Educational Horizons: Mapping the Terrain of Artificial Intelligence Integration in Bulgarian Educational Settings

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Abstract

The role of artificial intelligence in education (AIEd) has recently become a major topic of discussion and future planning. This article presents data from a large-scale survey involving 1463 Bulgarian educators in primary, secondary, and high schools. The results revealed that 70.30% of the teachers were familiar with or somewhat familiar with the existence of AI applications. Chatbots were the most popular among the surveyed teachers, with ChatGPT ranking as the most familiar. The teachers were almost equally split between those who reported use and those who declared nonuse of AI technology for instructional purposes. A significant association was found between the teachers' familiarity with and use of AI technology and their age-related generational traits. The younger educators (up to 40 years of age) were associated with higher use of AI technology as a support tool for creating lesson plans, lesson content, tests, and exams. The outlined tendencies can be used to inform policy, professional development, and future research in the realm of AI-driven education.

Keywords: Artificial Intelligence; Bulgarian schools; Classroom practices; Educational innovation; Education technology; Current trends in education; Survey study

1 Introduction

The concept of artificial intelligence in education (AIEd) can be traced back to the previous century and the establishment of the International AIEd Society (IAIED) in 1997 (Zawacki-Richter et al., 2019). Since then, AIEd has been discussed in scientific forums and journals, but the actual application of AI in education has only recently emerged as a major topic in both the educational community and the general public. The present interest in AI has been ignited by the fast development of various AI apps capable of producing human-like content, audio, and video materials from written prompts (Zhang et al., 2022). It is now evident that AI-based educational technology opens up limitless new opportunities for educators and learners, simultaneously posing numerous challenges stemming from the unknowns (Hsieh and Tsai, 2017; Murugesan and Cherukuri, 2023).

AIEd research is currently shifting its focus towards the role of AI in teaching practice, encompassing various aspects of its implementation, including the attitudes and readiness of educators and students for the successful integration of AI-based technology, suitable methodological approaches to the organization of AI-based instruction and assessment, setting ethical standards, and the actual observance of those standards (Baidoo-Anu and Owusu, 2023; Bozkurt, 2023; Grassini, 2023; Zawacki-Richter et al., 2019).

1.1 Review of related studies

Although teachers have always played a crucial role in the implementation of teaching innovations, the advent of AI has elevated their role to a whole new level (Ayanwale et al., 2022). The wide range of AI apps and the rapid release of newer ones make it difficult for teachers to explore all options, choose appropriately, and keep up with the learning demand (Sanusi et al., 2022). Moreover, teacher education programs for K-12 grade teachers provide none to minimal knowledge and skills for them to handle the

demands of AI-based technology as a teaching tool and teaching medium (Sanusi et al., 2022; Vazhayil, 2019).

Consequently, insufficient or lacking AI literacy may adversely affect teachers' confidence in using AI-based technology in their instruction. Furthermore, a number of studies have shown a strong association between instructors' preparedness to utilize technology and their degree of confidence (Al-Furaih and Al-Awidi, 2020; Ayanwale et al., 2022; Nikolopoulou, 2021). According to Ayanwale et al.'s research (2022), which included 368 in-service teachers from elementary through high school in Nigeria, teachers' willingness to utilize AI-based technology was also impacted by whether or not they thought its application relevant to the goals of teaching and learning. Another factor impacting teachers' views about AI was their level of trust in the efficacy and accuracy of AI-based technologies (Nazaretsky et al., 2021).

Differences in attitudes towards technology have also been associated with the generational traits of the teacher populations (Hernandez-de-Menendez et al., 2020; Puiu, 2017). For instance, compared to their older counterparts, teachers born after 1980 (also known as Generation Y or Millenials) and those born in or after 1995 (also known as Generation Z or technoholics) are more likely to hold positive attitudes towards AI technology (Chan and Lee, 2023).

Despite the growing body of research about the relation of teachers to AI technology, most of the studies have focused on teachers' perceptions and hypothetical use of AI (Nazaretsky et al., 2021; Nikolopoulou, 2021; Ayanwale et al., 2022; Sing et al., 2021). With the exception of ChatGPT, whose benefits and drawbacks have been discussed in a number of studies (Alkaiss and McFarlane, 2023; Bozkur et al., 2023; Mathew, 2023), there is little research about teachers' familiarity with current AI applications and their specific functions, including various other chatbots (e.g., Google Bard/Gemini), video and audio generators (e.g., DALL-E), virtual human generators (e.g., PlayHT), and others. Another missing element is the actual purpose of using these AI apps in teaching (in-class, homework assignments, assessments, creative projects, etc.).

This article adds to the existing AIEd research insights from a large-scale survey with Bulgarian primary, secondary, and high school teachers regarding their familiarity with and actual use of trending AI apps in their teaching practice. Connections with the instructors' age-based generational traits are also highlighted.

2 Methodology

The present paper is based on a survey study about the role of artificial intelligence (AI) in the Bulgarian school system, including primary school, secondary school and high school. The survey was administered online through Google Forms to school principals from all over Bulgaria. They were asked by the researcher to share the survey with the teachers in their schools and to encourage them to respond. The study was approved by the committee of scientific ethics in the faculty of mathematics and informatics at Plovdiv University "Paisii Hilendarski" under protocol №1252/31.01.2024. Prior to answering any survey questions, the teachers provided an informed consent regarding their participation in the study and the use of the data in academic publications. They were also assured that their responses would remain anonymous.

Apart from the demographic questions, the survey included 26 target items, organized in four sections: 1) teachers' familiarity with AI; 2) teachers' opinions on the application of AI in education, 3) the influence of AI on the teaching practice; 4) the place of AI in teacher training programs. This paper is based on part of the survey questions that were considered the most relevant to its purpose as stated below.

2.1 Purpose

The current study examined the familiarity with and actual use of trending AI apps by Bulgarian primary, secondary, and high school educators. The following research questions were addressed:

1. How familiar are teachers with AI? Is there a significant association between the level of familiarity and the teachers' age classified into generations as given in Chan and Lee (2023)?

2. Which are the most popular AI applications among Bulgarian school teachers?

To address question 2, one of the survey items asked teachers to check all AI applications that they were familiar with. The list of AI applications was created following the guidelines about the use of artificial intelligence issued by the Bulgarian ministry of education and science in

January 2024 (https://www.mon.bg/nfs/2024/02/nasoki-izpolzvane-ii_190224.pdf). In this document the current AI applications are conditionally categorized into three main groups (p. 11):

Chatbots (e.g. ChatGPT, Google Bard/Gemini, Microsoft Bing AI/ GitHub CoPilot, Perplexity). They generate human-like text based on textual prompts and directions.

Video, **audio**, and **image generators**: Creation of images and design, music, audio, video, presentations (e.g. DALL-E, Stable Diffusion, Midjourney, Bing Image Creator).

Virtual human generators: These systems generate verbalize/speak language and generate audio or video from written text (e.g. Synthesia, Play HT).

3. Do teachers use AI applications in their teaching practice and for what purposes?

2.2 Statistical Analysis

The statistical package for the Social Sciences (SPSS) Version 27 (2020) was used to analyze the data. The results are summarized by frequencies and percentages. The association between target variables (e.g., generation category, school level) and the teachers' responses was examined through the Chi-square test and the Kruskal-Wallis test, followed by Bonferroni paired comparisons. All statistical tests were two-tailed and performed at a Type I error (α) of 0.05.

3 Results

3.1 Demographic data

The survey was completed by 1463 teachers, of whom 83.00% were women, 16.60% were men, and 0.40% identified themselves as *other*. The distribution of the teachers by school level showed 21.50% teaching in primary schools, 26.10% in secondary schools, and 52.40% in high schools. The teachers came from 24 out of the 28 regions of Bulgaria. The majority of them (68.10%) worked in schools located in regional cities, 18.50% worked in small town schools, and 13.40% worked in village schools. According to their age, the teachers represented four generation groups, following the classification given in Chan and Lee (2023). The majority of them (68.80%) were of Gen X (Table 1).

Variables	N	Percentage
Gender		
Men	243	16.60%
Women	1214	83.00%
Other	6	0.40%
School level		
Primary	314	21.50%
Secondary	383	26.10%
High	766	52.40%
School location		
Regional city	966	68.10%
Small town	271	18.50%
Village	196	13.40%
Generation		
Gen Z (20 to 29 years)	73	5.0%
Gen Y/Millenials (30 to 43 years)	254	17.4%
Gen X (44 to 60 years)	1006	68.8%
Baby Boomers (over 60 years)	130	8.9%

Table 1: Distribution of the participants by demographic variables

3.2 Teachers' familiarity with AI

The distribution of the teachers' responses regarding their overall familiarity with AI was as follows: very familiar (n = 160, 10.90%); familiar (n = 305, 20.80%); somewhat familiar (n = 564, 38.60%); rather unfamiliar (n = 355, 24,30%); and unfamiliar (n = 79, 5.40%). Collapsing the top two and bottom two categories yielded the following distribution: familiar at 31.70%, somewhat familiar at 38.60%, and unfamiliar at 29.70% (Fig. 1).

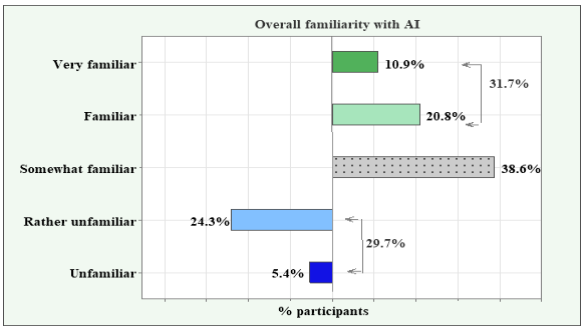

Figure 1: Distribution of the teachers' responses regarding their familiarity with AI

The generation categories, reflecting the age of the participants, showed significant associations with their familiarity with AI according to the Kruskal-Wallis test (test statistic = 41.719, df = 3, $p < 0.001$). The Bonferroni paired comparisons

revealed significant differences between all generations. The proportion of Gen Z teachers who were familiar with AI was significantly higher compared to that of the older generations (Gen Z ↔ Gen Y, $p = 0.044$; Gen Z ↔ Gen X, $p < 0.001$; Gen Z ↔ Baby Boomers, $p < 0.001$). The Gen Y teachers reported significantly higher familiarity than Gen X ($p = 0.010$) and the Baby Boomers ($p < 0.001$). A significant difference was also found between Gen X and Baby Boomers, with a higher percentage of familiarity associated with Gen X ($p = 0.018$).

The negative responses, combining the *rather unfamiliar* and *unfamiliar* options, revealed an opposite trend to the positive ones. Gen Z teachers showed the lowest percentage of unfamiliarity that was significantly different from Gen X ($p = 0.001$) and from the Baby Boomers ($p < 0.001$). The rate of negative responses in the Gen Y age group was significantly lower than that in the Gen X group ($p < 0.001$) and the Baby Boomers ($p < 0.001$). A significant difference was also found between Gen X and Gen Baby Boomers, with a lower percentage of negative responses in the Gen X group ($p = 0.003$).

The middle option *somewhat familiar* did not show substantial variations associated with the generational categories of the participants (Fig. 2).

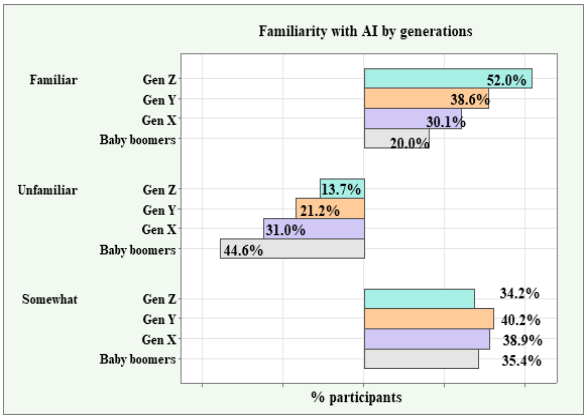

Figure 2: Familiarity with AI by generations

As is seen in figure 3, Chatbots were the most popular among the surveyed teachers. They were indicated as familiar in 121.30% of the responses. The percentage exceeds 100% because the question allowed as many answers as were known to the teachers. ChatGPT was the most popular among them, with 80% of the instructors being familiar with it. Video, audio, and image generators constituted 21.0% of the responses as Bing Image Creator had the highest share of 9.6%. Virtual human generators were the least popular, constituting only 4.80% of the responses.

The option "*other*" was present in 1.10% of the responses and included Open AI Playground (0.40%), YouChat (0.20%), Jasper AI (0.20%), Claude (0.20%) and Amazon Codewhisperer (0.10%).

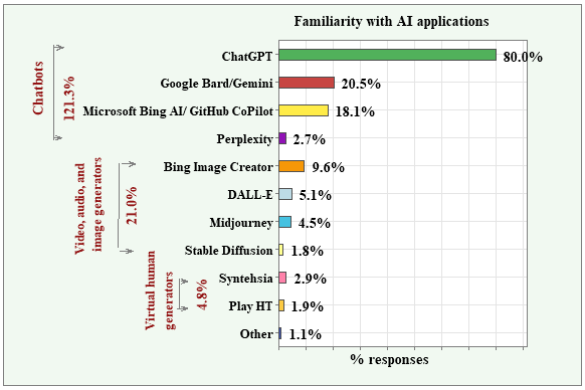

Figure 3: AI applications familiar to the participants in the survey

3.3 Teachers' use of AI in their teaching practices

Of the 1463 teachers who completed the survey, 51.10% (n = 747) did not use AI applications in their teaching practice. Frequent use, including options *very often* and *often*, was indicated by 8.70% of the participants, and occasional use (options *from time to time* and *rarely*) was reported by 40.20% of the teachers (Fig. 4). A significant association was found between the reported use of AI and the age-based generation category of the teachers according to the Kruskal-Wallis test (test statistic = 15.851, df = 3, $p = 0.001$). The highest percentage of teachers who reported using AI were of the younger generations (Gen X and Gen Y) and the lowest percentage was in the Baby Boomers' age group.

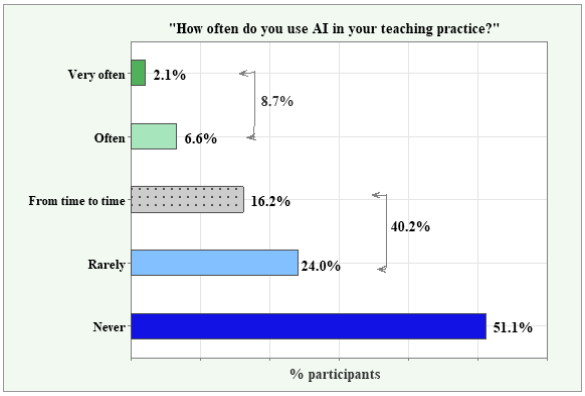

Figure 4: Teachers' use of AI in the teaching practice

The survey item about the purpose of using AI allowed multiple responses, which is the reason for the cumulative percentage to exceed 100%. In 86.50% of the responses, seven purposes for using AI were indicated. Figure 5 displays these purposes in descending order of use. Among them, *preparation of teaching materials* was the most frequent (24.60%), and the least frequent was *grading tests and exams* (4.10%).

Nonuse of AI was indicated in 61.20% of the responses, as some of the teachers selected both options "*I have not used AI in my teaching.*" and "*I do not want to use AI in my teaching.*"

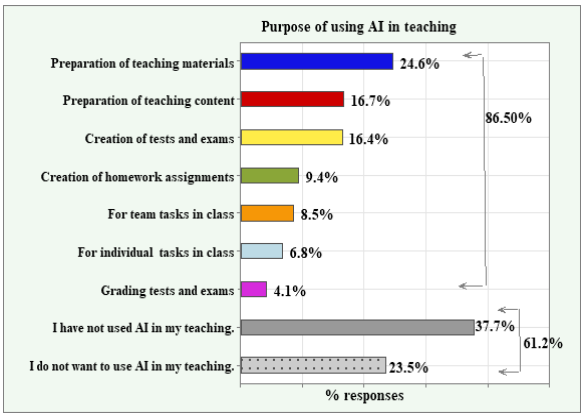

Figure 5: Purpose for using AI in the teaching practice

4 Discussion

The survey data on which this paper is based was collected at the beginning of 2024, when a variety of new AI applications appeared on the Internet and caught the attention of the general public, the media, and the educational community. The Bulgarian Ministry of Education was also involved in discussions and the preparation of guidelines for the use of AI in the education system. Thus, 2024 can be identified as the unofficial starting point of a long-term process of integrating AI in the educational context.

At this onset, the use of AI in teaching practice was not regulated by methodological directions and was mostly driven by the personal motivation of the teachers themselves. Our results showed that of the 1463 teachers who completed the survey, 70.30% were familiar with or somewhat familiar with the existence of AI applications. Given the very recent release of AI apps for general use, this percentage appears high and promising for future teacher training initiatives. The rate of familiarity was the highest among the younger generation of teachers (Gen Z and Gen Y) and the lowest among the teachers over 60 years of age (Baby boomers). The finding is not surprising given the trends reported in other studies regarding generational differences in attitudes to technology in general and to AI in particular (Chan and Lee, 2023; Hernandez-de-Menendez et al., 2020; Puiu, 2017).

Chatbots were the most popular among the surveyed teachers, with ChatGPT ranking as the most familiar. Much less familiar were video, audio, and image generators and the least familiar were virtual human generators. Given that ChatGPT has been the subject of several research studies discussing both the benefits and drawbacks of the app for teaching and student assessment, its popularity among the surveyed teachers was predicted (Alkaiss and McFarlane, 2023; Bozkur et al., 2023; Mathew, 2023).

Regarding the application of AI in teaching practice, the teachers were almost equally split between those who reported frequent to occasional use and those who declared nonuse at the time of the survey. The highest percentage of teachers who reported using AI were of the younger generations (Gen X and Gen Y), and the lowest percentage was in the Baby Boomers' age group. Our findings can indirectly be linked to the postulation that insufficient or lacking AI literacy may adversely affect teachers' confidence in using AI-based technology (Al-Furaih and Al-Awidi, 2020; Ayanwale et al., 2022; Nikolopoulou, 2021). Presumably, younger educators—who are naturally more technologically literate than their older counterparts—have the self-confidence to experiment with AI technology as a support tool for creating lesson plans, lesson content, tests, and exams. Although, to a lesser degree, AI was reportedly being utilized in homework assignments and individual and team tasks.

4.1 Limitations

The results reported in this article are time-sensitive due to the rapid release of new AI apps and the expanding field of AIEd, which is trying to catch up with technological advances. In a relatively short time span, teachers' familiarity with and use of AI apps will grow manifold. Nevertheless, the value of the present research is that it provides a reference point for comparing future developments. Because this paper was based on a limited number of survey questions, it leaves out important issues related to the drawbacks of using AI technology, such as

plagiarism, equitable assessment, the need for technical and methodological assistance in AI use, and others. Additionally, the findings regarding the teachers' familiarity with and utilization of AI technology are predicated on self-reports and may be impacted by an overestimation or underestimation of their actual practices.

5 Conclusion

The overarching conclusion that can be drawn on the basis of the reported results is that at the onset of introducing AI applications in the Bulgarian education system, the majority of the school teachers were familiar with current AI apps and were to a certain extent using AI technology in their teaching. This fact indicates a favorable inclination towards AI technology and the existence of some, although unsystematized, baseline knowledge and competence that can serve to inform policy, professional development, and future research in the realm of AI-driven education.

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