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Posibilidades de uso de la inteligencia artificial generativa como apoyo a la educación desde la perspectiva de los estudiantes de primaria y secundaria en la República Checa

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Resumen

El artículo se centra en las posibilidades de uso de la inteligencia artificial generativa (especialmente LLM) en la educación y la preparación en casa de los alumnos de primaria y secundaria en la República Checa, utilizando los resultados de la encuesta Los alumnos checos y la inteligencia artificial (2024), en la que participaron más de 28.000 encuestados de toda la República Checa. En nuestro artículo, analizamos las diferencias en el uso de la IA entre los alumnos de primaria y secundaria, para qué actividades la utilizan los alumnos y cuáles son las formas más avanzadas de utilizar estas herramientas (dentro y fuera de la escuela) para aumentar la eficacia de la educación; nos centramos en la personalización y la gamificación (incluida la creación de juegos educativos).

Palabras clave

Inteligencia artificial; grandes modelos lingüísticos; educación de alumnos de primaria y secundaria; gamificación.

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Possibilities of using generative artificial intelligence to support education from the perspective of primary and secondary school students in the Czech Republic

Abstract

The paper focuses on the possibilities of using generative artificial intelligence (especially LLM) in education and home preparation of primary and secondary school pupils in the Czech Republic, using the results of the survey Czech Pupils and Artificial Intelligence (2024), which involved over 28,000 respondents from all over the Czech Republic. In our paper, we look at the differences in the use of AI among primary and secondary school pupils, what activities pupils use AI for, and what are the more advanced ways of using these tools (in and out of school) to increase the effectiveness of education.

Key words

Artificial intelligence; large language models; education of primary and secondary school pupils; gamification

Introduction

Generative artificial intelligence: an introduction to the field

Artificial intelligence, particularly its generative forms, is currently experiencing a massive boom, with developers releasing new and increasingly sophisticated versions of these systems on an almost weekly basis. The term generative artificial intelligence (GenAI) refers to a category of artificial intelligence capable of autonomously generating new content, such as text, images, audio, and video (Allford et al., 2023; Lyu, 2023). In recent years, GenAI has experienced a significant surge, particularly in connection with large language models (LLMs) (Contreras Kallens et al., 2023; Houghton et al., 2023; Kumar, 2023) and their increasing accessibility to the public. One of the most well-known representatives of these AI models is GPT, which has been widely integrated into various freely available tools and continuously trained to enhance its ability to interact with humans. The true expansion of generative AI occurred with the release of ChatGPT 3.5 by OpenAI (Ayinde et al., 2023; Holland, 2023; OpenAI, n.d.) which marked a revolutionary shift and demonstrated to the public the capabilities and potential of these tools. While ChatGPT is the most widely recognized example, it is not the only tool leveraging generative AI—competing systems include Copilot (Microsoft), Gemini (Google/Alphabet), Claude (Anthropic), Grok (X), among others.

GenAI very often uses LLM (European Commission, 2023; Microsoft, 2023) and is then able to answer queries, edit and paraphrase texts, create literary research or produce original texts according to user requirements, such as reports, essays, short stories or scientific articles. In addition to text generation, it also offers analytical functions such as identifying main ideas, correcting mistakes or solving problems such as mathematical problems. Due to its versatility, generative AI finds applications in many fields, including education at all levels. Of

course, GenAI can also generate photos or other images, music, spoken word and other types of digital content - including, for example, videos.

A new feature is deep research (OpenAI, 2025), which is an advanced, multi-step research process where AI actively and autonomously collects, analyses and synthesises information from various sources on the internet. It is therefore not just a simple answer to a query, but a comprehensive approach that involves specifying the request, systematically searching databases and websites, then analysing and evaluating the collected data, and finally producing a structured report summarising the key findings. This agent-based process allows for a rapid, in-depth view of complex topics, which greatly streamlines research tasks in both academic and commercial settings. Deep research thus extends the traditional capabilities of generative AI and takes it to the level of a tool that not only generates content but also comprehensively supports decision-making processes through thorough verification and integration of information.

Generative artificial intelligence in primary and secondary education

Generative AI is rapidly evolving, and while research on its application in education is still emerging, several studies provide valuable insights into its potential and challenges. In the U.S., Diliberti et al. (2024) found that by late 2023, 18% of K-12 teachers integrated AI into their curriculum, primarily for adapting content and material creation. Similarly, in Uruguay, Jauhiainen & Guerra (2023) demonstrated how AI-personalized educational content improved student engagement and learning outcomes. In mathematics education, Bastani et al. (2024) observed significant improvements in problem-solving skills when high school students used AI-guided learning tools, though the effectiveness depended on the AI's level of interactivity. Research from Brazil (Villan & Santos, 2023) showed that ChatGPT-supported project-based learning increased student motivation and interdisciplinary collaboration. However, challenges persist, as highlighted by Elstad & Eriksen (2024) in Norway, where a lack of clear AI policies and teacher support hindered adoption. In the Czech Republic, Kopecký et al. (2024) found that while over half of students use AI tools, only a quarter engage with them regularly in school settings. Additional research by IPSOS (2025) emphasized the need for AI-literate teachers, with 76% of surveyed students acknowledging the gap in AI integration. These studies collectively suggest that AI can enhance personalized learning, engagement, and efficiency, but its effective implementation requires structured policies, teacher training, and ethical considerations.

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the gap in AI integration. These studies collectively suggest that AI can enhance personalized learning, engagement, and efficiency, but its effective implementation requires structured policies, teacher training, and ethical considerations.

Generative artificial intelligence offers teachers, students, but also, for example, parents, a wide range of possibilities - teachers can use it both in the preparation phase for lessons, as well as during lessons (evocation, awareness, reflection) and, of course, as a tool to support students' home preparation. There are many possible uses. At the same time, however, it is always necessary to observe the ethical principles of AI use - AI should actively support the pupil, not replace his/her activity. (Harry, 2023; Okaiyeto et al., 2023; Osamor et al., 2023; UNESCO, 2023).

In primary schools, generative AI can be used to create personalised learning materials and interactive tasks that meet the age and individual needs of students. With the ability to analyse data on individual student progress, AI makes it easier for teachers to adapt the content and pace of lessons, promoting better understanding of the content and increasing children's motivation. Such an approach also helps develop creative thinking as students are encouraged to experiment with new ideas and concepts. Research shows that the use of generative tools, for example in homework, contributes to greater pupil engagement and more effective learning. (Kopecký Kamil et al., 2024).

Another benefit of AI in primary schools is the automation of feedback and assessment of student work (Spector, 2023), allowing teachers to spend more time interacting directly with children. Indeed, tools based on generative AI can quickly analyse and correct tasks, helping to identify weaknesses in pupils' knowledge and design exercises tailored to their needs. This improves the quality of teaching and reduces the administrative burden on educators. Nevertheless, it is crucial to ensure that the results generated by AI are regularly checked and supplemented by human supervision (Galindo-Domínguez et al., 2024). At the same time, it should be noted that the default setting of AI tools is not entirely neutral, e.g. ChatGPT often provides feedback on e.g. student work, but this is of low quality. Therefore, the AI needs to be instructed via prompts to be truly objective in its evaluation.

Artificial intelligence can also interact autonomously with the pupil, i.e. it can automatically invent tasks for pupils, pupils perform them, the AI evaluates them and motivates pupils further. In case of failure, it can then guide them to the correct solution. This capability can be applied, for example, in the development of simple (but also more complex) educational games or gamified learning situations (Brandon, 2023; Tulsiani, 2024). The range of applications of generative AI is indeed very broad. On the other hand, however, the assignment needs to be thought through so that it is truly functional and supports, not replaces, learner activity. (Kopecký Kamil, 2024)

In secondary schools, the possibilities for using generative AI are expanding towards supporting more complex tasks and projects. Students can use AI to write reports, create more complex texts or even generate visual content, allowing them to better understand and apply theoretical knowledge in practice. Teachers can use these tools to prepare teaching materials, create tests, and automate routine tasks, freeing their hands for guiding discussions and supporting students individually. This approach promotes the development of critical thinking as students are encouraged to validate and modify AI-generated content. On the other hand, it must be taken into account that AI can also be used by students to solve given tasks, with the student himself obtaining the solution without demonstrating his knowledge and skills. In this case, the impact of AI on the pupil is already negative.

We must not forget how to use AI to support students with special educational needs. With the ability to analyze large volumes of data and adapt to individual student needs, AI enables

the creation of personalized learning programs that take into account the unique needs of each student. For example, adaptive learning platforms can track student progress in real-time and automatically adjust the difficulty of assignments or provide specific materials for areas in which a student needs improvement.

In addition, AI offers assistive technologies such as text-to-speech tools or speech recognition to help students with learning disabilities such as dyslexia better understand learning materials. AI-powered virtual assistants and chatbots can provide instant feedback and support, increasing the accessibility of educational resources and allowing students to work at their own pace. These technologies not only improve the accessibility of education but also promote inclusivity by ensuring that every student has equal opportunities to learn and develop.

Methodology

The primary objective of this study is to explore how primary and secondary school students in the Czech Republic use generative artificial intelligence (GenAI), especially large language models (LLMs), in both school-related and extracurricular contexts. The research aims to:

- Identify which GenAI tools are most commonly used by students.
- Examine how students' age, gender, and type of school influence AI usage patterns.
- Analyze the contexts in which teachers interact with GenAI.

Research instrument and data collection procedure

Data were collected using a custom-designed questionnaire created in Google Forms, which was distributed via email to teachers at all primary and secondary schools across the Czech Republic. Participation in the research was voluntary, with teachers deciding whether to involve their students in the study. Data collection took place between 2 September 2024 and 5 December 2024. No pilot study was conducted prior to the questionnaire's distribution. The survey was developed based on expert consultation and previous research experience. Initially, 28,745 responses were recorded; however, following data cleaning - where responses from university students and individuals under the age of 10 were excluded - a total of 27,336 valid responses were analyzed. The data were processed using Julius AI alongside other analytical tools, including Microsoft Excel.

Questionnaire structure

The research instrument followed a mixed-methods design, incorporating both quantitative methods (e.g., closed and scaled questions) and qualitative methods (e.g., open-ended questions). This approach facilitated a nuanced and multidimensional analysis of students' engagement with generative AI.

The questionnaire was organized into several thematic sections, each addressing specific aspects of AI use:

1. Demographics – The initial section collected fundamental respondent information, including biological sex, age, region of residence, and school type.
2. Generative AI in Leisure Time – This section explored students' engagement with generative AI outside the school environment. Participants were asked to specify which AI tools they used (e.g., ChatGPT, Midjourney, DALL-E, Stable Diffusion, Adobe

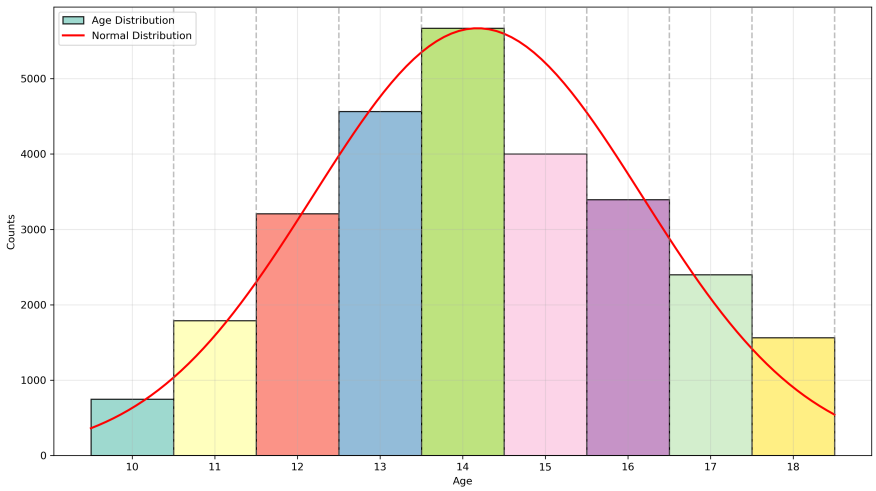
Firefly, Microsoft Designer) and for what purposes, such as completing homework, creating presentations, writing academic papers, or engaging in creative activities.

3. AI in Education – This section examined the presence and application of AI in educational settings. Respondents indicated whether AI was discussed or utilized in school and identified the primary users (teachers, students, or both). Furthermore, they detailed specific AI applications, such as generating graphics, producing text, or supporting school projects.
4. AI and the Future – Participants assessed the significance of AI proficiency and expressed their perspectives on whether generative AI could eventually replace teachers. They were also asked to justify their opinions regarding this potential shift.

Research sample

The final dataset (after data cleaning) comprised respondents aged 10 to 18 years (female = 51.79%, male = 48.21%). The age distribution was analyzed to assess its conformity with a normal distribution. The mean age of respondents was 14.18 years (SD = 1.99). Skewness (0.05) and kurtosis (-0.65) values indicated a relatively flat distribution. Although both the Shapiro-Wilk and Anderson-Darling tests rejected the null hypothesis of normality ($p < 0.001$), visual inspection of histograms suggested that the distribution was sufficiently close to normal for practical purposes.

Figure 1.
Age distribution with normal curve.



n = 27,336

Regionally, the highest proportion of respondents came from the Central Bohemian Region (14.61%), followed by the Moravian-Silesian Region (11.35%) and the South Moravian Region (11.31%). In contrast, the Karlovy Vary Region had the lowest representation (0.82%). Consequently, the data distribution across regions was notably uneven.

In terms of educational levels, the majority of respondents (60.0%) were enrolled in primary and lower secondary education (grades 1–9). The remaining 40% were distributed across

various types of secondary education. Secondary Vocational Schools with a graduation exam ("Maturita") accounted for 18.17% of respondents, followed by Eight-Year Grammar Schools (8.70%) and Four-Year Grammar Schools (7.38%). Secondary Vocational Schools awarding Apprenticeship Certificates represented 3.62% of the sample, while Six-Year Grammar Schools constituted 1.81%. A small fraction of respondents (0.33%) reported attending other types of educational institutions.

Results

Identification of the most frequently used tools

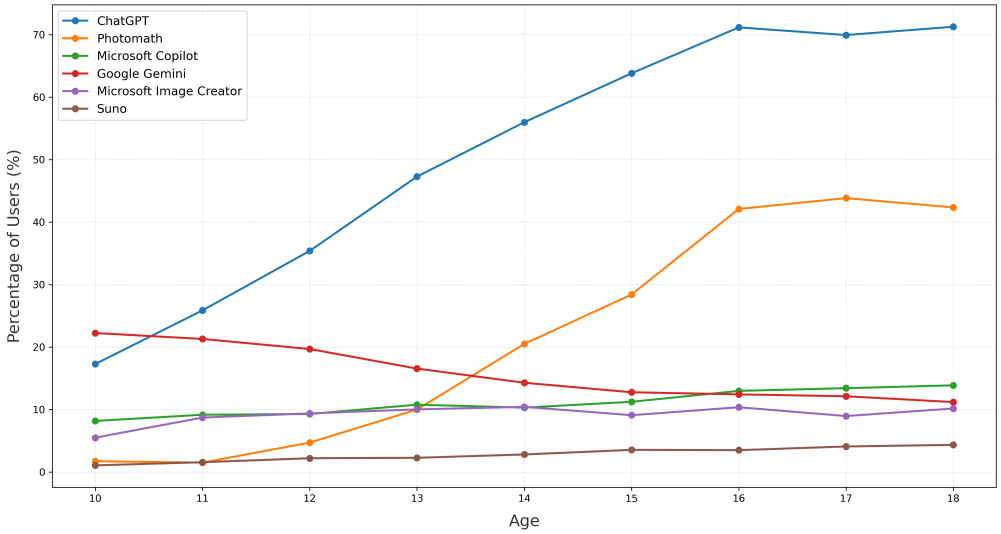
The questionnaire included a question specifically focused on generative artificial intelligence tools, allowing respondents to choose from a predefined list of sixteen widely used tools (e.g., ChatGPT, Microsoft Copilot) or to specify additional tools of their own. This combination of a closed selection and an open-ended response enabled a more comprehensive analysis of the AI tools most frequently utilized by Czech students.

For a more detailed examination, we selected the six most used tools, each of which was reported by at least 2% of respondents: ChatGPT, Photomath, Microsoft Copilot, Google Gemini, Microsoft Image Creator, and Suno. These tools reflect the diversity of AI applications - beyond the three large language models, the selection includes a graphic design tool (Microsoft Image Creator), a specialized tool for solving mathematical problems (Photomath), and an AI-powered music generation tool (Suno).

Age-related patterns in AI tool usage

To better understand how students engage with AI tools, we analyzed usage patterns across different age groups, as illustrated in Figure 2.

Figure 2.
GenAI tools usage by age



n = 27,336

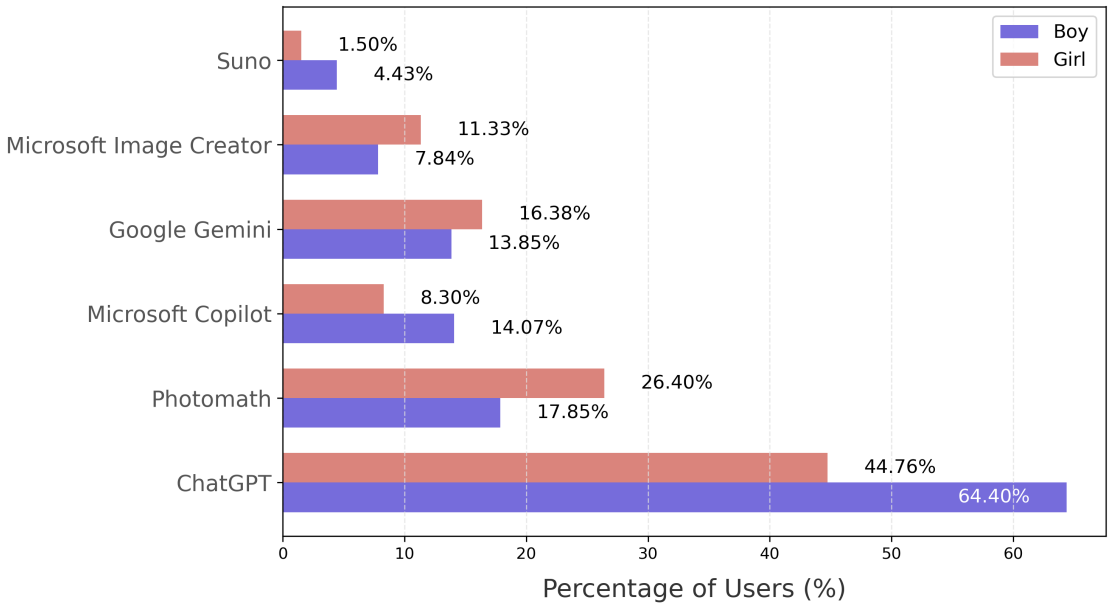
Chi-square tests confirmed statistically significant associations between age and the usage patterns of all six AI tools ($p < 0.05$), indicating that adoption rates vary across different age groups.

Overall, AI tool usage generally increased with age, with the most notable rise observed for ChatGPT, which was used by 17.29% of 10-year-olds and 71.27% of 18-year-olds. Photomath followed a similar trend, peaking at 43.85% among 17-year-olds. Microsoft Copilot, Microsoft Image Creator, and Suno also demonstrated higher adoption among older students, although with less pronounced differences. In contrast, Google Gemini exhibited an inverse trend, showing the highest usage rate among 10-year-olds (22.25%) and the lowest among 18-year-olds (11.20%).

Gender-related patterns in AI tool usage

We also examined whether the usage of selected AI tools differed based on gender, as illustrated in Figure 3.

Figure 3.
AI tools usage by gender.



n = 27,336

Boys and girls engage with AI tools differently, as indicated by our analysis of usage patterns and statistical comparisons. For each tool, usage percentages were calculated separately for boys and girls and two-sample t-tests (assuming unequal variances) were employed to determine whether the observed differences were statistically significant.

The analysis revealed significant gender-dependent disparities in the adoption of certain tools. For instance, ChatGPT displayed an approximately 18% higher usage rate among boys compared to girls, and the corresponding t-test confirmed that this difference was statistically significant ($p < 0.05$). Similarly, Microsoft Copilot also demonstrated significant differences favoring boys, while Photomath exhibited a statistically significant higher usage among girls.

In contrast, although tools such as Google Gemini, Microsoft Image Creator, and Suno presented differences in utilization between the two gender groups, these differences did not consistently reach statistical significance. Importantly, an age-adjusted analysis was also conducted to determine whether the age of users might confound the observed usage differences. Welch's t-test comparing the mean ages of boys (M = 14.16, SD = 1.97) and girls (M = 14.20, SD = 2.01) revealed no statistically significant difference (p = 0.072). This finding indicates that age does not play a confounding role in the observed trends.

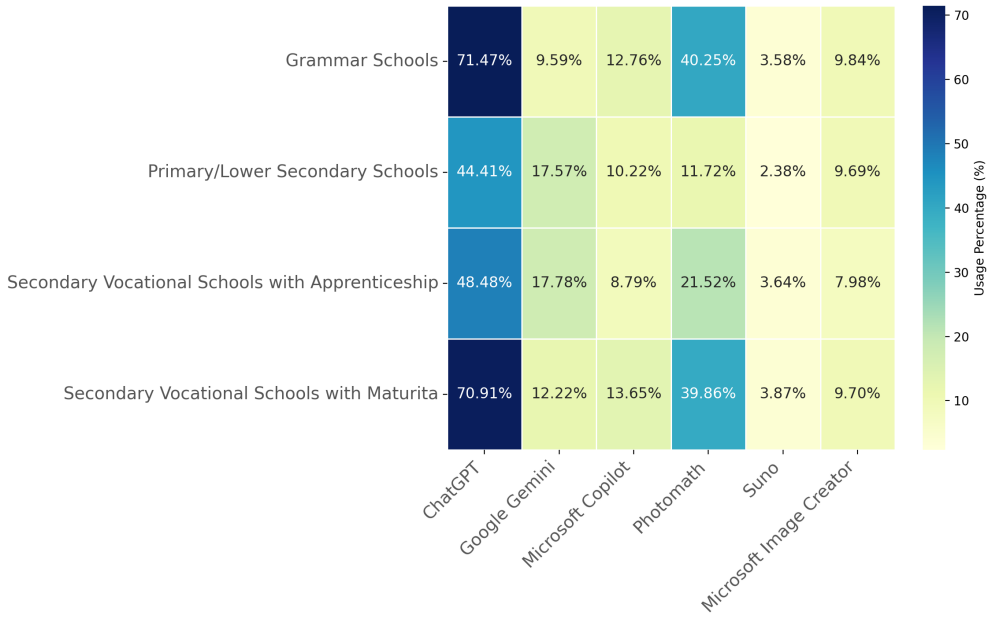
Type of school

Another variable analyzed was the comparison of different school types. To minimize the impact of age on AI usage across different types of schools, we selected only respondents aged 13 and older for this analysis. We focused on the four main types of schools in the Czech Republic.

1. Primary Schools and Lower Secondary Schools (n = 10,986) – the standard compulsory education institutions, where the pupils are typically aged 6 to 15.
2. Grammar Schools (n = 4,591) – selective schools that culminate in a final examination ("Maturita"), which qualifies students for university admission. Admission to these schools is competitive, with students applying at different stages: after the 5th grade (Eight-Year Grammar School), after the 7th grade (Six-Year Grammar School), or after the 9th grade (Four-Year Grammar School).
3. Secondary Vocational Schools (n = 4,959) – these institutions provide specialized secondary education and conclude with the "Maturita" exam, which is a prerequisite for university admission. These schools primarily enroll students from the age of 15.
4. Secondary Vocational Schools with Apprenticeship Certificates (n = 986) – these schools offer training in specific trades (e.g., cook, auto mechanic) but do not include the "Maturita" exam, meaning graduates are not eligible for university studies.

Figure 4.

Using AI at different school levels (13+ years)



n = 21522

The heatmap reveals significant differences in AI tool usage across various school groups, highlighting a growing digital divide in AI adoption.

Grammar Schools and Secondary Vocational Schools with Maturita exhibit the highest engagement with AI tools, particularly ChatGPT (71.47% and 70.91%, respectively) and Photomath (40.25% and 39.86%). This suggests that students in academically demanding programs are more likely to integrate AI into their learning, particularly for text-based and mathematical tasks.

In contrast, Primary and Lower Secondary Schools show lower AI usage, likely due to students' younger age and less academic need for advanced AI tools. ChatGPT adoption, for example, is significantly lower at 44.41%, and Photomath usage is just 11.72%, compared to over 39% in more advanced secondary schools.

Similarly, students in Secondary Vocational Schools with Apprenticeships engage with AI tools less frequently. This might be because their education is more focused on practical, hands-on skills rather than AI-driven academic tasks. ChatGPT usage in these schools is only 48.48%, and Photomath, which is popular among students in more academically focused institutions, is used by just 21.52% of students. Nevertheless, this disparity may indicate a significant digital divide between “Maturita” and “non-Maturita” study programs.

AI-Related school activities

Previous analyses have indicated that the majority of students already use artificial intelligence tools. However, the extent to which generative AI is actively utilized by teachers in the classroom remains an open question. To explore this, students were presented with a list of AI-based activities and asked to select those they had encountered during their lessons. Additionally, an option stating "We don’t use AI at all" was included, which was selected by 61.67% (16,858) of respondents. The specific AI-related activities experienced in the classroom are presented in Figure 5.

Figure 5.
Activities that students do in schools using AI (excluding answer "We don’t use AI at all")

Activity	Absolute frequency	Relative frequency
We generate information with AI and then check together in the classroom if it is correct	3366	12,31%
We use AI to create texts which we then work with	3041	11,12%
With AI in the classroom, we create graphics and edit photos	2761	10,10%
We use AI to solve more complex projects	1914	7,00%
We use smart AI assistants to help us learn	1585	5,80%
The AI generates a test for us which we then try to solve	1351	4,94%
With AI in the classroom, we create animations	1236	4,52%
With AI in the classroom, we create music (for example via Suno)	874	3,20%
We create spoken word with AI in the classroom	586	2,14%

n= 27,336

Discussion

Artificial intelligence is actively used in school environments by both lower secondary and upper secondary school students, with its usage increasing progressively with age. Most students utilize basic functionalities of these tools, such as text generation, graphic design, and music composition.

The findings indicate a clear age-related trend in AI adoption among students. While only 17.29% of 10-year-olds use AI, this figure rises to 71.27% among 18-year-olds. The most commonly used AI applications include ChatGPT, Photomath, Microsoft Copilot, Google Gemini, Microsoft Image Creator, and Suno.

Similar results are reported by the STEM agency (STEM, 2024) which conducted a research survey in the Czech Republic among students aged 11–19. Data were collected through an online questionnaire, with the primary aim of examining Generation Z's learning habits, preferences, and utilization of AI tools in education. The findings suggest that only 25% of students regularly use various online resources and materials for learning. A total of 45% of students reported using AI tools, with ChatGPT being the most popular (89%), followed by Photomath (43%). AI tools are predominantly used in English language, foreign language, and mathematics courses.

There are evident differences in AI usage between male and female students. Surprisingly, while most AI tools are more frequently used by boys, the tool Photomath, which assists in solving mathematical problems, is predominantly used by girls. Assuming that female students use this tool primarily to support their understanding of mathematical exercises, its usage could contribute to gradually reducing the persistent gender disparity in technical fields (Marchant, 2021). For instance, Capinding (2023) found that Photomath can be a valuable tool for teachers to enhance students' confidence, interest, and motivation in pre-calculus mathematics education.

A key finding is that, in most cases, students are ahead of teachers in AI usage. A detailed analysis of tool adoption shows that as early as age 11, more than 20% of students use ChatGPT, with usage steadily increasing to approximately 70% by age 16. In contrast, over 60% of teachers do not integrate AI into their teaching practices. Whether this is due to a lack of AI usage in general or an inability to fully leverage the didactic potential of generative AI remains an open question.

The gap between students and teachers in AI adoption may also manifest in restrictions imposed by educators. According to Czech study (STEM, 2024), 34% of teachers either discouraged or explicitly prohibited AI use in the classroom. The reluctance of teachers to engage with AI may be attributed to various factors including (Bae et al., 2024; Kopecký et al., 2023; Prather et al., 2024):

a) Teachers may lack sufficient methodological support in this area and are unsure how to integrate AI into their teaching practices.

b) They do not believe that AI would enhance the quality of instruction.

c) They distrust this technology.

d) They have no motivation to use AI.

e) They are unwilling to change their established teaching habits.

f) They fear that AI might replace them.

Some studies (Mendoza et al., 2024) have also demonstrated that when teachers participate in training focused on generative artificial intelligence, their willingness to actively integrate AI into their professional practice increases. This might be the key to overcoming the student-teacher disparity

It is also essential to consider ethical aspects (Cavazos et al., 2024; Kopecký et al., 2024). AI should be implemented in a way that fosters meaningful learning and student development rather than replacing their own engagement (e.g., generating homework assignments on behalf of students).

Research conducted in the Czech Republic (Kopecký et al., 2024) has shown that Czech students also engage in unethical AI use. For instance, 33% of students aged 14 and older reported generating homework assignments using AI, 30% used AI to solve mathematical problems or word problems, and 14.6% admitted to using AI to cheat on tests. Therefore, teachers should proactively consider the potential use of AI by students when designing and assigning tasks.

Conclusions

This study offers one of the first large-scale insights into how primary and secondary school students in the Czech Republic engage with generative artificial intelligence (GenAI), particularly large language models. Based on over 27,000 valid responses, the research reveals clear patterns related to age, gender, and school type, and provides a nuanced understanding of how students are already incorporating AI into their everyday learning and creative activities.

The results show that AI adoption increases with age—from 17% among 10-year-olds to over 70% among 18-year-olds. While boys tend to use most GenAI tools more frequently, girls showed significantly higher usage of Photomath, a tool assisting with mathematics. Students at grammar schools and secondary vocational schools with a "Maturita" exam are the most active users of AI, whereas students in apprenticeship programs report the lowest usage, highlighting a digital divide based on school type.

Importantly, the data show that students often use AI more actively than their teachers, with over 60% reporting that AI is not addressed at all in classroom activities. This signals a growing gap between student practices and institutional readiness.

This research provides important empirical evidence on how young people engage with GenAI across different educational settings. Its key contribution lies in uncovering how students themselves perceive and use AI tools, offering practical insights for curriculum developers, teacher training programs, and policymakers. It also highlights the need for greater AI literacy, both in terms of technical use and ethical understanding.

As a self-reported and cross-sectional survey, the study is limited in its ability to track behavior over time or verify the depth of student interaction with AI. It also does not explore how socioeconomic factors, access to devices, or parental support influence AI usage.

Further research should focus on qualitative insights into student motivations, perceptions of AI reliability, and ethical boundaries. Longitudinal studies could help assess how usage patterns evolve and whether early exposure to GenAI impacts academic performance, motivation, or creativity in the long term. Additionally, research should explore effective teacher support systems, as teacher training will be key to closing the current gap between student use and pedagogical practice.

In summary, generative AI offers great potential to support education—but only if implemented thoughtfully, equitably, and ethically. This study demonstrates that students are ready for this future. Now it's time for schools to catch up.

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