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Understanding Student Attitudes toward GenAI Tools: A Comparative Study of Serbia and Austria

Slobodan Adžić[1*], *Tijana Savić Tot*[1], *Vladimir Vukovic*[2], *Pavle Radanov*[3], *Jelena Avakumović*[4]

[1]University Union Nikola Tesla, Faculty of Management FAM, Sremski Karlovci, Serbia,
e-mail: s.adzic@famns.edu.rs; tijana.savictot@famns.edu.rs
[2]University of Applied Sciences Campus Wien, Wien, Austria, e-mail: vladimir.vukovic@edu.fh-campuswien.ac.at
[3]Metropolitan University in Belgrade, Faculty of Management, Belgrade, Serbia, e-mail: pavle.radanov@metropolitan.ac.rs
[4]College of Academic Studies Dositej, Department of Business Economics, Belgrade, Serbia,
e-mail: jelena.avakumovic@vsdositej.edu.rs

Abstract: This study explores university students' attitudes toward generative AI technology and tools in two European countries. Driven by the increasing integration of AI in education and the limited research on student perceptions, particularly in European contexts, this study aimed to understand how students view GenAI and its implications for higher education. The study employed a quantitative approach, using surveys to collect data on student attitudes toward AI across different fields of study, genders, and countries. A key innovation of this research is the development of a novel "Attitude toward AI" scale, designed to provide a robust and theoretically grounded instrument for measuring student perceptions of GenAI. The scale offers a valuable tool for evaluating the effectiveness of AI integration in education. The results showed that students' attitudes toward AI differed significantly based on their field of study and gender. Male students in technical sciences had the most positive attitudes toward AI adoption, indicating their potential to drive positive changes in AI implementation. While the effect size was small, this finding underscores the importance of considering individual factors when designing interventions to promote AI acceptance. The study underscored how prior experience shapes positive attitudes, highlighting the need for resources to familiarize students with GenAI and its ethics. The "Attitude toward AI" scale is a significant contribution addressing the lack of reliable instruments for assessing student perceptions of GenAI, enabling deeper understanding of factors influencing students' adoption, informing targeted interventions for different student groups. Further research is needed on GenAI's long-term impact.

Keywords: *artificial intelligence, ChatGPT, GenAI tools, student attitudes, attitudes scale.*

Introduction

The artificial intelligence market is projected to grow from approximately $200 billion in 2023 to over $1.8 trillion by 2030. GenAI, an AI technique capable of generating various content types (e.g., text, videos, images), is expected to see further significant advancements (Dwivedi et al., 2023; Kasneci et al., 2023). One prominent example is ChatGPT, a GenAI-powered chatbot trained to generate human-like text and perform natural language processing tasks such as text completion, conversation generation, and translation (Baidoo-Anu and Ansah, 2023). ChatGPT's rapid adoption is evidenced by its user base reaching one million within five days and 100 million within a month of its release. Currently, it boasts 180 million users and 14 billion views (approximately 1.5 billion visits per month), solidifying its position as a leading AI application (Duarte, 2024).

The growth of generative AI techniques and tools has disrupted numerous industries, including education, as AI integration in education is gaining momentum. A growing number of academic institu-

*Corresponding author: s.adzic@famns.edu.rs

tions and organizations are embracing this technology (Abdaljaleel et al., 2024; Bannister et al., 2023; Chan and Zhou, 2023a; Kasneci et al., 2023; Michel-Villarreal et al., 2023; Yuk Chan, 2023). Sectors like manufacturing and healthcare have already undergone significant transformation through the incorporation of AI-based solutions, and the education sector is exhibiting a similar trend (Habibi et al., 2023; Yuk Chan, 2023). The open-access release of these tools in late 2022 and early 2023 has sparked substantial shifts in teaching and learning, leading to a rapid expansion of research on their integration into education (Kadaruddin, 2023; Woodford, 2023). The rapid and widespread adoption of GenAI technologies has prompted extensive research exploring the implications and potential of integrating generative AI into educational settings, particularly from the perspectives of key stakeholders: educators, policymakers, and students (Kadaruddin, 2023). GenAI tools like ChatGPT are driving innovation in education, reshaping how students learn, teachers instruct, and institutions operate (Al-Zahrani, 2024; Al-Zahrani and Alasmari, 2024; Chiu, 2024).

One of the key trends of implementing GenAI in education is the development of Individual Adaptive Learning Systems, which use AI algorithms to tailor learning experiences to the unique needs and preferences of individual students (Ezzaim et al., 2024). These systems can analyze student data, identify learning gaps, and provide personalized content and feedback, potentially improving learning outcomes and student engagement (Ezzaim et al., 2024). A Global Student Survey of 11,816 students across 15 countries revealed that up to 40% used GenAI tools, primarily to accelerate learning (Chan and Zhou, 2023c). Despite widespread student adoption, usage patterns vary, and students believe institutions should provide clearer guidance on acceptable GenAI use. Students generally view GenAI positively, appreciating its potential for personalized learning support, writing assistance, and research capabilities (Chan and Zhou, 2023c). GenAI tools can aid researchers in identifying ideas, synthesizing information, and summarizing text, thus improving data analysis, writing composition, and publication efficiency (Berg, 2023; Kitamura, 2023; Van Dis et al., 2023). These tools, particularly text-to-text AI generators like ChatGPT, can benefit students, especially non-native speakers, by generating ideas and providing writing feedback. GenAI can also enhance learning assessment by providing tools for grading and feedback (Crompton and Burke, 2023; Gombert et al., 2024).

Another prominent trend is the integration of AI-based tools that assist teachers in administrative tasks, such as grading, evaluation, and class management. By automating these time-consuming responsibilities, AI enables educators to focus more on teaching and student-centered activities, potentially enhancing the overall quality of education. A 2023 study by Mizumoto and Eguchi demonstrated that ChatGPT can reduce grading time, maintain scoring consistency, and offer instant feedback, potentially transforming higher education by improving student outcomes and revolutionizing teaching and learning (Mizumoto and Eguchi, 2023). Previous research also suggests that AI-based chatbots for learning support can improve student learning achievement, self-efficacy, attitudes, and motivation (Boateng et al., 2022; Lee et al., 2022; Yan et al., 2022). Furthermore, AI-powered Institute Administration Systems are being developed to streamline various administrative processes, such as student enrollment, inquiries, and data management. These systems can help reduce the workload on administrative staff, allowing institutions to allocate resources more efficiently (Murdan and Halkhoree, 2024; Zhang and Goyal, 2024).

In addition to the technological advancements, the educational implications of AI adoption are far-reaching. AI-powered systems can provide personalized feedback and recommendations, fostering a more inclusive and effective learning environment. Moreover, the integration of AI in education can potentially bridge learning gaps, particularly for students with diverse needs or backgrounds (Murdan and Halkhoree, 2024; Zhang and Goyal, 2024).

Despite the potential benefits of GenAI in education, concerns exist regarding accuracy, transparency, privacy, ethics, holistic competencies, career prospects, and human values (Abdaljaleel et al., 2024; Bulut et al., 2024; Chan and Hu, 2023; Peres et al., 2023). Debate focuses on the challenges for teachers, who are expected to integrate this technology (Ferrell et al., 2024; Xu et al., 2024). A study of the top 50 higher education institutions found fewer than half have publicly available guidelines on GenAI, covering academic integrity, assessment design, and student communication (Moorhouse et al., 2023). Generative AI presents both transformative potential and significant challenges for higher education. While the integration of GenAI tools offers opportunities to enhance learning and teaching, concerns persist regarding accuracy, transparency, privacy, ethical implications, impact on holistic competencies and career prospects, and alignment with human values (Abdaljaleel et al., 2024; Bulut et al., 2024; Chan and Hu, 2023;

Moorhouse et al., 2023; Peres et al., 2023)

Existing research on GenAI adoption in education often prioritizes educator perspectives, overlooking the crucial need to understand student experiences and perceptions (Chiu, 2024; Dotan et al., 2024; Shailendra et al., 2024). Investigating student attitudes toward such tools is an initial step to ensure their effective implementation and ongoing improvement in the educational setting. While a substantial body of research has examined tertiary students' perceptions in this area, students' specific views and experiences of GenAI tools remain relatively underexplored (Bosch et al., 2023; Kelly et al., 2023a). Existing research on student perceptions of GenAI tools in higher education frequently focuses on broader technological aspects as well as specific applications using the technology acceptance model (TAM) (Almassaad et al., 2024; Kong et al., 2024). Further research is needed on student perceptions and experiences with GenAI tools, particularly in European contexts as existing studies primarily focus on Western countries (Bannister et al., 2023) and often lack specific investigation into the impact of demographic factors like gender, field of study, and year of study on student perceptions of GenAI (Almassaad et al., 2024; Baidoo-Anu and Ansah, 2023; Chan and Hu, 2023). Moreover, existing research often lacks validated measurement instruments for measuring students attitudes toward AI (Bosch et al., 2023; Kelly et al., 2023a).

This study addresses several key research gaps: a lack of research focusing specifically on student perceptions of generative AI tools, particularly in the European context; a need for a deeper understanding of how demographic factors shape student attitudes toward AI; the absence of validated instruments to measure student attitudes toward AI; and the need for more context-specific research on AI adoption in European higher education, as demonstrated by the comparative approach examining the Serbian and Austrian settings. The AI readiness index ranks Serbia 58th and Austria 15th out of 181 countries (Statista, 2024). Serbia is an Eastern European developing country with a forecasted continuous increase in GDP between 2023 and 2028, totaling 33.3 billion U.S. dollars (+44.39 percent) (O'Neill, 2024b). Austria, on the other hand, is a Western European developed country with an average GDP forecasted to increase by a total of 1.2 percentage points between 2023 and 2028 (O'Neill, 2024a). As developed countries have successfully implemented artificial intelligence, while developing countries are still in the preliminary stages of implementation, it is interesting to compare students' attitudes toward the use of AI tools. Developing countries face various obstacles when implementing artificial intelligence in higher education, including weak infrastructure, limited information access, a lack of institutional support, insufficient resources, and poor technological skills (Cui and Alias, 2024). A comparison of these two countries, which differ not only in their significant ranking level of the AI index but also in their level of economy, will allow us to gain insight into potential similarities and differences in students' attitudes toward GenAI tools. This comparative approach allows for insights into the potential impact of cultural and educational contexts on student perceptions, contributing to the development of effective GenAI integration strategies in higher education.

The study aims to investigate university student attitudes toward AI and GenAI tools in two distinct European countries: Serbia and Austria. Specifically, it examines:

1. Student usage of GenAI tools for academic work: This explores how students are currently utilizing these tools in their studies.
2. Overall attitudes toward AI in education: This assesses students' general perceptions and opinions about the role of AI in education.
3. The influence of demographic factors: This investigates how characteristics such as gender, field of study, and year of study impact student attitudes toward AI and GenAI tools.

The first objective of our study is to investigate the use of AI tools for academic purposes, as outlined in the literature above. We selected thirteen questions to design a research scale that assesses students' overall comprehension of artificial intelligence tools. The purpose of the newly developed AI tools scale is to examine which AI tools students use. The authors' second objective was to examine university students' attitudes toward AI. To identify these attitudes, the authors developed the Attitudes toward AI scale, a behavioristic scale commonly used in the literature (Bruner II, 2019) that measures attitudes between two opposing poles. These contrasting attitudes can be classified as negative versus positive (Baek and Yoon, 2017; Xie and Keh, 2016) or bad versus good (Fischer et al., 2010). The literature contains several articles that explain the positive and negative aspects of AI development, which can serve as a basis for constructing the attitudes toward AI scale in this study. Khakurel et al. (2018), Floridi et al. (2021), Makridakis (2017), and Huh et al. (2023) all expressed positive views on the emergence of AI tools

(Floridi et al., 2021; Huh et al., 2023; Khakurel et al., 2018; Makridakis, 2017). They argue that AI represents a remarkable technological advancement and an opportunity for the development of human society. However, it is important to note that these views are subjective and should be clearly marked. Negative views of AI development include concerns about its potential dangers to humanity and the need for strict limitations and control (Amann and Stachowicz-Stanusch, 2020; Turchin, 2019; Wendehorst, 2020).

By addressing these aims, the study seeks to contribute empirical evidence to the ongoing discussion surrounding AI in higher education and inform the development of effective strategies for integrating GenAI into educational practices. Additionally, the research introduces and validates a new "AI Attitudes Scale.

Literature review

The impact of students' perceptions and experiences of technological innovations, such as GenAI, in educational settings on their likelihood of using the tool and its incorporation into the learning process has been studied (Abdaljaleel et al., 2024; Alzahrani, 2023; Atlas, 2023; Chan and Zhou, 2023b; Crompton and Burke, 2023; Michel-Villarreal et al., 2023; Pradana et al., 2023; von Garrel and Mayer, 2023). Adopting a deep approach to learning, which involves seeking understanding and making connections between concepts, is more likely when students have positive self-perceptions and a supportive learning environment. On the other hand, individuals who are dissatisfied with their education or doubt their abilities may approach learning superficially, focusing solely on memorizing information and meeting qualifications (Parra-Díaz et al., 2024). Research has investigated students' perceptions of GenAI in higher education, including their experiences with the technology and the variables that affect their views, such as gender, discipline, and year of study (Alzahrani, 2023; Baidoo-Anu and Ansah, 2023; Chan and Zhou, 2023c; Elkhodr et al., 2023; Bosch et al., 2023).

A Rhodes University study of 1471 South African students found they were overwhelmingly positive about digital and AI tools' potential to facilitate their university progress (Bosch et al., 2023). Respondents said these tools could help clarify academic concepts, formulate ideas, structure essays, improve writing, save time, check spelling/grammar, clarify instructions, find sources, summarize texts, guide non-English speakers, and assist with referencing and plagiarism. The language is clear, objective, and formal. Many students found AI tools like ChatGPT helpful for clarifying concepts they couldn't fully grasp or that weren't properly explained. Most AI tool users were English speakers, with first-years using them for referencing, plagiarism checks, and grammar. On plagiarism, students didn't consider AI tool use as plagiarism, though those unfamiliar with ChatGPT were more likely to view it as such. This study provides insights into how underrepresented Global South students use AI to enhance learning, though self-reported, cross-sectional data limit generalizability. Students' conflicted AI views reflect a complex reality, making firm conclusions difficult. The results may not apply to different educational environments.

A Hong Kong study of 399 undergraduate and postgraduate students across disciplines found a moderate positive correlation between frequency of use and understanding of GenAI technologies (Chan and Hu, 2023). Students generally demonstrated good understanding and ease of use, but expressed concerns about the impact on university education value. Significant differences emerged between frequent and infrequent users. Overall, the results suggest students have a positive attitude toward GenAI's potential for personalized learning, writing assistance, and research, but also express concerns about privacy, ethics, and holistic skill development. The mixed-methods approach provides comprehensive insights, with the Hong Kong focus adding regional context. However, limitations include small sample size, self-reported bias, and lack of longitudinal or learning outcome data. The findings can inform strategies for integrating GenAI and addressing ethical issues, with broader implications.

Using expectancy-value theory, Chan and Zou (2023) investigated students' intention to use GenAI in an educational setting. They examined the influence of knowledge, familiarity, perceived value, and cost. The study was conducted among 405 university students in Hong Kong. The results showed that students' perceptions of the utility of GenAI had the greatest impact on their intentions to use these technologies. Most participants acknowledged the potential benefits of GenAI in the workplace, including improved learning outcomes such as enhanced academic achievement and digital competence. Students also found utility in features such as boosted productivity, instantaneous individualized feedback, and assistance with idea generation (Chan and Zhou, 2023c). This study contributes significantly by creating a validated instrument based on Expectancy Value Theory to assess student perceptions of generative

AI. Using a rigorous approach, the study demonstrates the instrument's reliability and validity, making it a useful tool for future research. The findings emphasize the importance of perceived value and cost in determining students' GenAI use intentions, which are critical for successful GenAI integration. However, the study's shortcomings include a sample that may not adequately represent the larger population, a cross-sectional methodology, and self-reported data biases. The assessment and insights can be used to guide initiatives aimed at encouraging students to have favorable attitudes toward GenAI and to use it responsibly. Despite its limitations, the study makes a significant contribution by providing a solid tool for measuring student impressions of GenAI.

A comparative study examined university students' attitudes and perceptions toward artificial intelligence, focusing on business and education majors (Almaraz-López et al., 2023). The findings revealed that students in both fields recognize AI's importance for their future careers. However, business students hold a more optimistic view, perceiving AI as a threat that could replace some professional roles. As students advance, their perception of AI's benefits increases while risks decrease. The surveyed population, including economics, business, and education students, is not well-versed in AI concepts and terminology. Though students see advantages like data analysis and personalized learning, they acknowledge limitations, such as relying on generated content accuracy. The study provides insights by comparing perspectives across disciplines, using a mixed-methods approach. The emphasis on academic fields allows for nuanced comparisons and field-specific AI concerns. The verified survey enhances the study's rigor. However, the single-institution sample and self-reported data limit generalizability and introduce bias. More coding and reliability details for the qualitative analysis would be beneficial, and the AI focus may restrict practical applications. The findings are important for educators, developers, and politicians interested in how students perceive AI across disciplines. Field-specific insights can guide specialized AI integration tactics. The comparative approach provides insights into how disciplinary environments impact student perspectives. Despite limitations, the study offers valuable insights into student AI perceptions across fields, which can strengthen future research on AI's role in higher education.

A recent study of 2,240 university students in Arab countries examined factors influencing their attitudes and usage of ChatGPT(Abdaljaleel et al., 2024). Key determinants were ease of use, positive technology attitude, social influence, perceived usefulness, behavioral/cognitive factors, low perceived risks, and low anxiety. This study offers valuable insights into student perceptions and use of ChatGPT across multiple countries. Strengths include a large, multinational sample and the TAME-ChatGPT instrument for evaluating adoption determinants. Critical elements found to impact ChatGPT adoption were perceived ease of use, utility, attitude toward technology, social influence, and behavioral/cognitive characteristics. This information is crucial for effectively integrating AI tools into education. However, the study has limitations. The convenience sampling method may introduce selection bias, limiting generalizability. The cross-sectional design restricts causal analysis and tracking of attitude/usage changes. Self-reported data raises concerns about biases. Additionally, differences in participants' ChatGPT experience were not accounted for. The findings are relevant to educational institutions and policymakers seeking to understand and address ChatGPT uptake issues. The identified determinants can guide focused interventions and strategies for responsible, effective AI integration in education. Despite these limitations, the study provides valuable insights into factors influencing university students' attitudes and usage of ChatGPT.

Parissi et al.'s (2023) research sheds light on how students' research skills influence AI acceptance (Parissi et al., 2023). Skilled students, who can define demands, design methods, and critically evaluate, are more likely to investigate and effectively use AI, assessing its trustworthiness and limitations. In contrast, less experienced students may fail to integrate AI due to unfamiliarity or difficulties assessing AI-generated content. These diverse reading levels present both opportunities and challenges for AI in education. Highly literate pupils can use AI to complete complex tasks, but there are restrictions and worries about AI's integrity. AI can help less literate children develop basic skills, but it also risks disinformation and over-reliance, needing cautious review. This necessitates incorporating AI literacy with information literacy instruction. Addressing ethical issues around plagiarism, privacy, and responsible AI use is crucial. Guidance on selecting appropriate AI tools will empower students to navigate the evolving AI landscape. By addressing challenges and opportunities, educators can equip students at all levels to use AI responsibly and ethically. The study uses a qualitative approach, observing seven students solving three information problems over a semester. A key finding is that the didactic intervention, based on the Big6 model and online search tools, led to students utilizing a greater variety of actions to locate information. The study

highlights the positive influence of structured information literacy training on students' search behaviors. It doesn't directly address AI or GenAI tools, but its focus on information-seeking behavior is relevant in the broader context of how students engage with information, including that generated by AI.

Lavidas et al.'s (2024) study on AI usage among Greek humanities and social sciences students sheds light on the elements that drive AI adoption in academia (Lavidas et al., 2024). Using the Unified Theory of Acceptance and Use of technological model, the researchers discovered that expected performance, prior technological habits, and enjoyment had a substantial impact on students' intents to use AI. Students who believed AI may improve their academic performance, were familiar with technology-mediated learning, and found AI tools enjoyable were more likely to show a desire to utilize them. Furthermore, the study found that behavioral intention, habit, and conducive settings were strong predictors of actual AI use. This emphasises the need of not only promoting positive views toward AI, but also providing the essential infrastructure and support for its effective implementation. Notably, the study discovered no moderating effects of gender or years of study on the connection between UTAUT components and AI usage intentions or behavior. The authors speculate that the sample's homogeneity may have contributed to this finding, underlining the need for further study with more diverse populations to investigate potential moderating influences. It's important to recall that the study's concentration on arts and social sciences students at a Greek institution restricts the generalizability of its results. More research in varied cultural and academic settings is required to acquire a more complete knowledge of the elements that influence AI adoption in higher education.

Aravantinos et al. (2024) propose a thorough review of AI applications in primary education, which provides significant insights into developing trends (Aravantinos et al., 2024). Their analysis categorizes research aims, learning material, outcomes, and pedagogical methodologies, offering a snapshot of the current situation. However, the study had certain drawbacks. The methodical methodology that follows PRISMA principles promotes methodological rigor and replicability. The emphasis on primary education covers an important, although frequently disregarded aspect of AI integration, providing insights into early acceptance. The complete categorization provides a foundation for understanding the various AI applications in this setting.

The dependence on the SCOPUS database may exclude relevant studies, resulting in publication bias. The insufficient empirical evidence limits conclusions regarding AI's usefulness, focusing on what is investigated rather than how effectively it works. The restricted age range may not convey AI's varied impact during the elementary school years. The lack of contextual analysis hinders our understanding of aspects such as teacher training, resources, and demographics, all of which may influence AI adoption. The findings are useful for educators, academics, and policymakers interested in AI in primary education. The study's framework can help to shape future research, teaching, and policies. It emphasizes the necessity for additional empirical research to assess AI tools and solutions. Further study should broaden the database search, focus empirical investigations, investigate contextual factors, and carry out longitudinal studies. Addressing these limitations will provide a more comprehensive understanding of AI's potential and challenges in primary education.

Recent studies explore students' attitudes towards generative AI (GenAI) in higher education across various cultural contexts. Students generally exhibit positive perceptions of GenAI, recognizing its potential for personalized learning, writing assistance, and research support (Chan and Hu, 2023). However, concerns about accuracy, privacy, and ethical issues persist (Chan and Hu, 2023; Yusuf et al., 2024). Gender, degree level, and prior AI knowledge influence students' perceptions of GenAI tools' efficiency, interaction, and affect (Daher and Hussein, 2024). Cultural dimensions significantly correlate with views on GenAI benefits and concerns, highlighting the need for culturally responsive policies (Yusuf et al., 2024).

Yusuf et al. (2024) make substantial contributions to understanding the cross-cultural implications of GenAI in higher education (Yusuf et al., 2024). Their large-scale survey of 1217 participants from 76 countries offers a comprehensive view of student usage, benefits, and concerns. The study's multicultural perspective is a crucial strength, allowing for a more nuanced understanding of how cultural influences influence views and use of GenAI. The complete data collected on many elements of GenAI usage, such as awareness, familiarity, prior experience, intended use, perceived benefits, and concerns, provides a holistic picture of student interaction with this technology. Critically, the work addresses ethical issues surrounding GenAI, such as academic dishonesty and the need for ethical rules. Regardless of its strengths,

the study's approach deserves consideration. While the huge sample size is favorable, online surveys have disadvantages, such as self-selection bias and potential disparities in answer quality between ethnic groups, which must be noted. The findings' generalizability to all cultural contexts may be limited, necessitating additional research focused on specific locations or cultural groupings. The scope of the research may also limit the depth of analysis of certain cultural factors. Future research could explore more into the precise cultural reasons underlying the observed disparities in views and behavior. Finally, while the study raises concerns and benefits, more research on the practical implications for educators and policymakers is required.

The Bannister et al., 2024 study includes numerous significant contributions (Bannister et al., 2024). It focuses on the frequently ignored interactions of overseas students with generative AI in higher education. By examining academic integrity regulations, it provides insights into how institutions are responding to GenAI and its implications for academic honesty, providing potential best practices. Furthermore, the study situates its analysis within the broader context of higher education commodification, exploring how this trend might influence international students' interactions with GenAI. Despite its strengths, the study has some limitations. The analysis of 142 higher education institution policies may not fully represent global practices, potentially limiting the generalizability of the findings. Additionally, the study focuses solely on policy analysis and doesn't directly incorporate the perspectives of international students themselves. Gathering their input would provide a richer understanding of the challenges and opportunities they encounter. Finally, similar to Yusuf et al., 2024, the study lacks specificity regarding the GenAI tools relevant to international students, which hinders the development of practical recommendations.

The two studies offer differing perspectives on GenAI's impact on higher education. Yusuf et al. provide a comprehensive overview of student perceptions across diverse cultural contexts, while the other study investigates institutional responses and the particular challenges confronting international students. Synthesizing the findings, two key takeaways emerge: First, cultural context is crucial, as cultural values influence how students perceive and use AI, underscoring the need for culturally sensitive approaches to AI integration in education. Second, policy gaps exist, as academic integrity policies may not adequately address the challenges posed by AI, especially for international students. It is imperative that institutions adapt their policies to ensure fairness and academic integrity amid the increasing prevalence of AI-based technologies. International students may be particularly susceptible to the ethical and practical challenges associated with GenAI, necessitating tailored support and resources to address their unique needs.

Further research is required to elucidate the interplay between cultural contexts, institutional policies, and student experiences, with the goal of developing effective strategies for the responsible integration of GenAI in higher education. Gathering qualitative data from diverse student populations, including international students, would enhance understanding and inform the implementation of more efficacious intervention strategies. Additionally, a focus on specific GenAI tools and their functionalities would provide more practical guidance for educators and policymakers.

Daher and Hussein's (2024) research looks into higher education students' opinions of Generative AI tools for learning, focusing on four essential components: efficiency, interaction, affect, and intention (Daher and Hussein, 2024). Their mixed-methods approach, which includes a questionnaire with 153 responses and interviews with ten students, provides a detailed knowledge of student viewpoints. The key findings show that GenAI tools are typically viewed positively. Students expressed medium levels of perceived efficiency and interactivity with the tools, as well as a strong intention to use them for learning. Affect, or the emotional response to GenAI tools, was also recorded at a moderate degree. The study also investigates demographic aspects. Male students had considerably greater judgments of efficiency, affect, and intention than female students, but perceptions of interaction did not differ significantly between genders. Surprisingly, only the level of degree pursued altered the perception of interaction, with Ph.D. students reporting higher levels than B.A. Furthermore, prior technology and AI expertise were found to be favorably connected with perceptions of efficiency, interactivity, and impact. While the study provides useful information, some limitations must be acknowledged. While the sample size is appropriate for the questionnaire, it is very small for the interviews, which may restrict the generalizability of qualitative results. The study's concentration on a single university may limit the conclusions' wider application. Future study could evaluate these perspectives in a variety of institutional and cultural contexts, as well as the long-term influence of GenAI tools on educational results.

Previouse studies explores university students' perceptions and experiences with generative AI

tools in educational settings and cover a range of topics related to AI in education, from specific GenAI tools to broader AI applications. They employ various methodologies, including surveys, systematic reviews, and policy analyses (Abdaljaleel et al., 2024; Almaraz-López et al., 2023; Aravantinos et al., 2024; Bosch et al., 2023; Chan and Hu, 2023; Chan and Zhou, 2023c; Lavidas et al., 2024; Parissi et al., 2023) The findings indicate that students generally have positive attitudes towards GenAI, recognizing its potential for personalized learning, writing assistance, and research support. However, concerns about accuracy, privacy, and ethical implications persist (Abdaljaleel et al., 2024; Chan and Hu, 2023). Influential factors such as ease of use, social influence, and perceived usefulness significantly impact students' attitudes. While these studies provide valuable insights into various aspects of AI adoption, they often lack a comparative cross-cultural perspective comparison that allows a deeper understanding of how cultural factors might influence perceptions and usage of GenAI, which is crucial for developing effective and culturally sensitive strategies for AI integration in higher education

Empirical research on potential gender differences in attitudes toward technology use has been active for several decades, reflecting the long-standing concern about the gender gap in the technology workforce. However, inconsistent findings across individual studies make it difficult to draw firm conclusions on this issue (Daher and Hussein, 2024; Gesser-Edelsburg et al., 2024). Gender differences in students' attitudes toward the use of GenAI tools are rarely reported. While one study found that gender did not have a direct impact on attitudes toward emerging technologies (Alghamdi et al., 2022; Baidoo-Anu and Ansah, 2023; Pellas, 2023) other findings have suggested a moderate effect (Xia et al., 2023; Zhou and Sanfilippo, 2023). Therefore, the question of whether attitudes toward technology use differ significantly based on gender remains unclear, warranting further research (Strzelecki, 2023).

Research on university students' attitudes toward GenAI tools across disciplines is inconclusive. While some studies indicate differences (Alzahrani, 2023; Kelly et al., 2023b; Smith and Storrs, 2023) others report no differences (Chan and Hu, 2023). Students in science and engineering appear to have greater awareness, experience, and confidence in using GenAI compared to healthcare students. However, research is limited, and further exploration of disciplinary differences is needed (Chan and Hu, 2023; Kelly et al., 2023b). A study at an Australian institution revealed most students lacked knowledge, expertise, and confidence in using these technologies (Kelly et al., 2023b). Findings varied by discipline and student subgroups, including international and mature students. Yet, some students felt comfortable with tools they had not used before .

Research suggests university students perceive GenAI as a useful and enjoyable learning resource that improves functionality and comprehension. Perceived value strongly predicts their intention to use it, though concerns about accuracy, privacy, and ethics are also expressed.

Students use tools like Grammarly and Criterion for formative writing due to their instant feedback on grammar, spelling, and punctuation (Rejeki, 2023; Shadiev and Feng, 2024). QuillBot is used for paraphrasing and summarizing (Rejeki, 2023). An experimental study found Grammarly students viewed the feedback as clear and helpful, despite no writing development differences (Shadiev and Feng, 2024). Those unfamiliar may struggle to understand Grammarly's feedback (Fan, 2023).Studies show AI tools like Plot Generator and chatbots enhance language acquisition and communication in the target language by aiding grammar and brainstorming (Chigwada and Pasipamire, 2024; Liu et al., 2024). Gayed et al. found students perceived a GenAI tool based on GPT-2 as user-friendly and effective for improving English (Gayed et al., 2022). Raman et al. investigated students' intentions to use ChatGPT in Indian higher education (Raman et al., 2023). Students believe AI can be useful in academic administration and teaching, but not for admissions, testing, or placements. ChatGPT adoption was highly influenced by innovation, compatibility, and user-friendliness. Gender differences emerged, with males preferring compatibility, usability, and observability, and females preferring usability, compatibility, relative advantage and trialability. A study on ChatGPT acceptance found social influence, performance expectancy, and effort expectancy significantly impact behavioral intentions (Strzelecki and ElArabawy, 2024). Gender and study level moderated relationships, but results were inconclusive. Research conducted at Vietnamese University on the benefits of ChatGPT among 230 students revealed that they considered it to save time, provide information in various areas, offer personalized tutoring and feedback, and illuminate ideas in writing (Ngo, 2023). However, one of the main concerns indicated by students is their inability to assess the quality and reliability of sources, accurately cite sources, and use idioms and synonyms correctly.

Materials and Methods

The ontological stance of the researcher is rooted in objectivism, which posits that reality, in this context artificial intelligence (AI), exists independently of the actors involved, specifically the students. The epistemological position adopted by the researcher is positivism. Positivists maintain that objective scientific facts can only be gathered through empirical methods. Consequently, the research strategy employed by positivists is grounded in quantitative research methods. Within this framework, research findings are regarded as objective and generalizable. As a scientific approach that emphasizes structure, quantification, generalization, and testable hypotheses, the deductive approach is predominantly aligned with positivist research philosophy. The research strategy of the investigator is exploratory, as exploratory research seeks to investigate or clarify the understanding of a particular question, issue, or phenomenon, namely AI in this study.

This exploratory research had two objectives. The first objective was to determine the practices of students regarding the use of artificial intelligence (AI), specifically ChatGPT, and AI-based tools. The second objective was to ascertain the attitudes of students toward AI. A quantitative research strategy and a survey were chosen as the research tools.

By employing statistical methods, quantitative approaches not only facilitate the numerical description of phenomena but also assist in identifying relationships between two or more variables, which is the intent of the researcher in this study. Surveys are particularly suitable for inquiries regarding attitudes, and scales are widely utilized in questionnaires within the social sciences.

The research was conducted at universities in two non-English speaking European countries, Serbia and Austria, from December 2023 to February 2024 in Serbia and from January to February 2024 in Austria. The initial sample was intentionally selected from individuals who studied in Serbia or Austria using purposive sampling techniques. In the context of purposive sampling, participants are selected based on specific characteristics predetermined by the researcher, which in this instance are students, as their perspectives on artificial intelligence constitute the focal point of the study. However, the method for obtaining scores within that sample was random. This randomness aids in mitigating the influence of both known and unknown factors through the random selection of cases. Ideally, such randomization techniques afford each individual within the population an equal opportunity to be included in the sample, and, more critically, facilitate the application of inferential statistical methods during the analysis of the results.

The survey was anonymous, and participation in the student survey was voluntary. The responses were collected electronically through a questionnaire created using Google Forms. The online questionnaire was completed by 240 respondents, three of whom were not students. Those three respondents were excluded as invalid. The sample of Serbian students comprised 202 participants, significantly larger than the sample of Austrian students, which consisted of 35 participants. The sampling process in Austria was administered by the institution, limiting the researchers' ability to influence the number of respondents. Consequently, the research process extended over three months, during which the number of students in both groups, categorized by country of study, did not reach a satisfactory level for conducting statistical tests based on a priori power analysis results. Based on the central limit theorem, statisticians have established that a sample size of 30 or more typically yields a distribution of means that closely approximates a normal distribution. Consequently, a recommendation of a minimum sample size of 30 for statistical analyses serves as a valuable practical guideline for the least number of cases in each category within the overall sample, as the authors achieved in this research. All participants provided their consent to participate in the research and to use the obtained results for academic purposes in writing a scientific paper.

The survey was created in three languages: Serbian for Serbia, German for Austria, and English for the purpose of writing this paper. The questionnaire consisted of 30 questions, five of which were demographic questions, while one was an open-ended question for participants' comments. In terms of measurement, the closed-ended questions in the survey were categorized as scale types, specifically ordinal and nominal. The questionnaire included two new scales created specifically for this research, namely, the AI tools, which is composed of 13 questions, and the attitudes toward AI, which consists of 7 questions. The Likert scale, recognized as the most commonly utilized type of scale in research, was also selected for this study. Participants' attitudes and opinions were assessed on a scale ranging from 1 to 5, where 1 indicated complete disagreement and 5 indicated complete agreement. Descriptive measures

and parametric statistical techniques were employed, including the power test, independent samples t test (Student's, Welch's, and Yuan's), Bayesian independent samples t test, one-way analysis of variance (ANOVA), Bayesian ANOVA, two-way between-groups ANOVA, and correlation (Pearson product–moment correlation coefficient).

Parametric tests are generally regarded as more robust than non-parametric tests, and their use is recommended in social research. An a-posteriori power analysis was conducted to ascertain the true effect size, thereby confirming the sensitivity of the tests. For hypothesis testing in this quantitative study, t-tests were employed for two variables, while ANOVA was utilized for three variables. In light of the selection of parametric tests, both the traditional Student's t-test and Welch's t-test were applied for variables with unequal variances, along with Yuan's test or robust t-test for variables where there was a risk of Type II error based on the power analysis. Finally, to examine the impact of two independent variables in combination on a dependent variable, a two-way between-groups ANOVA was employed. Reliability analysis and factor analyses (principal component analysis and principal axis factoring) were conducted to test the scales. The data analysis was conducted using IBM SPSS Statistics 25 (for descriptive statistics, t-tests, and two ANOVAs), JASP 0.18.3 (for power analysis and factor analysis), and jamovi 2.3.28 (for Bayesian tests and robust t-tests).

Results

Responses were obtained from 337 valid participants (N=337), of whom 202 (85.23%) were from Serbia and 35 (14.77%) were from Austria. In terms of gender, the majority (158 or 67%) were female, 77 or 33% were male, and two students chose not to disclose their gender. The highest number of students belonged to the business studies field (40.93%), followed by students in the technical sciences (31.65%) and social sciences (14.35%). The remaining students accounted for less than 10% of the sample, including natural sciences (6.33%), medicine (5.06%), arts (1.27%), and one student in humanities (0.42%). For the purpose of the ANOVA tests, these seven groups of students were divided into three groups, namely, 97 students in business studies, 75 students in technical sciences, and 65 students in other fields of study. In terms of academic year, the highest number of students were in their first year (93), followed by fourth-year students (71), third-year students (27) and second-year students (21) following suit. There were 20 master's students in the sample and five doctoral students. These students were also grouped into three groups for the purpose of ANOVA: the first group consisted of students in the first two years of undergraduate studies (48.10%), the second group consisted of students in the second two years of undergraduate studies (41.35%), and the third group consisted of graduate students (10.55%).

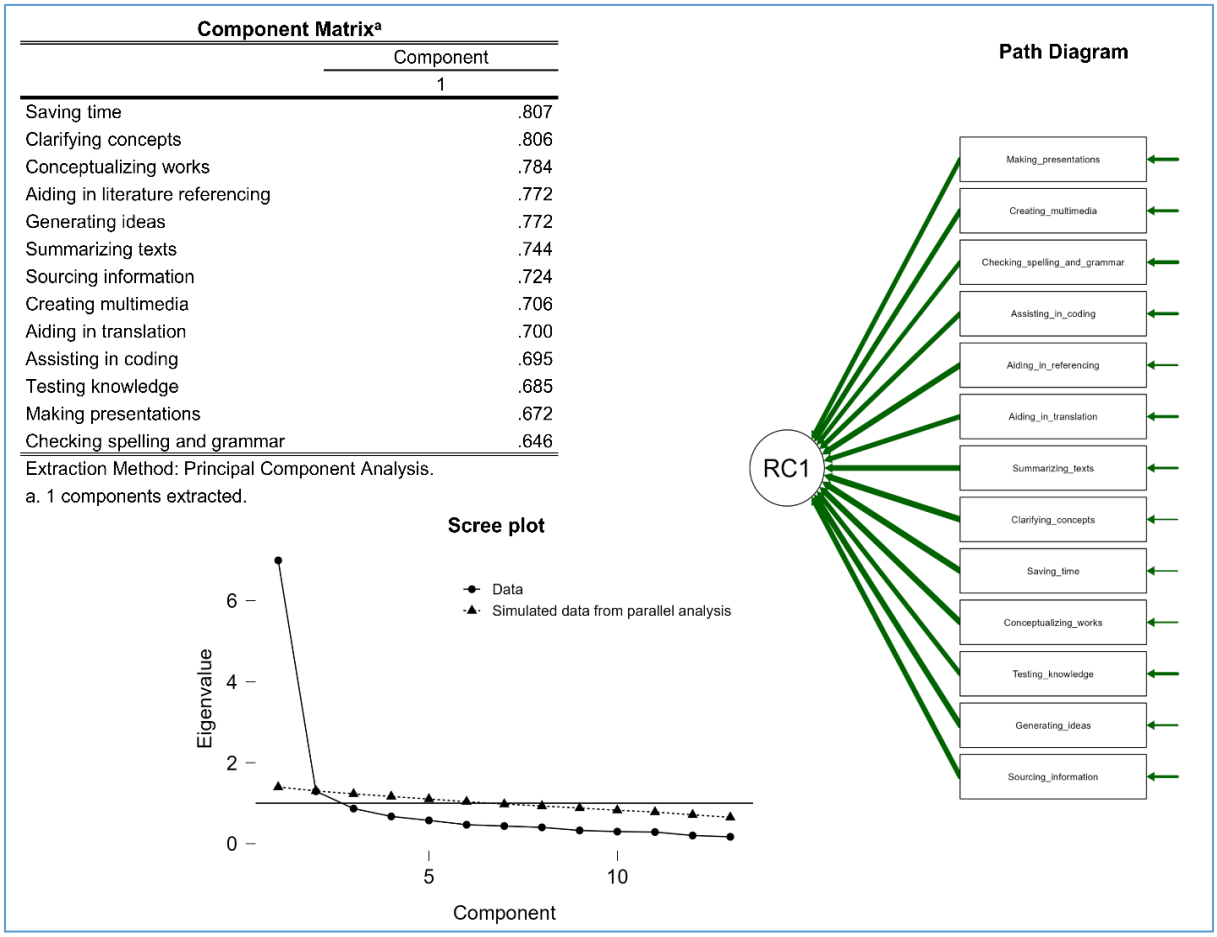
To determine which existing AI tools students utilize in their work, we developed a scale called "AI Tools", which consists of 13 variables, and calculated the mean values (Table 1). Subsequently, we assessed the reliability of the scale. The resulting Cronbach's alpha coefficient was .927. Consequently, we can assert that the internal consistency of our "AI Tools" scale, comprising 13 items, is truly exceptional, as values above 0.8 are preferred.

To assess the honesty of the respondents, particularly whether they provided automatic responses to Likert-type questions in these self-administered surveys, Harman's single-factor test was conducted. We performed a principal axis factor analysis with one fixed factor and obtained a result of 48.20%, indicating that a single factor accounts for 48.20% of the variance in the data, which falls below the threshold of 50%. This implies that there is no issue of common method bias.

Table 1. *Results of the AI tools scale, in descending means*

	N	Mean	Std. Deviation
Saving time	237	3.30	1.581
Sourcing information	237	2.98	1.493
Clarifying concepts	237	2.90	1.469
Summarizing texts	237	2.87	1.530
Generating ideas	237	2.81	1.394
Aiding in translation	237	2.64	1.561
Conceptualizing works	237	2.57	1.387
Average grade	237	2.54	1.051
Testing knowledge	237	2.46	1.439
Assisting in coding	237	2.23	1.459
Aiding in literature referencing	237	2.22	1.415
Checking spelling and grammar	237	2.16	1.364
Making presentations	237	2.04	1.374
Creating multimedia	237	1.82	1.170
Valid n (listwise)	237		

Figure 1. Factor Analysis of the AI tools scale



The 13 items of the Attitude toward AI Scale were subjected to further analysis through principal component analysis (PCA). We conducted a factor analysis and determined that our scale is suitable for analysis, as indicated by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, which yielded

a value of .911, surpassing the recommended threshold of .6. Additionally, Bartlett's test of sphericity yielded statistically significant results ($p < .001$). The component matrix highlights the factor loadings for the tasks associated with AI usage. All items loaded strongly onto a single component (RC1), representing the practical benefits of AI tools. Tasks with the highest loadings include "Saving time" (loading = 0.807), "Clarifying concepts" (loading = 0.806), and "Conceptualizing works" (loading = 0.784). Lower, but still significant, loadings include tasks such as "Making presentations" (loading = 0.672) and "Checking spelling and grammar" (loading = 0.646). The scree plot confirms the retention of one component, with the first component demonstrating a significantly higher eigenvalue compared to subsequent components. Through principal component analysis and examination of the screeplot (Figure 1), we identified the presence of one component with an eigenvalue of 6.99, explaining 53.80% of the variance. The path diagram illustrates the single-factor solution, with all observed variables loading onto the latent construct (RC1). The Oblimin rotated solution demonstrated the presence of a simple structure, with all variables strongly loading onto a single component, as depicted in Figure 1. The diagram visually emphasizes the broad utility of AI tools across a wide range of academic tasks. Given that this scale encompasses a comprehensive list of AI tools, the unidimensionality of the scale was not unexpected. The findings highlight the broad acknowledgment of artificial intelligence's significance among students in enhancing and optimizing both cognitive and practical processes.

To determine attitudes toward AI for the purpose of inferential statistical tests, we developed the "Attitude toward AI" scale. Originally, this scale consisted of 7 variables, 3 of which were negative and were reversed for further testing (Table 2). The calculated Cronbach's alpha coefficient was .780. Hence, we can infer that the internal consistency of our original scale is satisfactory, as values above .7 are deemed acceptable. Nevertheless, one item in our scale (AI should be strictly limited and controlled Transformed) exhibited a negative correlation during testing. Upon its exclusion from the scale, the Cronbach's alpha coefficient for the remaining six items increased to a more favorable .795, with no negative correlation observed during testing. The revised scale (Table 3) served as the foundation for all subsequent tests. Principal axis factoring analysis revealed that there was no common method bias in our new Attitudes toward AI scale data, as 47.65% of the variance on a single factor was below the threshold of 50%.

Table 2. *The results of the first Attitudes toward AI Scale, in descending means*

	N	Mean	Std. Deviation
AI represents a remarkable technological advancement	237	3.86	1.200
The emergence of AI tools is a positive thing	237	3.35	1.207
I am glad that AI has been invented	237	3.17	1.307
Average grade	237	3.14	0.852
I believe that AI is a danger to the human race Transformed	237	3.12	1.296
AI represents an opportunity for the development of human society	237	3.05	1.325
I am afraid of further AI development Transformed	237	2.99	1.397
AI should be strictly limited and controlled Transformed	237	2.40	1.342
Valid N (listwise)	237		

Table 3. *Results of the new and improved Attitudes toward AI Scale, in descending means*

	N	Mean	Std. Deviation
AI represents a remarkable technological advancement	237	3.86	1.200
The emergence of AI tools is a positive thing	237	3.35	1.207
Average grade	237	3.26	0.907
I am glad that AI has been invented	237	3.17	1.307
I believe that AI is a danger to the human race Transformed	237	3.12	1.296
AI represents an opportunity for the development of human society	237	3.05	1.325
I am afraid of further AI development Transformed	237	2.99	1.397
Valid N (listwise)	237		

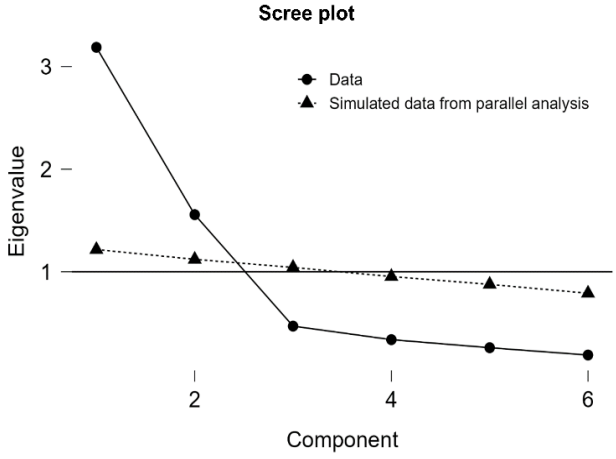
Our novel AI Attitudes Scale could be further simplified through factor analysis. The scale was deemed appropriate for analysis due to the KMO measure of sampling adequacy at .763, exceeding the recommended value of .6. Additionally, Bartlett's test demonstrated statistical significance at $p < .001$. The component matrix reveals the factor loadings for the items, indicating strong correlations between specific items and their respective components. The first component (RC1) is characterized by positive perceptions of AI, including statements such as "The emergence of AI tools is a positive thing" (loading = 0.908) and "I am glad that AI has been invented" (loading = 0.905). The second component (RC2) reflects concerns about AI, as evidenced by high loadings for items such as "I am afraid of further AI development" (loading = 0.844) and "I believe that AI is a danger to the human race" (loading = 0.841). Principal component analysis revealed the presence of two components with eigenvalues exceeding 1 (Figure 2). The scree plot illustrates the eigenvalues of the components, with a sharp decline after the second component. The two components were rotated using an oblimin rotation procedure. The rotated solution, as shown in Figure 2, yielded two interpretable factors that can be interpreted as positive attitudes toward AI (RC 1) and negative attitudes toward AI (RC 2). The two-component solution explained a total of 79.08% of the variance, with Factor 1 contributing 53.13% and Factor 2 contributing 25.95%. All seven items demonstrated clear loadings on either one of the factors, with all values surpassing 0.3. Notably, a very weak positive correlation (p=.183) was observed between these two components. The results suggest a clear dichotomy in participants' perceptions of AI, with RC1 capturing positive attitudes and opportunities related to AI, and RC2 reflecting apprehension and fear of its potential consequences. This dual perspective highlights the complexity of students' attitudes towards AI and underscores the importance of addressing both opportunities and risks in discourse surrounding AI development.

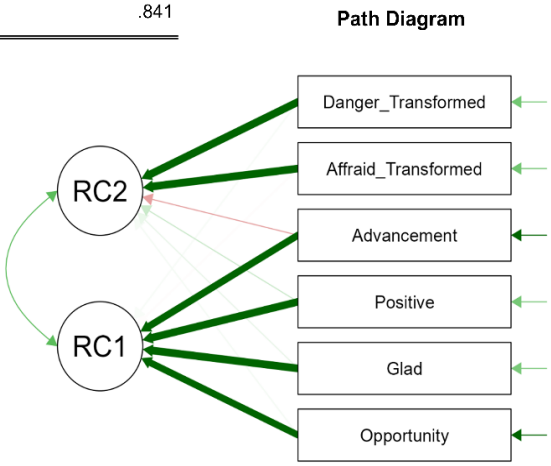
Figure 2. Factor Analysis of the Attitudes toward AI Scale

Component Matrix[a]

	Component	
	1	2
The emergence of AI tools is a positive thing	.908	
I am glad that AI has been invented	.905	
AI represents an opportunity for the development of human society	.819	
AI represents a remarkable technological advancement	.790	
I am afraid of further AI development Transformed		.844
I believe that AI is a danger to the human race Transformed		.841

Extraction Method: Principal Component Analysis.
a. 2 components extracted.





The initial step was to examine the strength and direction of the correlation of the linear relationship between our interval-level variables, which will serve as dependent variables in further tests, namely, (1) Attitudes toward AI Scale, (2) Rating of the usefulness of the ChatGPT question, and (3) Consideration

of using ChatGPT as cheating in an academic setting. The Shapiro-Wilk test for multivariate normality was not statistically significant ($p = .246$), leading to the selection of a more robust parametric test, the Pearson product–moment correlation coefficient (r). Two out of the three correlations were statistically significant. There was a significant, moderate positive relationship between the Usefulness of ChatGPT and Attitudes toward AI ($r = .514$, $n = 229$, $p < .001$). Additionally, a statistically significant correlation was found between Cheating and the Usefulness of ChatGPT ($r = -.309$, $n = 229$, $p < .001$) of a lower magnitude than the previous one but still present, with the strength of this negative relationship being low. There was a negligible, negative and nonsignificant correlation between the Cheating and Usefulness variables of the ChatGPT ($r = -.103$, $n = 229$, $p = .113$). Overall, the results suggest that if a student highly values the usefulness of ChatGPT, he or she will also have a more positive attitude toward AI, while he or she will hold a more negative attitude toward AI if he or she perceives the use of ChatGPT as an unethical academic practice in terms of being conducive to cheating. Nevertheless, the strength of these relationships is not strong.

For the purpose of parametric techniques, it is necessary to verify the assumptions on which these tests are based. The P value of the Shapiro-Wilk test for all variables was statistically significant, indicating that the assumption of normality was violated. To overcome this bias, we will conduct group testing with the bootstrapping option. All bootstrap results were derived from 1000 samples. We will test the homogeneity of variances and statistical power separately for each group, and if necessary, we will conduct more robust testing. The dependent measured variables that will undergo testing are (1) Attitudes toward AI Scale, (2) How do you rate the usefulness of the ChatGPT question, and (3) Do you consider using ChatGPT to be cheating in an academic setting?

An independent-samples t test was conducted to test the assumption that students ($n = 132$) who use ChatGPT as a learning aid ($M = 3.56$, $SD = 0.819$) have more positive attitudes toward AI than do students ($n = 105$) who do not use it ($M = 2.88$, $SD = 0.873$). A design with group sample sizes of 132 and 105 can detect effect sizes with a very high probability of at least 1 - β = .968 ; Levene's test was not significant. The t test was significant, $t(235) = 6.154$, $p = .001$. The effect size of this difference (.679, *BCa* 95% *CI* [.46, .89]) was large $d = .805$. The associated Bayes factor, $BF_{10} = 2.969 \times 10^{+6}$, suggested that the data were almost 3 million times more probable under the alternative hypothesis than under the null hypothesis. These findings suggest that students who use ChatGPT as a learning aid hold significantly more positive attitudes toward AI compared to their peers who do not.

These two groups of students were also subjected to an independent-samples t test to compare their ratings of the usefulness of ChatGPT. Levene's test showed significance ($p < .05$), indicating a violation of the assumption of equal variance, leading to the use of Welch's t test. As anticipated, ChatGPT users rated the usefulness of ChatGPT to be greater ($M = 3.87$, $SD = 0.903$) than nonusers ($M = 2.52$, $SD = 1.249$). This difference, 1.347, *BCa* 95% *CI* [1.05, 1.62], was significant, $t(183.319) = 9.291$, $p = .001$, and represented an effect of $d = 1.259$. The results of the Bayesian independent samples t test suggested that the chances of the null hypothesis occurring were nearly impossible $BF_{10} = 4.027 \times 10^{+15}$. Additionally, students who do not use ChatGPT ($M = 2.39$, $SD = 1.240$) were more convinced that using this service constitutes cheating in an academic environment, unlike ChatGPT users ($M = 3.02$, $SD = 1.394$). The test was significant, $t(235) = -3.693$, $p = .001$, with equal variances in both groups. The magnitude of the mean difference, -.633, *BCa* 95% *CI* [-.98, -.29], was above medium ($d = -.633$). A Bayes factor of 79 ($BF_{10} = 78.733$) corresponds to strong evidence favoring the alternative hypothesis. The results indicate that students who use ChatGPT perceive it as significantly more useful than those who do not. In contrast, non-users were more inclined to perceive ChatGPT use as academic dishonesty compared to users.

The subsequent step involved comparing the participants from different countries, specifically students from Serbia ($n = 202$) and students from Austria ($n = 35$). With sample sizes of 202 and 35, respectively, this research design can detect effect sizes with a probability 1 - β = .776. This indicates that there is a 77.60% chance of correctly rejecting a false null hypothesis if there is indeed a true effect, which falls slightly below the recommended level of 80%. To overcome this bias and obtain reliable results, a robust variant of the t test known as Yuan's t test will be conducted. These tests also address the issue of unequal variances. A robust independent samples t test was conducted to compare the attitudes toward AI between Serbian students ($M = 3.20$, $SD = 0.908$) and Austrian students ($M = 3.60$, $SD = 0.835$). The difference between the two groups was found to be significant $Yt(25.7) = 2.09$, 95% *CI* [-.807, -.006], $p = .047$. The effect size falls between small and medium, $\xi = .345$. The calculated Bayes factor is BF_{10} =

3.16. Given the alternative and null hypotheses, a Bayes factor of 3 corresponds to a belief of 75 percent in the statement that the alternative hypothesis is true. This finding corresponds to positive evidence in favor of the alternative hypothesis. The same groups of students were subjected to Yuen's test to compare their ratings of the usefulness of the ChatGPT. However, the test did not yield significant results *Yt*(54) = .83, 95% *CI* [-.535, .222], *p* = .410. Furthermore, no significant association was found between these two groups of students from different countries regarding whether the use of ChatGPT constitutes cheating at the university *Yt*(32.3) = .078, 95% *CI* [-.603, -.558], *p* = .938.

The significant difference in attitudes toward AI between Serbian and Austrian students suggests that cultural or contextual factors may influence perceptions of AI. The non-significant results for ratings of ChatGPT's usefulness suggest that students from both Serbia and Austria share similar perceptions of its utility. Similarly, the non-significant difference in perceptions of ChatGPT use as academic cheating indicates that both Serbian and Austrian students hold comparable views on this ethical issue. These findings highlight subtle but important differences in attitudes toward AI between students from different countries, emphasizing the need to consider cultural and contextual factors in studies of AI perceptions. However, shared perceptions regarding the usefulness and ethical implications of ChatGPT suggest that some views transcend national boundaries, reflecting the universal nature of students' experiences with AI in education. The lower statistical power (1 - β = .776) in this analysis slightly reduces the ability to detect true effects. Moreover, the small sample size for Austrian students ($n = 35$) limits the generalizability of the findings for this group. Future research could address these limitations by including larger and more balanced samples from different countries.

Finally, it is possible to test independent variables by student gender. These groups are not equal, but they are relatively large, with 77 male students and almost double that of 158 female students. Power analysis detected a probability of at least 1 - β = .948 to detect a true effect in independent samples t tests. Of the three tests conducted, two were found to be significant, and the assumptions of homogeneity of variances were not violated. The test regarding cheating through ChatGPT did not show statistical significance *t*(233) = 1.088, *BCa* 95% *CI* [-.169, .569], *p* = .284, *d* = .15. However, on average, male students ($M = 3.51$, $SD = 0.931$) had more positive attitudes toward AI than female students ($M = 3.14$, $SD = 0.877$). This difference, .373, *BCa* 95% *CI* [.096, .629], was found to be significant, *t(233)* =-3.693, *p* = .005, and represented an effect of *d* = .416. A Bayes factor close to ten ($BF_{10} = 9.698$) corresponds to positive evidence in favor of the alternative hypothesis. Moreover, a statistically significant difference was also found between the observed groups and their attitudes toward the usefulness of the ChatGPT *t(233)* =2.106, *p* = .035. This difference in means (.368, *BCa* 95% *CI* [.032, .698]) indicated a small effect *d* = .293; the Bayes factor $BF_{10} = 1.20$ was barely worth mentioning. There was no significant difference between male and female students' perceptions of whether using ChatGPT constitutes cheating. The significant difference in attitudes toward AI indicates that male students generally hold more favorable views than their female counterparts. Although male students rated ChatGPT as slightly more useful than female students, the small effect size and the weak Bayes factor suggest that this difference is of limited practical significance. These results suggest that while gender may influence general attitudes toward AI, its impact on ethical concerns and specific perceptions of usefulness is less pronounced.

We performed several parametric ANOVAs to examine the potential significant differences among the means in our sample of students in different study years. The students were grouped into three categories for the purpose of ANOVA: the first group consisted of students in the first two years of undergraduate studies ($n = 114$), the second group included students in the second two years of undergraduate studies ($n = 98$), and the last group comprised graduate students ($n = 25$). Our results indicated no statistically significant findings across all tests, specifically in relation to their perceptions of the utility of ChatGPT (*F(2,234)* = 1.090, *p* = .338), beliefs about the use of ChatGPT as cheating (*F(2,234)* = .350, *p* = .705), and attitudes toward AI (*F(2,234)* = 1.406, *p* = .247). The absence of significant differences suggests that students across different stages of their academic journey perceive the utility of ChatGPT in a similar way. Likewise, students' beliefs about the ethical implications of using ChatGPT appear to be consistent across study years. The lack of significant differences in attitudes toward AI suggests that students' general perceptions of AI remain stable regardless of their academic progress. These findings highlight a notable consistency in perceptions and attitudes toward ChatGPT and AI across different academic levels.

We also conducted tests to examine the differences among students from different fields of study.

For the purpose of ANOVA, all students were divided into three groups: business students (n = 97), technical students (n = 75) and students from other disciplines (n = 65). The results showed that there was no significant effect in these three groups on the variable "the usefulness of ChatGPT" (F(2,234) = 2.555, p = .080) or on the variable "the perception of ChatGPT as cheating" (F(2,234) = .202, p = .817). However, the ANOVA test revealed a significant difference among business students (M = 3.05, SD = 0.899), technical students (M = 3.42, SD = 0.842), and students from other disciplines (M = 3.37, SD = 0.947) in terms of their attitudes toward AI (F(2,234) = 4.336, p = .014, η^2 = .036). Post hoc tests using the Tukey HSD test indicated that a difference at the p < .5 level exists between a subset of the business sciences students and a subset of the technical sciences students. According to Cohen's criteria, the effect size falls between small and medium. The associated Bayes factor, BF_{10} = 2.340, provides weak evidence in favor of the alternative hypothesis. The lack of significant differences suggests that students from various fields of study share similar perceptions regarding the usefulness of ChatGPT. The non-significant results for perceptions of ChatGPT as cheating indicate that ethical concerns about its use are broadly similar across disciplines. The significant difference in attitudes toward AI among the groups points to discipline-specific variations. Specifically, technical students exhibited more positive attitudes compared to business students. These results suggest that while perceptions of ChatGPT's usefulness and its ethical implications are consistent across disciplines, attitudes toward AI vary, particularly between business and technical students.

Finally, we aimed to further test the established statistical relationship between students grouped based on their field of study and their attitudes toward AI by conducting a two-way between-group ANOVA with the introduction of an additional dichotomous factor into the analysis, namely, (1) country of study and (2) gender of the student, as we found a significant statistical association between these variables and attitudes toward AI in t tests. The interaction effect between the country of study and the field of study was not statistically significant, F(1,236) = .156, p = .694. However, the results of a 3 × 2 ANOVA examining the effects of gender and field of study on attitudes toward AI were statistically significant. The means and standard deviations for attitudes toward AI enhancement based on gender and the field of study are presented in Table 5. The ANOVA results (Table 6) indicated a significant main effect for attitudes toward AI, F(7,236) = 3.946, p < .001, *partial* η^2 = .108, a significant effect for gender, F(2,236) = 6.360, p < .002, *partial* η^2 = .053, a significant effect for the three groups of students divided based on their scientific orientation, F(2,236) = 7.715, p < .001, *partial* η^2 = .063, and a significant interaction between gender and field of study, F(3,236) = 2.971, p < .033, *partial* η^2 = .037, which was the most important finding of this test. Post hoc tests using the Tukey HSD test again indicated a difference at the p < .5 level only between a subset of the business sciences students and a subset of the technical sciences students; no difference was established for the subset of other sciences students. These findings highlight the complex interplay between gender and field of study in shaping attitudes toward AI. The significant interaction suggests that educational strategies promoting AI literacy and adoption should account for both academic discipline and gender. Moreover, the lack of interaction with the country of study implies that these results may generalize across different cultural or institutional settings. The significant interaction between gender and field of study is particularly noteworthy. This finding implies that the influence of academic discipline on attitudes toward AI is not uniform across genders. For example, the disparity in attitudes between business and technical students may be more pronounced for one gender than the other.

Table 4. *The means and standard deviations of the factors*

Dependent Variable: Attitudes_towards_AI_NEW

What is your gender?	Three groups of field of study	Mean	Std. Deviation	N
1 Male	1 Business Sciences	3.0269	.93105	31
	2 Technical Sciences	3.7586	.80374	29
	3 Other Sciences	3.9608	.76041	17
	Total	3.5087	.93067	77
2 Female	1 Business Sciences	3.0631	.89000	66
	2 Technical Sciences	3.2000	.80920	45
	3 Other Sciences	3.1773	.92952	47
	Total	3.1361	.87665	158
Total	1 Business Sciences	3.0515	.89861	97
	2 Technical Sciences	3.4200	.84156	75
	3 Other Sciences	3.3718	.94730	65
	Total	3.2560	.90737	237

Table 5. *Two-way ANOVA's Tests of Between-Subjects Effects*

Dependent Variable: Attitudes_toward_AI_NEW

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	20.916a	7	2.988	3.946	.000	.108
Intercept	219.013	1	219.013	289.259	.000	.558
Gender	9.631	2	4.816	6.360	.002	.053
Field_Grouped	11.683	2	5.842	7.715	.001	.063
Gender * Field_ Grouped	6.748	3	2.249	2.971	.033	.037
Error	173.388	229	.757			
Total	2706.833	237				
Corrected Total	194.304	236				

a. R Squared = ,108 (Adjusted R Squared = ,080)

The results of the two-way ANOVA tests and the t test confirming a statistically significant difference in attitudes toward AI between male and female students lead us to assume that male students in technical sciences hold a more positive attitude toward AI, which in turn leads to positive changes in the application of ChatGPT and new AI technologies. To confirm this assumption, we used the SPLIT command to divide the dataset by gender and repeated the ANOVA test for the effect of study direction and attitudes toward AI separately for female and male students. There was no significant difference in attitudes toward AI among female students only $F(2,155) = .397$, $p < .673$. On the other hand, there was a statistically significant difference at the $p < .001$ level in attitudes toward AI among three groups of male students with different study disciplines $F(2,74) = 8.658$, $p < .001$. Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effect size, calculated using eta squared, was $\eta^2 = .019$. Post hoc comparisons using the Tukey HSD test revealed that the mean score for business students ($n = 31$, $M = 3.03$, $SD = 0.931$) was significantly different from that for students in the technical sciences ($n = 29$, $M = 3.76$, $SD = 0.804$). The third group of students combined with students from all other science disciplines ($n = 17$, $M = 3.96$, $SD = 0.760$) did not differ significantly from the first two groups of students. Finally, a Bayes factor $BF_{10} = 74.813$ corresponds to strong evidence in favor of the alternative hypothesis. These findings provide critical insights into how gender and academic discipline intersect to shape attitudes toward AI. For male students, the field of study plays a notable role, with those in technical disciplines displaying the most positive attitudes. This emphasizes the importance of tailoring AI-related initiatives to leverage the positive predispositions of technical sciences students

while fostering more favorable attitudes among business students. For female students, uniform attitudes across disciplines suggest that other factors (e.g., educational experiences or societal influences) may be more relevant in shaping perceptions of AI.

Discussions

In the observed sample, students demonstrated a high level of use of mobile devices, as all of them used them for academic purposes. However, less than half of them, 44%, do not utilize ChatGPT as a tool. These results are not surprising, considering that mobile devices were predicted to have the second-fastest growth by the end of 2023 (Cisco, 2020). However, from a Serbian perspective, it is important to note that research conducted only four years ago (Stojanović and Domazet, 2020) indicated a very low level of mobile learning usage. Therefore, this recent improvement is significant. Considering the wide usage of ChatGPT, (Duarte, 2024) reported that less than half of the students, 44% of whom used ChatGPT as a tool. There are many reasons supporting this result, ranging from uncertainty about the accuracy, privacy, or transparency of the GenAI tools themselves (Abdaljaleel et al., 2024; Chan and Zhou, 2023c). This means that to help not only students but also all stakeholders better understand and use AI tools in an ethical and responsible way, policies and guidelines should be put in place (McDonald et al., 2024; Miao and Holmes, 2023; Perera and Lankathilake, 2023).

This finding aligns with the average score obtained from the AI tools scale, which is 2.54. There is a slightly above-average use of these tools for academic purposes. This finding implies that students do not fully utilize these tools for academic purposes. As GenAI tools are typically used without supervision or guidance, students may need assistance from their teacher to ensure that they are used correctly and to avoid the risk of misuse (Selim, 2024; Wale and Kassahun, 2024). Some students may use these tools without reflection or scepticism, which can lead to unintentional or intentional plagiarism. In addition, some students may choose not to use writing tools due to scepticism or a lack of effective learning strategies, particularly those who are repeating the course (Burkhard, 2022; Prentice and Kinden, 2018).

According to the results in Table 1, in which AI tools used by students are sorted according to the mean, the variable Saving time achieved the strongest rating of 3.30, which is the only mean above 3.0 on the AI Tools scale. In contrast, the weakest rating of 1.82 and the only rating below 2.0 made the variable Creating multimedia. Above-average ratings, in the range of 2.5-3.0, achieved six variables, i.e., Sourcing information of 2.98, Clarifying concepts of 2.90, Summarizing texts of 2.87, Generating ideas of 2.81, Aiding in translation of 2.64, and Conceptualizing works of 2.57. Finally, the below-average ratings, in the range of 2.0-2.5, scored five variables, i.e., testing knowledge of 2.46, assisting in coding of 2.23, assisting in literature referencing of 2.22, checking spelling and grammar of 2.16, and making presentations of 2.04. These results are supported by previous work indicating that students use AI tools for sourcing information, clarifying concepts, summarizing texts, generating ideas and aiding in translation (Bosch et al., 2023). However, the observed sample showed that tasks such as literature referencing, making presentations, and checking spelling and grammar were used less frequently. It is not surprising that tools for checking grammar and spelling are used less often, as students already use AI tools for translation. Additionally, testing knowledge is field specific, and it is rare to find material that corresponds to class materials and would be helpful for students. However, it is surprising that they reported low usage of literature referencing, which is obligatory in academic work.

The attitudes toward AI scale consisted of seven positive and negative attitudes toward AI. Through reliability testing, the scale was reduced to six items (Table 3), achieving an alpha level of .795 and an average mean score of 3.26. Factor analysis revealed two factors, four positive attitudes toward AI and two negative attitudes toward AI, in line with the initial design of the scale. Component 1 factors, which include positive attitudes, are, in descending order, the following: the belief that the emergence of AI tools is a positive thing (M=3.35), which had the strongest correlation of .908 in Component 1; the belief that AI has been invented (M=3.17), which had the second strongest correlation of .905; that AI represents an opportunity for the development of human society (M=3.05), which achieved a correlation of .819; and that AI represents a remarkable technological advancement (M=3.86), which had the weakest but still a high correlation of .790 in Component 1. Component 2 factors, which include negative attitudes, are, in descending order, fear of further AI development (M=2.99), which had the strongest correlation of .844 in Component 2, and that AI is a danger to the human race (M=3.12), with a correlation of .841. This result is

not surprising considering the novelty of ChatGPT. Watters and Lemanski reviewed the early literature on ChatGPT and discovered a "predominance of negative sentiment across disciplines" that raised concerns about employment opportunities and ethical considerations (Watters and Lemanski, 2023). However, a recent study has shown that people in general have a positive attitude toward the potential of GenAI tools to increase their efficiency and reduce the workload of bureaucratic systems in the future (Bright et al., 2024).

The usefulness of ChatGPT received an above-average and relatively high rating of 3.27. The result is not surprising if we believe that various studies have indicated its usefulness (Abdaljaleel et al., 2024; Bosch et al., 2023; Chan and Hu, 2023). The average rating was 2.67 for the question "Do you consider using ChatGPT to be cheating in an academic setting?" indicates that students do not have a unanimous opinion regarding the use of AI as an academic violation. Correlational analysis revealed that students who highly rated the usefulness of ChatGPT also tended to have more positive attitudes toward AI. However, the more students perceive the use of ChatGPT to be suitable for cheating, the more negative their attitude toward AI becomes. Through parametric t tests, it was determined that students who use ChatGPT have a positive attitude toward AI. Additionally, ChatGPT users rated its usefulness more highly than nonusers did. This finding is expected, as it is reasonable to assume that students who utilize AI would value its capabilities. Conversely, students who do not use ChatGPTs hold stronger beliefs that its usage constitutes cheating in an academic environment. These findings are consistent with previous research showing that students who had never used ChatGPT were more likely to regard it as cheating, whereas those who had previously used ChatGPT were more likely to believe that it is occasionally considered plagiarism. (Bosch et al., 2023). In relation to the country of study, no significant difference was found between students from Serbia and students from Austria regarding the usefulness of ChatGPT and whether the use of ChatGPT constitutes cheating at the university. However, a significant statistical association was found between students' country and their attitude toward AI, indicating that Austrian students have more positive attitudes toward AI than their Serbian counterparts. However, in further analysis, this difference gradually diminishes in favor of the field of study pursued by the students, likely because the majority of Austrian students in the observed sample were enrolled in the technical sciences. No gender differences were found in the test on cheating using ChatGPT, while a weak statistical association was established regarding the usefulness of ChatGPT, and a moderate statistical association was found regarding attitudes toward AI. The study revealed that ChatGPT users had more positive attitudes toward AI than did those who did not use ChatGPT.

ANOVA did not reveal any significant statistical associations among the means of students of different study years across all tests, specifically in relation to their perceptions of the utility of ChatGPT, their beliefs about the use of ChatGPT as cheating, or their attitudes toward AI. Very few studies have investigated students' perceptions within different years of study. One of the few studies showed that first-year students commonly use AI tools for referencing, plagiarism checks, and grammar, in contrast to their older colleagues (Bosch et al., 2023). In two out of three ANOVA tests, no significant associations were found among the means of students from different disciplines and the dependent variable utility of ChatGPT, beliefs about the use of ChatGPT as cheating. However, the ANOVA test revealed a difference among the three groups of students from different disciplines and their attitudes toward AI variables; specifically, a difference existed between a subset of business sciences students and a subset of technical sciences students. A number of studies have indicated that students' attitudes and use of AI tools in various disciplines may vary (Alzahrani, 2023; Chan and Hu, 2023; Kelly et al., 2023b; Smith and Storrs, 2023). The study programmes of technical and engineering disciplines may require the use of such tools, which could be a reason for their high usage. (von Garrel and Mayer, 2023). This could include a possible affinity for technology among students in these areas and/or, considering the gender-specific differences in usage, a greater proportion of male students in these study areas (von Garrel and Mayer, 2023). As we found significant differences in gender and country of study using t tests, we included gender and country of study as additional factors in the analysis of the established statistical relationships between students grouped based on their field of study and attitudes toward AI. The interaction effect between the country of study and the field of study was not statistically significant, but the interaction effect between gender and the field of study achieved statistical significance. The results indicated that male students in the technical sciences hold a positive attitude toward the implementation of new AI technology. The result was confirmed through a new series of ANOVA tests.

There was a statistically significant difference in attitudes toward AI among the three male student

groups with different disciplines, at a significance level of p<.001. Post hoc tests revealed a statistically significant difference in mean scores between technical sciences students and business sciences students. Since the technical sciences students reported higher mean scores, we concluded that the research results are supported. However, it is important to note that the actual difference in mean scores between the groups was relatively small. This small effect size was not surprising, as gender and field of study are two of many factors that can influence positive attitudes toward AI (Alzahrani, 2023; Chan and Hu, 2023; Chan and Zhou, 2023c).

This research has also revealed that male students in the technical sciences are the drivers of positive changes in the implementation of new AI technology and tools, as unequivocally indicated by the results. These are the findings, and the interpretation of these findings, given the exploratory nature of the study and the popularity of the topic, lies with each individual. Those who fear AI may see a danger in a separate group of AI popularizers, but we view them as catalysts for the development of positive attitudes toward AI.

Technical education plays a crucial role in fostering a supportive and motivating environment for AI adoption. Several factors contribute to this trend: Technical education often involves direct interaction with advanced technologies, including AI, which can cultivate a supportive and motivating environment for AI adoption. Students in these fields are frequently exposed to cutting-edge tools and software, helping them develop familiarity and comfort with AI technologies (Al-Momani and Ramayah, 2024). Courses often emphasize problem-solving, innovation, and the practical application of AI, reinforcing positive attitudes towards these technologies. The curriculum in technical sciences typically includes extensive coursework in AI, machine learning, and related fields (Abbasi et al., 2024). This exposure helps students understand the capabilities and potential applications of AI, making them more likely to appreciate and adopt these technologies. Hands-on projects and research opportunities allow students to experiment with AI tools, further enhancing their engagement and enthusiasm. Students in technical fields are aware of the growing demand for AI skills in the job market. This awareness can motivate them to develop a positive attitude towards AI, as proficiency in these technologies can significantly enhance their career prospects (Opiyo, 2024). The prospect of lucrative and innovative job opportunities in AI-related fields acts as a strong incentive. The community and peer network within technical disciplines often value technological advancement and innovation. Positive attitudes towards AI can be reinforced through interactions with like-minded peers and mentors who advocate for the adoption and development of AI technologies (Sun and Pratt, 2024). This supportive network can cultivate an environment where AI is seen as a beneficial and exciting tool. While gender dynamics can vary, technical fields have historically seen higher enrollment of male students, which may influence the overall perception and attitudes towards AI (Park et al., 2023). Male students might experience less stereotypical bias and may feel more confident and motivated to engage with AI technologies due to a more inclusive environment in their technical education.

GenAI tools influence student learning and attitudes through personalized learning, enhanced critical thinking, facilitated knowledge construction, and promoted exploration and creativity (Bahroun et al., 2023; Ogunleye et al., 2024; Samala et al., 2024; Wu et al., 2024). However, addressing surface learning concerns is essential to ensure that these tools contribute to meaningful and comprehensive educational experiences. Incorporating case studies and examples illustrates the diverse applications and potential impact of GenAI tools in education, providing a richer context for understanding their influence on student learning and attitudes (Samala et al., 2024). Research on learning strategies emphasizes the importance of deep processing and active engagement with the material. Future research should investigate how GenAI tools can be designed and implemented to promote deep learning and avoid surface-level engagement. This includes exploring pedagogical approaches that encourage students to critically evaluate AI-generated output and use it as a starting point for deeper inquiry. Generative AI tools can significantly enhance student learning by tailoring educational experiences. These tools adapt to individual learning styles and paces, offering customized resources and feedback that improve comprehension of complex concepts (Imran and Almusharraf, 2024). For instance, adaptive learning platforms powered by GenAI provide personalized problem sets and immediate feedback, enabling students to identify and address their weaknesses while maintaining motivation through achievable goals (Samala et al., 2024). A study on the use of such a platform in a mathematics course demonstrated improved student performance and increased satisfaction with the learning process. This personalized approach exemplifies how GenAI can facilitate more effective and engaging learning experiences (Imran and Almusharraf, 2024). However,

research also cautions against over-reliance on automated systems without human interaction and guidance. Future research could explore the optimal balance between AI-driven personalization and teacher-led instruction. Generative AI tools can foster critical thinking by offering students diverse perspectives and challenging them to analyze and evaluate information (Ogunleye et al., 2024). By generating multiple viewpoints on a topic, these tools encourage students to consider and critique different arguments. For example, in a history class, students utilized a GenAI tool to generate various arguments for a debate on the causes of World War I. The tool presented perspectives from economic, political, and social angles, prompting students to evaluate the validity and coherence of each argument against historical evidence. This exercise broadened their understanding of the topic and honed their critical thinking skills (Ogunleye et al., 2024). Further research could investigate how different GenAI tools and pedagogical approaches can be used to effectively foster critical thinking skills in various disciplines. Generative AI tools can facilitate knowledge construction by helping students link new information with existing knowledge. Through interactive engagement, these tools enable a deeper understanding of subjects. For instance, in a writing course, a GenAI tool assisted students in developing essays by providing suggestions for structure, coherence, and argumentation. This interactive process allowed students to refine their writing and develop a more nuanced understanding of their topics, effectively synthesizing new insights with prior learning (Bahroun et al., 2023; Wu et al., 2024). Generative AI tools can spark exploration and creativity by enabling students to experiment with diverse scenarios and ideas (Ogunleye et al., 2024). These tools can simulate various conditions and generate creative solutions, fostering innovation. In a creative writing class, for example, students used a GenAI tool to brainstorm story ideas and plot twists. The tool offered diverse suggestions based on initial prompts, inspiring students to explore unique narrative paths and experiment with new writing styles and genres, ultimately enhancing their creative capabilities. By providing students with new tools and possibilities, GenAI can encourage them to think outside the box and develop novel solutions. Further research could investigate how GenAI can be used to support different types of creative activities, such as writing, design, and problem-solving. While GenAI tools offer numerous advantages, they also raise concerns about the potential for surface learning (Wu et al., 2024). Students may be tempted to rely on these tools for quick answers without deeply engaging with the material. For instance, if students use a GenAI tool to summarize key arguments for a historical debate, the tool may provide concise summaries but omit crucial context and nuances. Relying solely on these AI-generated summaries could lead to a superficial understanding of the topic. Therefore, educators must integrate these tools thoughtfully, encouraging deep learning and critical engagement with the content rather than mere reliance on AI-generated outputs.

Students' perceptions of generative AI tools are strongly shaped by their prior experiences with these technologies. According to the study students who had positive encounters with GenAI tools rated them highly in terms of efficiency and interaction (Daher and Hussein, 2024). These students appreciated the quick and accurate responses provided by the tools, which aided their learning process. Conversely, students who faced negative experiences, often due to technical issues or inaccurate. The affective component, referring to students' emotional responses to GenAI tools, also plays a crucial role in shaping their perceptions (Roe et al., 2024). Students who felt supported and engaged by the tools reported higher levels of satisfaction and intention to use them in the future. This was highlighted in the same study, where male students and those with higher technology knowledge exhibited significantly higher perceptions of AI tools compared to their counterparts. Similarly, the intention to use GenAI tools was found to be higher among students who had positive affective responses. Another study emphasized that familiarity and willingness to engage with GenAI tools are crucial factors (Chan and Hu, 2023). Students who were more familiar with these technologies tended to perceive them positively and were more inclined to use them in their learning activities. The study also found that students recognized the potential benefits of GenAI tools, such as personalized learning support and assistance with writing and brainstorming. Despite the potential benefits, students also expressed concerns about the use of GenAI tools. These included doubts about the accuracy of the information provided, the risk of overreliance on the tools, and the potential impact on personal development and career prospects. Research on students' perspectives on Generative AI-assisted academic writing highlighted that students encountered AI-related, student-related, and task-related challenges during their use of GenAI tools for academic writing (Kim et al., 2024). These challenges could hinder students' acceptance and integration of these technologies into their learning practices.

Cultural norms play a significant role in shaping students' openness to adopting new technologies like AI. Serbian culture, rooted in strong family and community ties, fosters a collectivist orientation that prioritizes group harmony (Genkova et al., 2022). Conversely, Austrian culture exhibits a more individualistic ethos, emphasizing personal achievement and independence, influenced by the historical legacy of the Austro-Hungarian Empire (Makri and Schlegelmilch, 2017). The development of AI literacy also contributes to students' attitudes. Serbia faces challenges, including low digitalization levels and a shortage of qualified personnel, which may lead to more cautious attitudes towards AI among Serbian students (OACD, 2024). In contrast, Austria's implementation of a comprehensive national AI strategy, integrating AI across various sectors including education, likely fosters a more positive and receptive outlook towards AI among Austrian students (OECD, 2024a). Economic conditions can also influence student attitudes. As a developing economy, Serbia grapples with challenges like unemployment and brain drain, which may foster pragmatism and caution towards future prospects, including those related to AI (OECD, 2024b). Austria's robust and stable economy, coupled with high living standards, likely contributes to a more optimistic and ambitious outlook among Austrian students, potentially increasing their openness to AI's potential benefits (OECD, 2024a). Educational practices are another factor shaping student attitudes. Serbia's ongoing educational reforms aim to enhance quality and accessibility, but outdated curricula and limited resources may impact student motivation and attitudes towards education, including AI-related subjects (OACD, 2024). Austria's well-established education system, emphasizing quality and innovation, promotes critical thinking and a holistic learning approach, likely fostering positive student engagement and a more receptive attitude towards emerging technologies like AI (OECD, 2024a). The contrasting contexts of Serbia and Austria underscore the importance of considering these factors when developing and implementing AI-related educational initiatives. Further research exploring the nuanced interplay of these factors within each national context is warranted.

Generative AI (GenAI) integration in schools requires meticulous planning and consideration, addressing both policy and practice implications. Schools must revise assessment methods and update plagiarism policies to account for GenAI capabilities, with a focus on evaluating higher-order skills like critical thinking and creative problem-solving (Luo (Jess), 2024). Robust data privacy and security policies are essential to protect student information and ensure regulatory compliance (Luo (Jess), 2024). Ensuring all students have access to the necessary technology and resources to effectively use GenAI is crucial, which includes addressing digital literacy disparities (Bahroun et al., 2023). Continuous investment in teacher training and professional development is necessary for effective GenAI integration, including training on technical aspects, pedagogical approaches, ethical considerations, and fostering digital literacy among students (Bahroun et al., 2023; Luo (Jess), 2024). Policies should guide the adaptation of existing curricula and the creation of new learning experiences that leverage GenAI capabilities (Zhao et al., 2024). Integrating Generative AI into teaching and learning practices has significant practical implications. GenAI can personalize learning experiences and automate routine tasks, transforming the educational landscape. To effectively leverage these tools, teachers must adapt their approaches. Classroom management and student engagement also require new strategies when incorporating GenAI. Schools need to develop methods to manage these tools in the classroom and ensure active student engagement (Samala et al., 2024). Furthermore, GenAI can enhance collaboration and communication among students, teachers, and parents. Schools must establish effective strategies to utilize these tools for improved collaboration and communication (Bahroun et al., 2023). Leveraging GenAI, teachers should adapt assessment practices to provide personalized feedback and enable automated grading (Naseer et al., 2024). Additionally, establishing ongoing professional development systems is essential for teachers and administrators to stay updated with AI advancements (Bahroun et al., 2023).

Our study sheds light on students' attitudes toward AI technology and tools in two European countries and contributes to broader discussion on the use of these technologies in education. It is crucial to understand student perceptions in the context of GenAI technologies, as positive perceptions lead to a deep learning approach, while negative perceptions result in a surface approach (Parra-Díaz et al., 2024). To improve GenAI technologies, educators and policymakers should consider the perceptions of students. This will help to promote effective learning outcomes while addressing their needs and concerns. As there are only a small number of research studies on university students' attitudes toward AI tools (Bosch et al., 2023; Kelly et al., 2023b; Raman et al., 2023), particularly in European countries, this study has the potential to raise awareness among educators and learners toward a student-centered approach and the

importance of involving various stakeholders. Furthermore, the study revealed a significant difference in positive attitudes toward AI among students in various technical disciplines. Additionally, a significant difference in positive attitudes was noted among male students.

Conclusions

The attitudes of the students demonstrate the need to consider certain implications for the successful integration of GenAI into higher education. First, studies highlight that a positive attitude toward the use of AI technology for academic purposes is shaped by previous experience with these tools. To make informed decisions about the use of these technologies, institutions should provide educational resources and workshops to familiarize students with GenAI technology and its ethical and societal implications. Furthermore, institutions can develop strategies and interventions to promote positive attitudes toward AI, ultimately enhancing the learning experience for students. Second, the results of the study can be used to develop targeted interventions for different student groups. To foster AI adoption among specific groups of students, it is important to consider individual differences that may influence their perceptions of GenAI. Therefore, to promote the adoption of AI among specific groups of students, it is important to identify the factors that influence their adoption based on their respective disciplines, genders, years of study, and cultural contexts.

Additionally, the development of an AI attitudes scale represents a significant contribution to the field. Currently, there is a shortage of reliable and theoretically supported instruments for assessing students' attitudes toward GenAI, making it difficult to systematically understand the factors that influence their intention to use these technologies. The Attitude toward AI scale fills this void in the literature and provides a solid basis for future research and practice in this field. In addition, the applicability of the instrument to different educational contexts will allow researchers and practitioners to compare the factors that influence the adoption of GenAI among different populations, such as students and educators at different levels, in different countries, or in different academic disciplines. This may inform the development of context-specific interventions and policies to support the adoption of GenAI in higher education, providing valuable insights into the contextual factors that may shape perceptions of GenAI.

When interpreting the findings, it is important to consider the limitations of this study. The sample size was relatively small, which may limit the generalizability of the results to the broader population of students or countries. Additionally, due to the cross-sectional design of the study, it is not possible to examine how students' attitudes change over time as they are exposed to and gain experience with GenAI technologies. Future research should address these limitations by using larger and more diverse samples and employing longitudinal designs to track changes in students' attitudes toward generative AI over time. Furthermore, future research could investigate the influence of AI literacy on a particular cohort of students from diverse academic backgrounds, age groups and cultural contexts.

Based on the findings of this study, the authors recommend several strategies for educators, policymakers, and institutions aimed at fostering a balanced and inclusive approach to the integration of AI among university students. Given that male students, particularly in technical fields, exhibit more favorable attitudes towards AI, educational initiatives should capitalize on these positive inclinations by integrating advanced AI applications and promoting innovative thinking. For female students, where no notable differences across academic disciplines have been identified, the focus should be on developing inclusive and engaging AI-related materials to enhance interest and build confidence across all fields of study.

In light of the comparatively less favorable attitudes towards AI of business students, enhancements to the business curriculum should emphasize the practical applications of AI, such as in analytics, decision-making, and process automation, to clarify the technology's relevance and utility within their discipline. To further capitalize on the positive attitudes of technical students, educational institutions should offer advanced AI courses that highlight real-world applications, ethical implications, and the importance of interdisciplinary collaboration. Students from non-technical and business backgrounds should be encouraged to engage in collaborative AI projects with technical students. This initiative can help bridge the gap in attitudes and familiarity with AI technologies while fostering innovation across disciplines.

Conflict of interests

The authors declare no conflict of interest.

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Author Contributions

Conceptualization, S.A., T.S.T. and V.V.; methodology, S.A.; formal analysis, S.A. and V.V.; writing—original draft preparation, S.A. and T.S.T.; writing—review and editing, S.A. and T.S.T. All authors have read and agreed to the published version of the manuscript.

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