and their application in education, while also reviewing the current state of research on their efficacy, particularly focusing on ChatGPT. Through analysis of survey findings, authors aim to provide insights and recommendations for future research endeavors.

5. Methodology

Survey, what was created by authors, was placed on Question Pro and distributed via emails to students. Students from Latvia, Lithuania, Uzbekistan, Ukraine and Bulgaria participated in the survey. In total 360 students participated and answered questions of the survey. Survey was distributed during the first semester of the study year 2023/2024, from 01.09.23 to 20.01.2024.

Table 1 represents structure of the survey.

As it is presented in the Table 1, there were two parts of the survey – respondent profile part, and part dedicated to the attitudes and knowledge related to the AI in education.

Distribution of respondents by countries in represented in Table 2.

Table 1. Structure of the survey (source: author's contribution)

Part of the survey	Description		
	Types of the questions	Evaluation scale	Codes
A: Respondent profile (gender, age, location, field of education, level of education, country of residence)	Open/Closed	Multiple-choice	A_1–A_6
B: Attitude and Knowledge of Chat GPT (8 statements to assess knowledge and attitude)	Closed	Multiple-choice	B_1–B_8

Table 2. Distribution of respondents by country of study (source: author's contribution)

Country	Amount of respondents	Share in %
Latvia	149	41%
Lithuania	119	33%
Ukraine	54	15%
Uzbekistan	12	3%
Bulgaria	26	7%

As it is presented in the Table 2, 360 respondents noted their country of study. Largest share of the respondents mentioned that they study in Latvia – 41% of the share, followed by Lithuania – 33% of the share. Other countries were represented by less than 20% of the total share.

Distribution of gender of the respondents who filled survey is similar – 48% of respondents were female and 50% of respondents were male; 2% of respondents chose option "other".

Largest share of the respondents were 21–25 years old, followed by students who were less than 20 years old – 93 respondents. 26–30 years old and 31–35 years old share was very similar – 48 and 50 persons following. 28 respondents noted that they are more than 40 years old, but smallest share was represented by 36–40 years old respondents.

Table 3 represents level of degree respondents' study in and their field of education.

As it is shown in the Table 3. Not all 360 respondents answered questions related to level of degree and field of education, as those questions were not obligatory. 209 students noted their level of degree they study at. Largest share of the respondents is represented by students, who study at the bachelor level – 173 respondents, or 83% of the total share. 10% of respondents study at the short cycle program, 5% study for a master degree and smallest share of respondents – 2%, study at the PhD level program.

Table 3. Level of degree and field of education of the respondents' (source: author's contribution)

Criteria	Amount of respondents	Share in %
Level of degree		
Short cycle	21	10%
Bachelor	173	83%
Masters	10	5%
PhD	5	2%
Field of education		
Education	20	10%
Economics	14	7%
Finance	30	15%
Management and entrepreneurship	24	12%
Information technologies	10	5%
Mathematics	0	0%
Engineering	24	12%
Manufacturing	2	1%
Medicine	34	17%
Other	47	23%

As for field of education, 205 students answered this question. Results show that largest share of the respondents – 17% what is 34 students study medicine, followed by 15% of students who study finance, 12% of students who study management and entrepreneurship and the same share was related to engineering. Other study fields were represented by less than 10% of respondents, but 23% of respondents mentioned that they study in different field.

6. Results

Firstly, authors idea was to find out how many respondents use Chat GPT in general for their studies. 414 students answered question "Do you use generative tools of artificial intelligence tools (like Chat GPT etc.) in the daily study process?". Results were distributed similarly, as 194 respondents (54%) answered that they do use Chat GPT in they daily study process, but 166 students (46%) answered that they do not use. Definitely, results show that not all the higher education institutions implemented generative tools of AI in the study process, and not all students themselves uses it to complete tasks of their studies.

In order to reach the goal of the study, authors analysed for what exactly students use Chat GPT. 290 students answered question "For what tasks do you use generative tools of AI (like Chat GPT)?"

Table 4 represents distribution of answers of respondents.

Table 4. Distribution of answers of the respondents on the question "For what tasks do you use generative tools of AI (like Chat GPT)?"

Answer	% from the total share
To find answers of test/task/exam	18%
To gain new knowledge	33%
For inspiration	34%
For help in development of structure of research/task	15%

As it is shown in the Table 4., largest share of the respondents mentioned that they use generative tools like Ghat GPT for inspiration (34%) and to gain new knowledge (33%). 18% of respondents noted that they use it to find answers on test, task or exam, but smallest share – 15% mentioned that they look for help in development of structure of research/task.

Authors of the study developed following hypothesis:

H1: Students of technical education (IT and engineering) evaluate their knowledge of Chat GPT higher, than students from other fields.

Students were asked to rate their knowledge about usage of Chat GPT from 1 to 10.

To test the hypothesis, authors used Kruscal-Wallis non-parametric test.

Results of the tests show that there is no statistically significant difference between evaluation of knowledge of Chat GPT and field of education of respondents, as Asymp.Sig. (2-tailed) is .091 (as standard alpha levels is 0.05).

Based on the calculations, hypothesis is approved.

H2: Students of technical education (IT and engineering) use Chat GPT more than students from other fields.

First question of the questionnaire was "Do you use Chat GPT", were respondents had two simple answers– yes or no.

To test the hypothesis, authors used Kruscal-Wallis non-parametric test.

Results of the tests show that there is a statistically significant difference answers if students use Chat GPT and field of education of respondents, as Asymp. Sig. (2-tailed) is 0.014. Students from Engineering programs answered "yes" statistically more often than students from other faculties. In this case, hypothesis is partly approved, as there are no statistically significant difference in the results of answers of students from IT programs.

7. Conclusions

Although artificial intelligence (AI) is not a novel concept, the emergence of Chat GPT has ignited fervent discussions within scientific and academic spheres. The field encountered formidable challenges during the "AI winters" of the 1970s and 1980s, characterized by widespread skepticism and dwindling funding owing to exaggerated claims regarding AI's capabilities. Despite these adversities, the late 20th century witnessed significant breakthroughs that reignited enthusiasm and propelled advancements in AI research. A pivotal milestone was the development of the neocognitron by Fukushima in the 1980s, laying the foundation for contemporary deep learning architectures and introducing hierarchical, multi-layered neural networks capable of sophisticated pattern recognition.

In the realm of education, AI's role has evolved from rudimentary adaptive learning systems to sophisticated generative AI tools, facilitating personalized learning experiences. This evolution has culminated in the integration of AI into educational practices and technologies, fostering adaptive learning environments and tailored instructional content.

A survey conducted by the authors utilized QuestionPro and was distributed via email to students from Latvia, Lithuania, Uzbekistan, Ukraine, and Bulgaria. A total of 360 students participated and answered the survey questions. Among them, 224 respondents (54%) reported using Chat GPT or similar generative AI tools in their daily study routines, while 190 students (46%) stated they did not. These results indicate that not all higher education institutions have implemented generative tools of AI into their study processes, and not all students utilize them for their academic tasks.

To understand the specifics of how students utilize Chat GPT, the authors analyzed responses to the question "For what tasks do you use Generative Tools of AI (like Chat GPT)?" Out of 360 respondents, the majority indicated using such tools for inspiration (34%) and gaining new knowledge (33%). Additionally, 18% mentioned using it to find answers for tests, tasks, or exams, while the smallest share (15%) sought help in structuring research or tasks.

For the specific research authors highlighted 2 main hypothesis. First hypothesis was rejected, as students with technical education do not evaluate their knowledge of generative tools of AI – Chat GPT higher than students from other fields. Second hypothesis was partly approved, as students from enginnering field do use generative tool of AI like Chat GPT more that students from other fields, however, there was no statistically significant difference in the results of answers of students from IT programs.

Despite the ethical concerns of the researchers and academics, artificcial intelligence became part of science and education since it was launced in a very popular tool as Chat GPT, what means that it is not possible to ignore its presence in daily life. However, it is crucial to develop ethical guidelines of usage of such tools. Nevertheless, not all students use it, as it was shown in the research, as only half ot the students noted that they use generative tools of AI like Chat GPT in their studies.

8. Discussion

Nowadays, when we are facing the transformation of many fields by artificial intelligence, the education industry is not an exception. However, there is still ongoing scientific and academic discussion, on if generative tools in education are allowed to be used, and if yes, then how exactly. There are serious concerns from the side of education institutions who had not developed guidelines for the usage of generative tools such as Chat GPT, as nowadays it is not possible to ignore these tools. Results of this specific research highlight that only half of the students use Chat GPT for their studies, however, more than half is already a significant sign for the education institutions to implement guidelines for the usage and educate students to boost their creativity.

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