AI Literacy in Teacher Education in the Czech Republic

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Abstract: The development of artificial intelligence is rapidly transforming education systems worldwide, including those in the Czech Republic. This paper assesses the level of AI literacy among teachers and its integration into the Czech education system. The aim is to determine how well teachers are equipped with knowledge, skills, and understanding of AI, and how effectively they can integrate AI and AI awareness into their teaching. The methodology entails gathering data via a questionnaire survey distributed to teachers across various educational levels. The survey comprises questions that concentrate on AI literacy aspects, such as basic AI principles, the capacity to apply AI to teaching, discussing ethical issues related to AI use in the school environment, and critical thinking abilities. The questionnaire analyses the current state and challenges teachers face when integrating AI into teaching and learning practices. The results will be evaluated to identify areas where teachers' AI literacy needs strengthening and to propose strategies and recommendations for improving teacher training programmes and support. These strategies comprise teacher training, the provision of resources and support for integrating AI into the classroom, and reflection on the ethical and societal aspects of AI. It is equally important to invest in the long-term development of AI literacy among teachers as a fundamental step towards effectively harnessing the potential of AI in education and preparing students for the digital future. This article presents strategies and recommendations for the further development of AI literacy among teachers in the Czech Republic. The objective is to enhance their capacity and facilitate the more effective utilisation of AI in education.

Keywords: AI literacy, Digital competencies, Czech education system, AI integration to education, Critical thinking

1. Introduction

Artificial intelligence (AI) is regarded as one of the most significant technological developments of the past few decades. It is regarded as one of the most significant technological revolutions in history and has the potential to transform various sectors and aspects of our lives. This revolution is not only affecting the industrial sphere. At a global level, it is becoming a key element for innovation, economic growth and improving quality of life. A study by the McKinsey Global Institute (2018) indicates that AI could contribute up to $13 trillion to the global economy by 2030, representing approximately 1.2% annual GDP growth. This growth is driven by productivity gains, innovation and the emergence of new industries. AI enables the automation of routine tasks, freeing up human resources for more creative and complex activities that deliver greater value. AI also has significant potential in healthcare. For instance, AI algorithms can analyse vast quantities of health data and assist doctors in diagnosing diseases with greater accuracy than traditional methods. Studies have demonstrated that AI can enhance the detection of diseases such as cancer and enable personalised medicine that is tailored to the individual needs of patients.

The advent of artificial intelligence (AI) has opened up new avenues for educational advancement. These can significantly enhance the quality and efficiency of teaching, but they also present challenges that must be addressed. The growing importance of AI in education is evident in the increasing use of AI-based platforms and solutions to enhance the learning experience (Negoiţă, 2023). The potential of AI in education is considerable, encompassing precision teaching and improvements in student-teacher interaction. Consequently, it is vital to address ethical considerations and integrate AI responsibly into education (Negoiţă, 2023). In order to achieve effective and responsible integration of AI into the education system, it is essential to develop AI literacy. This encompasses an understanding of AI systems, their use, including applications that utilise AI principles, and evaluation in terms of transparency, safety, ethics, and impact on society. This paper presents a pilot study that assesses the level of AI literacy among teachers and its integration into the Czech education system. The objective of this study is to ascertain the extent to which teachers possess the requisite knowledge, skills and understanding of AI, as well as their capacity to integrate AI and AI awareness into their teaching.

1.1 The Potential of Artificial Intelligence in Education

The advent of artificial intelligence (AI) has the capacity to revolutionize the way we learn and educate others. The utilisation of AI technologies, such as adaptive systems, personalised learning programmes, and intelligent tutoring systems, enables the creation of learning environments that can adapt to the individual needs and abilities of students. This, according to Zhang & Aslan (2021) and Harry (2023), promotes more effective learning outcomes. This is achieved using technologies that analyse data to identify learning patterns and adapt educational content accordingly. Ahmad and his collective (2021) posit that artificial intelligence can facilitate greater accessibility to education for students with disabilities by providing them with tailored support and interfaces that can adapt to the learning styles and needs of diverse learners. Zheng and He (2021) posit that the utilisation of data-driven insights enables educators to gain deeper insights into student performance and learning processes. This, in turn, facilitates the implementation of data-driven decision-making, which in turn improves educational strategies and outcomes. In conclusion, artificial intelligence is of paramount importance in education, primarily due to its capacity to personalise learning, enhance teaching effectiveness, improve accessibility and provide invaluable insights into educational practices. Furthermore, AI tools can assist teachers in reducing their workload, allowing them to focus on more valuable tasks such as grading tests and tracking student progress. This allows for a greater allocation of time for direct instruction and individualised student support.

Nevertheless, the advent of AI has brought about several significant ethical and societal challenges. It is of the utmost importance to guarantee that AI systems are transparent, impartial and answerable. The issues of privacy, security and the ethical use of AI are the subject of intense debate. Organisations and governments around the world are engaged in the creation of regulations and standards with the objective of ensuring that the development of AI benefits society. The significance of AI development in a global context is considerable. Artificial intelligence has the potential to contribute significantly to economic growth, and to improve and address some of the greatest challenges facing humanity. Nevertheless, it is of the utmost importance that this development is conducted in a responsible manner, with due consideration for the ethical and societal implications.

1.2 The State of AI in Education in the Czech Republic

The education system in the Czech Republic is undergoing a transformation because of the influence of new technologies. In 2021, the first significant revision of the Framework Educational Programme for Primary Education in the field of digital technologies was implemented, which included the introduction of a new key competence, Digital, and modifications to the educational content of the educational area Informatics. The new digital competency is designed to ensure that by the end of primary education, pupils will have acquired the following skills:

- operate commonly used digital devices, applications and services; use them for learning and for engaging in school and community life; decide independently which technologies to use for which activities or problems,
- acquire, retrieve, critically assess, manage and share data, information and digital content, choosing processes, methods and means appropriate to the specific situation and purpose,
- creating and editing digital content, combining different formats, expressing themselves using digital means,
- use digital technologies to facilitate work, automate routine activities, streamline or simplify their workflows and improve the quality of their work,
- understand the importance of digital technologies for human society, become familiar with new technologies, critically evaluate their benefits and reflect on the risks of their use,
- avoid situations threatening the security of equipment and data, situations with a negative impact on his/her physical and mental health and the health of others; act ethically when collaborating, communicating and sharing information in the digital environment (RVP ZV, 2021).

In the Czech Republic, there are several initiatives and projects aimed at the promotion of AI in education. This is part of a broader global phenomenon where AI is creating new opportunities and challenges in the field of education. The objective of these projects is to increase awareness of AI among teachers and students, provide training in AI-related subjects, and create AI-focused educational materials.

To illustrate, the Edu AI chat assistant was developed by the Association for Better ICT Solutions, the National Pedagogical Institute of the Czech Republic and Charles University within the Edu AI project. The Edu AI

assistant provides guidance to students undertaking online preparation for the mathematics and Czech language entrance examinations for secondary schools. Furthermore, the website www.aidoskol.cz serves as a convenient gateway for schools, teachers, and students, directing them to a plethora of courses, training, workshops, and educational materials. The signpost is divided into three sections: training offers, materials and resources, and recommended tools. Nevertheless, the most prominent initiative in the field of AI education in the Czech Republic is the AI for Kids project, which encourages creativity, critical thinking and social responsibility in the context of a technology-driven world. The AI for Kids project provides educators with a range of educational materials, including a general introduction to AI for adults, the interactive story William & Meriwether, a translated textbook on machine learning for children, and AI Methodologies. Furthermore, they maintain an up-to-date awareness of new AI applications on their blog, and produce a diverse range of educational resources, not only for teachers but also for children. The organization is currently engaged in the development of an AI curriculum with the objective of facilitating the integration of AI into curriculum documents. In addition to the overview of these projects and their offerings, it is also of great importance to consider the level of AI literacy among teachers. This is a crucial factor in determining the successful integration of AI in education.

1.3 AI Literacy for Teachers

Although AI literacy has not yet received significant attention in the Czech Republic, there are several initiatives aimed at developing this area worldwide, particularly in the field of education. The importance of AI literacy in education is underscored by the multidisciplinary framework proposed by Allen (2023), which emphasises understanding AI systems, critically evaluating their implications, and fostering collaboration. A key question is how teacher education programmes can empower both future and current teachers to become competent in working with AI and to effectively guide their students in an increasingly AI-influenced environment. To analyse the current state and the challenges teachers face in incorporating AI into the classroom, a questionnaire survey was conducted. To identify the key concepts, themes and competencies that are considered essential for AI literacy in teacher education programmes, a literature search was conducted on how AI literacy is conceptualised in this context.

2. Methodology

The objective of the pilot research is to assess the level of AI literacy of teachers across different levels of education in the Czech Republic and to identify the main barriers and challenges associated with the integration of AI into teaching. In setting the objectives of this pilot research, we therefore posed the following two research questions:

RQ1. To what extent are teachers equipped with knowledge, skills and understanding about AI?

RQ2. What are the main barriers and challenges teachers face in integrating AI into teaching?

A questionnaire survey was employed to elicit responses. The questionnaire comprised five main sections: demographics, which sought to ascertain teachers' age, number of years of experience, and level of education; AI knowledge and skills, which assessed their level and frequency of use of AI tools; integrating AI into teaching, which sought to identify the barriers teachers face and ascertain whether there is support from the school and the resources needed; ethical and social issues; and promoting critical thinking. The questionnaire was distributed electronically to primary, secondary and university teachers in the Czech Republic. The data collected was analysed using descriptive statistics and the results presented in the following chapter.

3. Results

In order to obtain basic information about the respondents, the first part of the questionnaire was devoted to the collection of basic demographic data. Firstly, the distribution of respondents at different levels of the education system was of interest. The largest proportion of respondents (34.83%) indicated that they work at the second level of primary schools, while 21.72% stated that they work at secondary schools. A further 17.42% of respondents indicated that they work at the first level of primary schools, 8.71% at higher vocational schools, and 17.32% at universities. This distribution demonstrates a comprehensive representation of teachers at different levels of education, providing a comprehensive view of AI literacy.

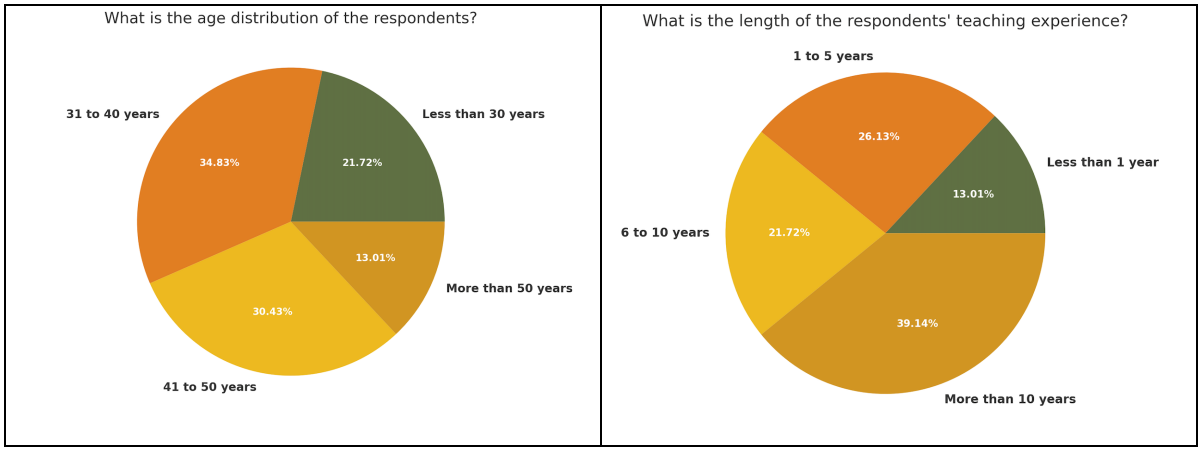

Figure 1 The charts illustrate the age of respondents and their teaching experience

The initial pie chart illustrates the age distribution of respondents to the pilot survey. A notable proportion of respondents, 34.83%, are within the age range of 31 to 40. The next largest group is respondents aged 41 to 50 years, who make up 30.43% of respondents. The next largest group is those under the age of 30, with a proportion of 21.72%. In contrast, those over the age of 50 represent the smallest segment, with a proportion of 13.01%.

The second chart illustrates the length of teaching experience of the respondents. The largest group, comprising 39.14% of respondents, has accumulated more than ten years of teaching experience. This indicates a significant proportion of educators with extensive experience. The proportion of educators with one to five years of experience is 26.13%, while 21.72% have been teaching for six to ten years. The smallest group, comprising 13.01% of respondents, is that of teachers with less than one year of experience. The data indicate a balanced proportion of experienced and relatively new teachers interviewed, which could reflect different levels of familiarity with the incorporation of AI into teaching.

These results collectively provide valuable insights into the demographics and professional backgrounds of the respondents. The diversity of age and teaching experience, along with the wide range of education levels represented, suggests that the view of AI literacy is multifaceted. It is possible that educators who are older and more experienced may encounter different challenges and levels of acceptance than their younger and less experienced colleagues.

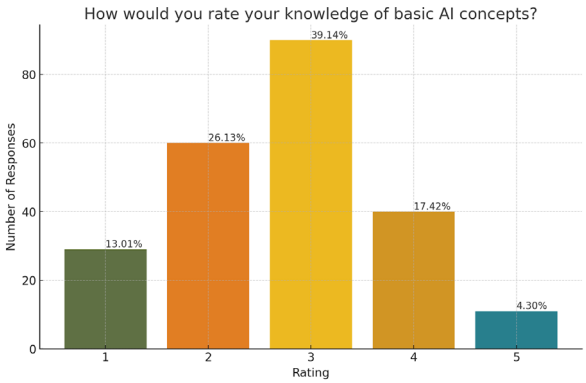

Figure 2: The chart shows how respondents rate their level of basic AI concepts

The chart illustrates the respondents' self-assessed level of understanding of fundamental AI concepts. The largest proportion of respondents (39.10%) indicated that they rated their knowledge as average (3). A smaller percentage of respondents, namely 17.40%, consider their knowledge to be above average (4), while only 4.30% consider their knowledge to be excellent (5). A notable proportion of respondents (26.10%) indicate that their knowledge is below average (2), while 13.00% rate their knowledge as very low (1). This discrepancy indicates that most respondents possess at least a rudimentary comprehension of AI, although a minority self-identify as experts in this field.

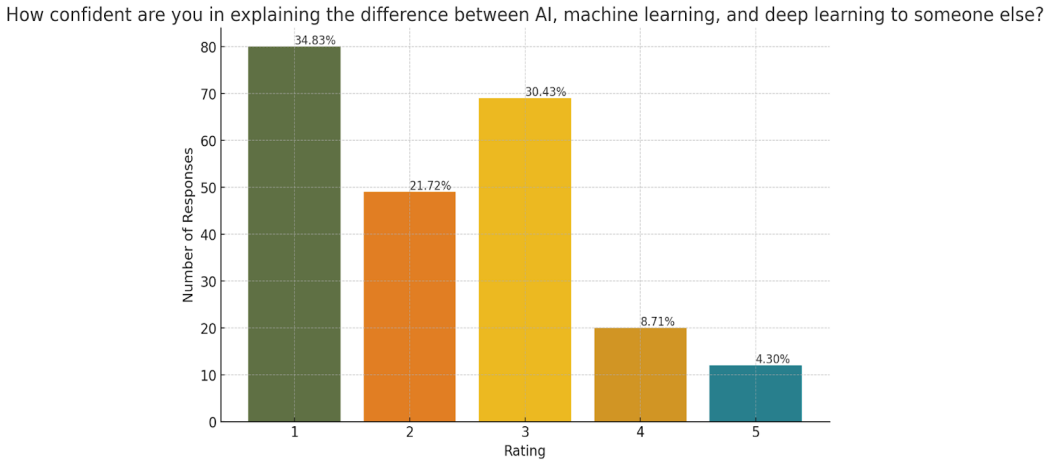

Figure 3: The chart shows how confident respondents are in their ability to explain the difference between AI, machine learning and deep learning

The chart above illustrates the respondents' level of confidence in their ability to differentiate between AI, machine learning and deep learning. A total of 34.80% of respondents indicated that they were unsure of their abilities (rating themselves as 1), while 30.40% expressed a moderate level of confidence (rating themselves as 3). A total of 21.70% of respondents indicated a lack of confidence (rating themselves as 2), while 8.70% expressed a moderate level of confidence (rating themselves as 4) and only 4.30% indicated a high level of confidence (rating themselves as 5). This dispersion indicates that a significant proportion of respondents lack the requisite confidence to comprehend and articulate these pivotal concepts.

To gain a deeper insight into the relationship between self-assessment and the level of knowledge of these key concepts among our respondents, we proceeded to pose questions pertaining to the distinction between artificial intelligence, machine learning and deep learning. The objective of these inquiries was not only to ascertain how respondents define and differentiate between these concepts, but also to determine their level of knowledge about each technology.

The results showed that 56.52% of respondents view AI as the ability of machines to perform tasks that typically require human intelligence. 65.22% of respondents see machine learning as algorithms that learn and improve based on data. 39.13% of respondents see deep learning as the fundamental level of AI, and the same proportion, 39.13%, associate it with training neural networks with many layers. It is clear from the previous graphs that most respondents feel less confident in explaining the differences between AI, machine learning and deep learning. This self-assessment correlates with the results of the questions, which show that while respondents have a basic understanding of these concepts, they often lack a deeper understanding and the ability to clearly explain these concepts. For example, most respondents correctly identify the applications and principles of machine learning, but fewer can describe deep learning in detail. It is also important to note that respondents could only guess the correct answer, which could explain the relatively high percentage of correct answers without necessarily implying a deep understanding of the concepts.

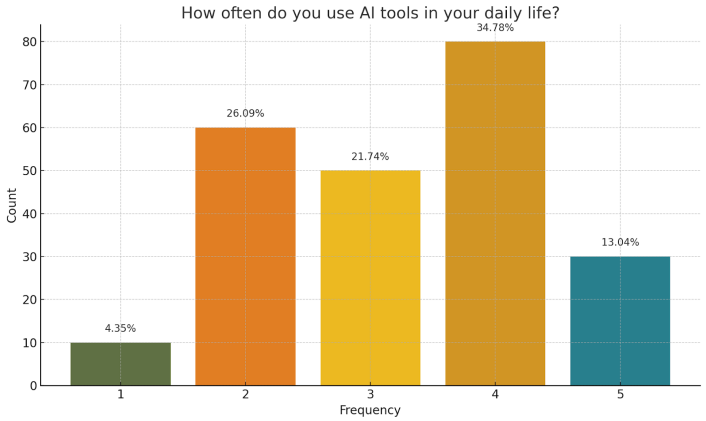

Figure 4: The chart showing frequency of using AI tools in respondents' daily lives

This chart shows the frequency with which respondents use AI tools in their daily lives. The survey, conducted among 230 participants, revealed that a significant proportion (34.78%) use AI tools frequently. 26.09% of respondents said they use AI tools to a moderate extent, while 21.74% use them occasionally. Only 13.04% of respondents use these tools very often, and a minimal number of 4.35% said they rarely use AI tools. This data highlights the increasing integration and reliance on AI technologies in everyday activities.

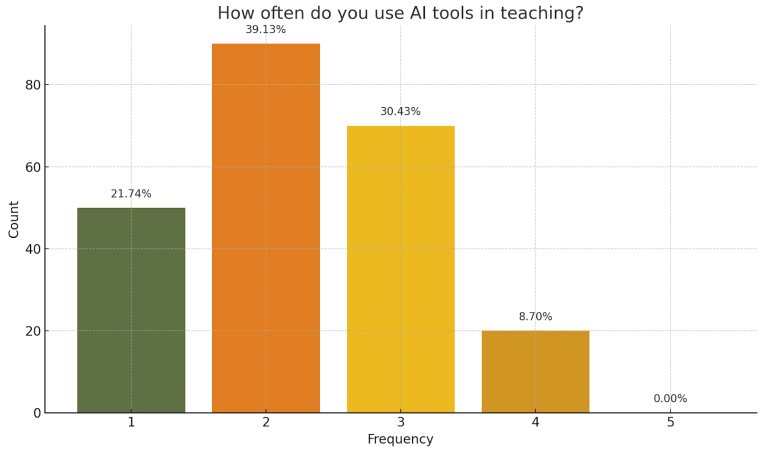

Figure 5: The chart shows the frequency of respondents' use of AI tools in their teaching

In pedagogical practice, the frequency of use varies widely, as we can see above. The results show that the majority of respondents (39.13%) use AI tools in teaching occasionally, another significant group (30.43%) reported a moderate level of use, while 21.74% of respondents do not use these tools at all.The following graph shows how often respondents use AI tools for teaching or for administrative tasks. The pilot study found that 39.13% of respondents use AI tools occasionally, a further 30.43% plan to start using AI tools, and 21.74% of respondents said they use these tools frequently. Only 8.70% of respondents are not interested in using AI tools.

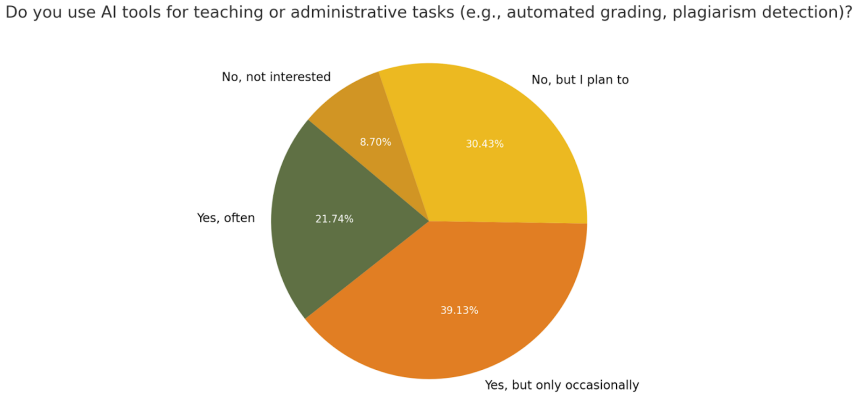

Figure 6: The chart shows how often respondents use AI tools for teaching or administrative tasks

In the following question, we asked what specific AI tools they had used in their teaching practice. 60.87% of respondents have used AI tools to generate text, for example to create exercises or teaching materials. Chatbots were used by 43.48%, making them the second most used tool. Speech recognition, e.g. for transcribing lectures, and data analysis, e.g. for assessing student performance, were used equally by 21.74% of respondents. Personalised learning tools were the least used, with only 13.04% of respondents using them. 34.78% of respondents said they had never used AI tools in their teaching. This data shows the different ways in which AI technologies are being integrated into educational processes, with some tools, such as text generation and chatbots, being used significantly more than others.

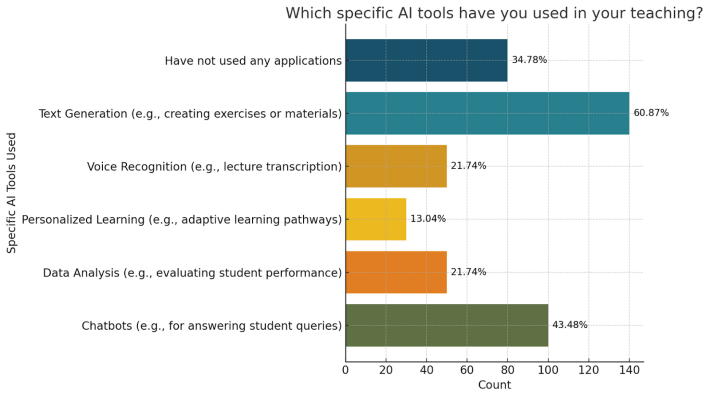

Figure 7: The chart shows what tools respondents used in their teaching

Respondents were also asked to rate the level of support from their school for integrating AI into the curriculum. The graph below shows that the largest proportion of respondents, 39.13%, rate their school's support as moderate, meaning that they perceive some support, but not very substantial. The second largest group (30.43%) rate the support at level 2, indicating that the support is rather weak. 17.39% of respondents said that support was at level 4, which is above average. 13.04% of the respondents rate the support as very weak, while no respondents rate the support of their school as excellent.

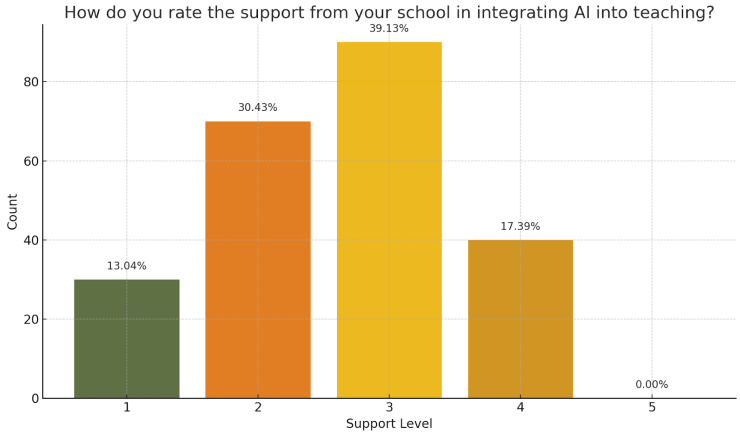

Figure 8: This graph shows how respondents rated the level of support from the school in integrating AI into the curriculum

Technical problems are seen as the biggest obstacle, with the highest number of respondents (82.61%). 65.22% of respondents identified insufficient teacher training and professional development as a significant barrier. 43.38% of respondents indicated that financial resources were insufficient to support the integration of AI into the educational process. 21.74% of respondents encountered resistance to change, indicating cultural and psychological barriers to adapting to new technologies. These data show that while technical and financial aspects are important, it is also essential to focus on teacher training and overcoming resistance to innovation to successfully integrate AI tools into the curriculum.

While teachers face several barriers to integrating AI into the classroom, we were interested in teachers' perceptions of the importance of teaching students about AI. The largest group of respondents (39.13%) consider teaching students about AI to be moderately important, while the second largest group of respondents (30.43%) consider it to be above average. 26.09% of respondents consider teaching students about AI to be very important, indicating a strong interest in the topic. Only 4.35% of respondents indicated that they considered this topic to be of low importance. This trend indicates a growing awareness and interest in integrating AI knowledge into educational programmes.

Concurrently, the majority of respondents (30.43%) concurred with the assertion that AI can be biased and thus necessitates critical evaluation. A further 26.09% of respondents expressed a moderate degree of agreement with this assertion. A total of 17.39% of respondents indicated that they agreed with the level of bias at levels 2 and 5. This response indicates a divergence of opinion between those who view critical

evaluation as moderate and those who view it as maximum. Conversely, 8.70% of respondents disagreed with the necessity of critical evaluation of AI due to bias. Nevertheless, the data indicate that most respondents perceive a risk of AI bias and consider it important that AI technology be subjected to critical evaluation. This awareness is crucial for ensuring the fair and objective use of AI in educational and other processes.

In addition to critical evaluations of AI, teachers also have some concerns that warrant further examination. The majority of respondents (82.6%) identified ethical issues as their primary concern. A significant proportion of respondents (56.5%) expressed concern about the potential impact of AI on the quality of education. Additionally, 39.1% of respondents indicated concern about the potential loss of jobs, while 26.1% expressed concern about the potential loss of student privacy. Notably, only 13.00% of respondents expressed concern about the safety implications of AI. Nevertheless, teachers discuss the ethical implications of AI to a similar extent, with 30.4% discussing it frequently and 30.4% discussing it not at all. It is alarming that none of the teachers surveyed discuss ethical issues with their students daily, even though 56.5% of respondents rate the importance of ethical considerations in the use of AI as important or very important. A mere 17.3% of educators consider the importance of ethical considerations in the use of AI to be low or very low. Similarly, the capacity to guarantee data security and protection when utilising AI tools is also rated at a low level. A total of 47.8% of respondents rated their ability as moderate, with no respondents considering themselves experts in this area. Additionally, 43.5% rated their ability as low or very low.

Nevertheless, it is encouraging to observe that, despite the low ratings, teachers demonstrate a willingness to provide students with explanations regarding the error and how to identify it when presented with distorted or incorrect AI information (52.2%). A total of 34.8% of respondents indicated that they would cease using the tool in the event of an error, while 13.00% stated that they would inform the tool developer of the error. Fortunately, none of the respondents would ignore this fact, as evidenced by the following graph.

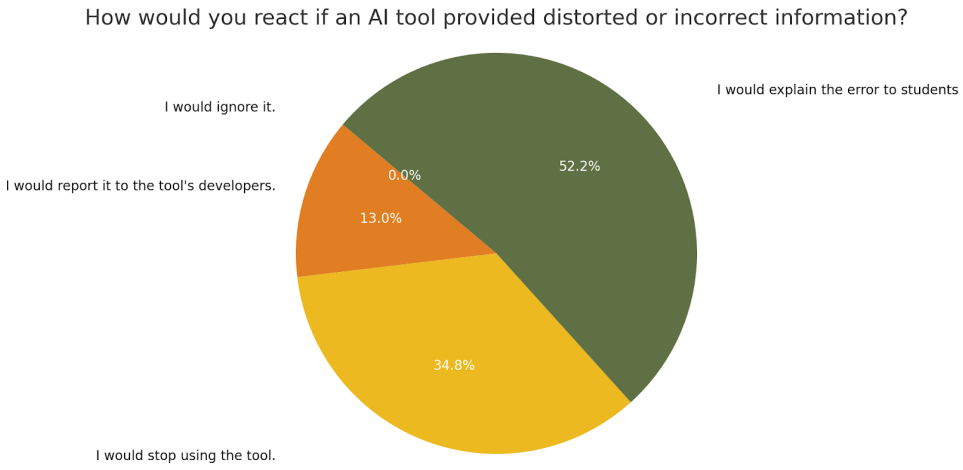

Figure 9: The chart shows the response to biased or incorrect information provided by the AI tool

4. Discussion

The results of this study indicate a diverse level of AI literacy among teachers in the Czech Republic, with significant implications for the integration of AI into the educational system. A majority of respondents demonstrate basic knowledge of AI, but a smaller percentage exhibit confidence and expertise in more advanced AI concepts such as machine learning and deep learning. This indicates a need for targeted professional development to enhance teachers' understanding of these crucial technologies.

The data indicate that AI tools are moderately used in daily life and teaching practices, with text generation tools and chatbots being the most employed. This suggests a growing familiarity with AI technologies, yet the infrequent use of personalized learning tools highlights potential areas for further adoption and integration.

The most significant barriers to AI integration are predominantly technical, with insufficient training and professional development also identified as significant challenges. These barriers indicate that to effectively integrate AI into education, there needs to be a concerted effort to provide robust technical support and

comprehensive training programmes. Financial constraints and resistance to change are additional obstacles that must be addressed through strategic planning and resource allocation.

The ethical and societal implications of AI are a critical concern for educators. The majority of respondents recognise the importance of addressing AI bias and the ethical use of AI, yet discussions on these topics with students are infrequent. This discrepancy indicates a necessity for curricular modifications to integrate ethics and critical thinking about AI technologies into pedagogical methodologies.

5. Conclusion

The study highlights the necessity of enhancing AI literacy among teachers in the Czech Republic to facilitate the effective integration of AI into the educational system. While there is a foundational understanding of AI among educators, there is a pressing need for targeted professional development to deepen their knowledge and confidence in advanced AI concepts. Addressing technical barriers and providing adequate training and support are essential steps towards successful AI integration.

Furthermore, the ethical implications of AI must be prioritized in educational discourse to prepare students for the challenges and opportunities presented by AI technologies. By fostering a comprehensive understanding of AI and its ethical considerations, educators can better equip students for the digital future.

Strategic recommendations include:

- Developing comprehensive AI training programmes for teachers at all educational levels.
- Ensuring adequate technical support and resources to facilitate AI integration.
- Incorporating AI ethics and critical thinking into the curriculum.

Promoting collaborative initiatives to facilitate the sharing of best practices and resources among educators. The implementation of these strategies will enable the Czech education system to fully utilize the potential of AI, thereby enhancing the quality of education and preparing students for a technology-driven world.

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