Perception and Use of GenAI Chatbots in Education by Students at the University of Rijeka

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Abstract. *The development of generative artificial intelligence (GenAI) technologies offers opportunities for enhancing education, particularly through AI-driven tools like chatbots. This study explores University of Rijeka students' perceptions of GenAI chatbots (N=300), examining their motivation, usage patterns, acceptance of this technology, and the perceived value it adds to their educational experience. Our results show that a substantial majority of students have accepted and are actively using GenAI chatbots in their study routines. Despite this acceptance, our findings also highlight the need for educational institutions to provide formal education and structured integration of these tools in the teaching and learning processes. These insights inform the development of an improved version of the educational recommender system ELARS, to support personalized learning and efficient chatbot interaction in STEM education.*

Keywords. chatbot, LLM, ELARS recommender system, generative artificial intelligence, higher education.

1 Introduction

The development of generative artificial intelligence (GenAI) technologies has created numerous opportunities to fundamentally improve education which is why the application of this technology in teaching is the subject of many studies (Labadze et al., 2023), (Chiu, 2024).

As GenAI continues to pervade various industries and is expected to be an integral part of professional practice in the 21st century (Al-Zahrani, 2023), it is necessary to provide students with opportunities to acquire the skills to use it and to explore effective ways to include this technology into learning and teaching processes. Although proficiency in leveraging these tools can enhance students' career prospects and empower them to handle complex tasks and develop solutions to real-world problems, it is equally important for students to be aware of the challenges of using AI and its potential negative impacts in order to make informed decisions as future professionals. Furthermore, familiarity with ethical standards is crucial for the responsible use of AI technologies (Luo, 2024). Thus, the chance to employ GenAI within formal education through well-designed learning activities can educate students on best practices for utilizing this technology and offer them a positive experience they will (want to) repeat.

The study presented in this paper aims to explore perceptions of University of Rijeka students on the use of GenAI chatbots in learning. Chatbots are computer applications that enable human-like interaction using natural language or text. They can support students in the acquisition of complex concepts as they enable the dynamic generation of responses based on large language models (e.g., GPT-4, Gemini), are always available, and stimulate interactive conversations and student activities (Haindl & Weinberger, 2024). One of the most well-known chatbot is [1]ChatGPT by OpenAI (ChatGPT, 2024), offering advanced natural language processing capabilities (Shoufan, 2023). Other popular chatbots are [2]Copilot by Microsoft (Copilot, 2024), [3]Gemini by Google (Gemini, 2024), and [4]Claude by Anthropic (Claude, 2024).

The study was conducted within the project "Support for personalized learning in STEM based on learner personas and recommendations". The purpose of the project is to develop innovative approaches to enhance the quality of e-learning and the acquisition of knowledge and skills needed for 21st century jobs.

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[1] ChatGPT: https://chatgpt.com
[2] Copilot: https://copilot.microsoft.com
[3] Gemini: https://gemini.google.com
[4] Claude AI: https://claude.ai

Results presented in this paper contribute to the body of research on the implementation of the GenAI technologies in education by identifying students' perceptions towards GenAI chatbots and factors influencing their motivation to use this technology. These findings will inform the development of the improved version of the educational recommender system ELARS (Holenko Dlab et al., 2019) that will encourage students to interact with chatbots using recommendations based on learner personas (Tudor, Holenko Dlab & Đurović, 2024). In addition, these findings could be valuable for educators aiming to use AI-based educational tools in their practice.

2 Related Work

Among the various applications of GenAI in education, chatbots have proven to be a particularly promising tool. Recent research underscores the transformative potential of Generative AI (GenAI) chatbots in education, revealing their wide-ranging applications and benefits. This trend indicates an increasing interest in utilizing GenAI technologies to innovate teaching methodologies (Al-Zahrani, 2023).

Labadze et al. (2023) identified key benefits of chatbots for students in their systematic literature review, including homework and study assistance, personalized learning experiences, and skill development, particularly in problem-solving and critical thinking. Chatbots offer customized content, aiding students in understanding complex concepts and enhancing flexible, personalized learning. As learning companions, chatbots provide explanations and clarifications, helping students to complete assignments more effectively.

Haindl & Weinberger (2024) provide empirical evidence that chatbots can enhance learning in undergraduate programming courses by offering personalized assistance and clarifying complex concepts. Šarčević et al. (2024) similarly found that interacting with large language models (LLMs) improves academic support, learning efficiency, and personalized learning. Xu et al. (2023) highlighted ChatGPT's potential to enhance personalization within personalized learning environments (PLEs), promoting a learner-centered approach compatible with formal education requirements.

Beurer-Kellner et al. (2023) address the technical aspects of interacting with LLMs through prompt engineering, essential for optimizing chatbot responses. Their work highlights the importance of developing effective prompts to maximize the benefits of chatbots in an educational context.

Chiu (2024) argues for involving students in research to understand their perspectives on GenAI's educational impact, which generally show positive attitudes toward chatbots. Such research shows that students find chatbots interesting, useful, and easy to use, though they note the importance of having good background knowledge due to occasional inaccuracies in chatbot responses (Shoufan, 2023). Stöhr et al. (2024) emphasize the need to consider diverse student backgrounds when integrating GenAI technologies in education. Their study found significant differences in attitudes based on gender, with female students generally expressing more negative views, and by field of study, with technology students using these tools more frequently than those in humanities.

Esiyok et al. (2024) highlight the potential of chatbots tools to enhance learning and productivity, suggesting that universities should update curricula and promote self-directed learning with technology. Al-Abdullatif (2023) also recommends encouraging chatbot use in education and calls for further research on their long-term effects on student outcomes and engagement. Chan & Hu (2023) underscore the interactive benefits of chatbots but point out significant challenges related to ensuring accuracy, relevance, and the ethical use of these tools in academic settings.

3 Methodology

The aim of the research is to investigate how students from University of Rijeka accept and use GenAI, particularly chatbots, how they perceive its value, and what are the key motivational factors behind the use of this technology from their point of view.

Research questions were:
- RQ1: What motivates university students to use GenAI chatbots in their studies?
- RQ2: Do university students accept and use GenAI chatbots technology?
- RQ3: How do university students perceive the value of GenAI chatbots in their studies?
- RQ4: What are the potential benefits and disadvantages associated with using GenAI chatbots in teaching and learning, as perceived by university students?
- RQ5: Do university students think that GenAI chatbots should be included into organized educational activities and why?

3.1 Research Instrument

To address the research questions, this study employed a paper-based questionnaire as the primary research instrument. Utilizing the paper format ensured the complete anonymity of the participating students. In the questionnaire, students had to indicate their study program level (undergraduate or graduate, year of study), age, gender and whether they had used GenAI chatbots before the survey.

If the students had used GenAI chatbots, they were asked to indicate their attitude using 18 statements (see Table 1) on a Likert scale (1 – strongly disagree, 2 – disagree, 3 – no opinion, 4 – agree, and 5 – strongly agree). In addition, they were asked to answer two

open-ended questions about the advantages and disadvantages of using GenAI chatbots as part of their studies and whether GenAI chatbots should be included in organized educational activities.

In order to examine how the students perceive GenAI chatbots, three standard frameworks were used: the Motivational Model (MM) (Aytekin et al., 2022) the Technology Acceptance Model (TAM) and the Value-Based Adoption Model (VAM) (Al-Abdullatif, 2023). These models are used to understand user acceptance and adoption of technology by analyzing different influencing factors.

The motivation model (MM) stems from broader motivation theory and enables the examination of intrinsic and extrinsic motivational factors. Intrinsic motivation (IM) can be seen as the extent to which an individual engages in an activity for its own sake, because it is inherently interesting or enjoyable. Extrinsic motivation (EM), on the other hand, can be seen as the extent to which an individual engages in an activity because they believe it contributes to achieving a valuable outcome that is different from the activity itself (Marques et al., 2011). In this study, extrinsic motivation was examined through external regulation (EM-ER) and introjected regulation (EM-IR).

The Technology Acceptance Model (TAM) is a theoretical model that aims to explain how students come to accept and use a technology, in this research GenAI chatbots, in educational activities (Al-Abdullatif, 2023). In this study, the following components of TAM were used: perceived usefulness (PU), perceived ease of use (PEOU), behavioral intention to use (BI), attitude toward using (ATU), and actual use (AU). The extent to which a student believes that using GenAI chatbots would enhance their performance was explored through PU. PEOU was used to explain the extent to which a student believes that using GenAI chatbots would be free from effort, while BI was used to explain the extent to which a student has formulated conscious plans to use or not use GenAI chatbots. Using ATU, students' general affective response to using GenAI chatbots were examined and using AU whether students have actually used GenAI chatbots.

The Value-Based Model (VAM) incorporates the concept of perceived value in understanding of GenAI adoption by students. In this study, it was used to examine perceived value (PV), perceived sacrifices (PS), and perceived benefits (PB) of GenAI chatbots. PV was examined using utility value (PV-UV) and hedonic value (PV-HV). Perceived sacrifice was explored through effort cost (PS-EC), psychological cost (PS-PC), social cost (PS-SC), time cost (PS-TC), and perceived value over cost (PS-PVOC) from the students' perspective. Using PB, the positive outcomes associated with the adoption of GenAI chatbots (e.g., convenience, improved performance) were explored.

3.2 Participants

Students enrolled in study programs in the technical and social science fields at the University of Rijeka participated in the research. Participants were selected based on availability, using a convenience sampling approach. Overall, 350 students participated in an anonymous survey, of which 300 had used generative AI chatbots prior to the survey.

Among the surveyed students with prior experience with GenAI chatbots, there were 230 male and 70 female students. The students' ages ranged from 18 to 27 (average age was 20.48).

3.3 Data Analysis

After the students had been surveyed, the questionnaires were transferred to digital form for analysis. The average (Avg) and standard deviation (StD) were calculated for each statement, both overall and by gender. Percentages for each response option (1 to 5) were calculated as well. The D'Agostino-Pearson test, using a significance level of $p<0.05$, was employed to assess whether the results for female and male students followed a normal distribution. Based on the outcomes of this normality test, the Mann-Whitney U test was chosen for comparing scores between genders for each statement. Additionally, Pearson correlation coefficients were calculated to examine the strength and direction of statistically significant linear relationships.

Answers to the open-ended questions were analyzed to identify the most common answers.

4 Results

Out of 350 students that have been surveyed, 300 of them have used GenAI chatbots prior to the survey, resulting in a TAM-AU score of 85.71%. For these students the results are presented in Table 1. Comparison using the Mann-Whitney U test with a significance level of $p<0.05$ revealed no significant statistical differences between the results for all statements, except for two statements from the VAM, PB (S11), p=0.03, and PS-EC (S12), p=0.02.

The results for statements related to MM are presented in Table 1 and Fig. 1. The analysis shows that GenAI chatbots are not currently a mandatory part of study programs, with an average score of 2.23 (EM-ER). Further analysis shows an average score of 2.17 for introjected regulation (EM-IR), suggesting that students are not significantly motivated by internalized pressures or expectations to use GenAI chatbots. Strong intrinsic motivation (IM) towards GenAI chatbots was found, with an average score of 4.09 indicating independent use of chatbots for study purposes. Additionally, the chatbots were perceived as inherently interesting, which is reflected in an average score of 3.40. However, it is notable that 35% of

students were neutral regarding their interest in the chatbots. Answer to RQ1 based on these results is: students are motivated to use GenAI chatbots in their studies primarily through intrinsic motivation.

The results presented in Table 1 and Fig. 2 reveal key insights into students' experiences with GenAI chatbots related to the TAM. The actual use of GenAI chatbots among students is notably high, with 85.71% suggesting that they actively use these tools. Student attitudes toward GenAI chatbots are generally positive, with an average score of 3.93. However, it is important to note that 25.33% of students were neutral, and 5.66% expressed a negative attitude, indicating that approximately 31% of students do not have a fully positive opinion on these tools. Regarding perceived usefulness, students rated GenAI chatbots with an average score of 3.67. Nonetheless, 33.66% of students did not find them particularly useful, pointing to inconsistencies in how effectively chatbots support learning activities. Additionally, there were concerns about the accuracy of chatbot responses, with an average score of 2.13 reflecting that some students experienced issues with incorrect answers, though 34.33% did not report this problem. In terms of perceived ease of use, average score of 4.25 indicates that most students find them easy to learn but only 52.33% of students felt that instructing the chatbots to provide desired answers was straightforward, with 33.33% choosing to remain neutral. Finally, average score of 3.97 reflects a strong likelihood that they will continue to use these tools throughout their studies, although 31.66% of students are uncertain about their future use of chatbots. Based on the presented results, it can be concluded that the answer to RQ2 is positive, but there is room for additional improvement. The majority of students have accepted and are using chatbots in their studies, yet they would benefit from formal education activities that will teach them how to use this technology correctly and more efficiently.

The results presented in Table 1 and Fig. 3 address RQ3 through statements of VAM. The majority of students believe that GenAI chatbots assist them in achieving their study goals, with an average score of 3.59 (PB). However, 42.33% of students do not support this belief, indicating that a significant portion of students remains unconvinced about the benefits of these tools. The results of comparison using Mann-Whitney u test indicated that male students agree more strongly with this statement compared to female students (U=6738.50, p=0.03).

Perceived costs were assessed through different types of sacrifices reported by students. The perceived effort cost (PS-EC) was rated low, with an average score of 1.83. Female students perceive using GenAI chatbots as requiring less mental effort than male students (U=6621.00, p=0.02). A statistically significant correlation with gender was found only for this statement. The correlation coefficient r=0.1264 (p=0.03) indicate a very weak positive correlation that

suggest that gender has only a minor effect on how much mental effort is perceived when using chatbots.

The psychological cost (PS-PC) was rated higher at 2.77. A notable 29.33% of students expressed frustration when encountering issues with GenAI chatbots, and 26.33% were neutral on this issue. 7.66% of students have stopped using the chatbots, and 13.66% were neutral, totaling 21.33% of students who either discontinued use or are undecided. Students reported minimal concerns about perceived social cost (PS-SC), with an average score of 1.58, and generally do not view chatbots as time-consuming (PS-TC). Nevertheless, 43.33% of students did not fully support this view, with 29.33% neutral and 14% acknowledging some perceived time costs. When evaluating the perceived value (PV) of chatbots, opinions were mixed. Only 37.67% of students agreed that the chatbots make learning fun, while 27.33% disagreed and 35% were neutral. The average score for perceived value in terms of quality improvement (PV-UV) was 3.76, with 60.67% of students believing that chatbots enhance the quality of their work. 28.33% of students were neutral, and 11% disagreed. Presented results give answer to RQ3: students see value and benefits in using chatbots for learning, while they do not find the perceived sacrifices alarming.

Students have answered two open-ended questions to address RQ4 and RQ5. The first question was: *In your opinion, what are the main advantages and disadvantages of using GenAI chatbots during studying?* List of five advantages identified by students includes the following:

1. *Quick Access to Information*: Students highlight using chatbots for quick access to information they need. This allows them to save time in research and preparation for assignments and exams.
2. *Simplicity and Efficiency*: The tools are user-friendly, enabling students to easily get answers to their queries, often with explanations and context.
3. *Aid in Understanding Material*: Chatbots are useful for explaining concepts and terms that students may not fully grasp. Many students appreciate the ability to ask additional questions and receive clear explanations.
4. *Reduced Mental Effort*: These tools simplify information retrieval, allowing students focus on more important aspects of learning.
5. simplify information retrieval, enabling students to focus on key learning aspects
6. *Support in Problem Solving*: Chatbots assist students in solving math and programming tasks, often providing step-by-step instructions that facilitate understanding and problem-solving.

List of five disadvantages identified by students includes the following:

1. *Inaccuracy of Information*: One of the most frequently mentioned issues is the inaccuracies in data generated by GenAI chatbots. Students

emphasize the need for additional verification of all information obtained through these tools.

2. *Dependency on Technology*: There is concern that excessive use of chatbots may reduce students' critical thinking abilities and their capacity for independent problem-solving. Relying too much on technology could lead to lack of effort and reduced deeper understanding of the material.
3. *Confusing or Incomplete Information*: In some cases, chatbots may provide confusing/incomplete information, which can hinder students' ability to properly comprehend or solve a problem.
4. *Potential for Academic Misconduct*: The use of chatbots may encourage some students to engage in plagiarism or cheating rather than genuine learning and understanding of the material.
5. *Language and Contextual Barriers*: The tools are often better developed for English language use, which may pose challenges for students seeking information in Croatian or having specific requirements in their local context.

The answer to RQ4 is that in students' opinion, the use of chatbots offers significant advantages in terms of quicker and easier access to information, as well as assistance in learning and task-solving, but there is also a need for a critical approach and additional verification of information to avoid inaccuracies and potential pitfalls of excessive reliance on technology.

Table 1. Results of questionnaire (N = 300)

Model Code		Statement	Female (N = 70)		Male (N = 230)		All (N = 300)	
			Avg	StD	Avg	StD	Avg	StD
Motivational model (MM)								
EM-ER	S1	The use of GenAI chatbots is mandatory in my study program.	2.30	1.15	2.21	1.22	2.23	1.21
EM-IR	S2	I use GenAI chatbots to avoid feeling like I'm falling behind.	2.01	1.16	2.21	1.22	2.17	1.21
IM	S3	I independently used GenAI chatbots for my study needs.	4.00	1.13	4.11	1.17	4.09	1.17
IM	S4	I enjoy using GenAI chatbots because they are interesting.	3.19	1.03	3.46	1.15	3.40	1.13
Technology Acceptance Model (TAM)								
PU	S5	The answers provided by GenAI chatbot are accurate and do not need to be verified.	2.16	1.01	2.13	0.99	2.13	0.99
PU	S6	GenAI chatbot help me execute my study tasks more efficiently.	3.71	1.06	3.65	1.21	3.67	1.18
PEOU	S7	Learning to use GenAI chatbot is easy.	4.30	0.80	4.23	0.86	4.25	0.85
PEOU	S8	It's easy for me to instruct GenAI chatbot to do what I want.	3.43	0.93	3.53	0.94	3.50	0.94
BI	S9	I will definitely use GenAI chatbot throughout my studies.	3.91	1.04	3.98	1.16	3.97	1.14
ATU	S10	My attitude towards using GenAI chatbot is positive.	3.84	0.84	3.96	0.96	3.93	0.94
Value-Based Model (VAM)								
PB	S11	I use GenAI chatbot because I believe they help me achieve my goals.	3.37	1.04	3.66	1.19	3.59	1.16
PS-EC	S12	GenAI chatbot require a lot of mental effort.	1.63	0.85	1.90	0.90	1.83	0.89
PS-PC	S13	I feel frustrated when I encounter a problem with a GenAI chatbot.	2.91	1.32	2.72	1.23	2.77	1.25
PS-PVOC	S14	I used GenAI chatbot but I no longer use them.	1.81	0.99	1.81	1.04	1.81	1.03
PS-SC	S15	GenAI chatbot isolate me from my colleagues at university.	1.44	0.86	1.62	0.93	1.58	0.92
PS-TC	S16	It takes a lot of time to effectively use GenAI chatbot.	2.26	1.13	2.35	1.04	2.33	1.06
PV-HV	S17	GenAI chatbots make learning fun.	3.26	1.05	3.05	1.17	3.10	1.15
PV-UV	S18	GenAI chatbots improve the quality of my work.	3.61	0.96	3.80	1.10	3.76	1.07

Motivation to use GenAI Chatbots

Legend: ■ 1 - strongly disagree ■ 2 - disagree ■ 3 - no opinion ■ 4 - agree ■ 5 - strongly agree

	1	2	3	4	5
S4	6%	14%	35%	25%	20%
S3	6%	4%	16%	23%	51%
S2	41%	21%	23%	10%	5%
S1	38%	23%	24%	10%	5%
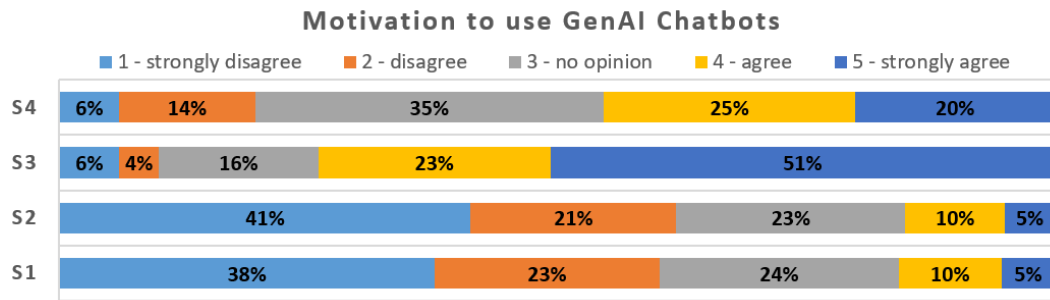
Figure 1. Motivational model (MM) results

Acceptance and use of GenAI Chatbots

Legend: ■ 1 - strongly disagree ■ 2 - disagree ■ 3 - no opinion ■ 4 - agree ■ 5 - strongly agree

	1	2	3	4	5
S10	2%	4%	25%	37%	32%
S9	5%	6%	21%	25%	43%
S8	2%	13%	33%	38%	14%
S7	1%	2%	14%	36%	46%
S6	7%	10%	16%	41%	25%
S5	32%	34%	25%	8%	1%
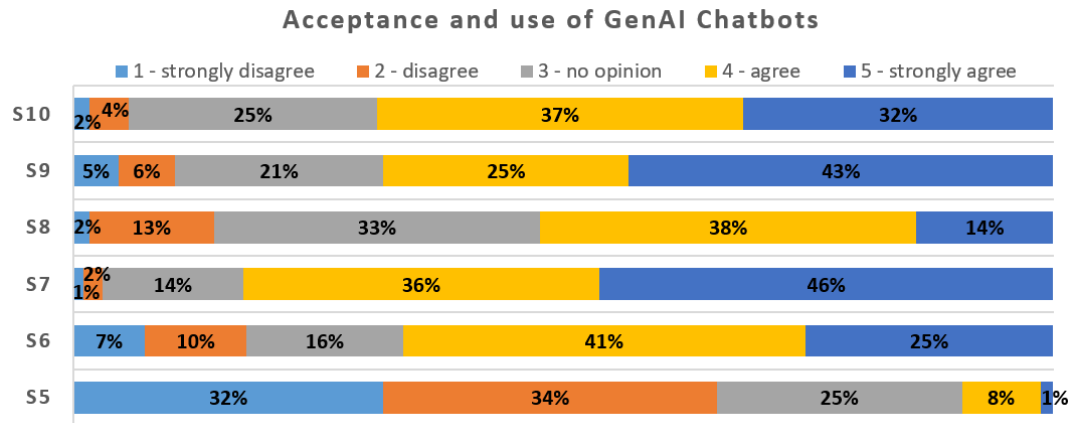
Figure 2. Technology Acceptance Model (TAM) results

Value of GenAI Chatbots

Legend: ■ 1 - strongly disagree ■ 2 - disagree ■ 3 - no opinion ■ 4 - agree ■ 5 - strongly agree

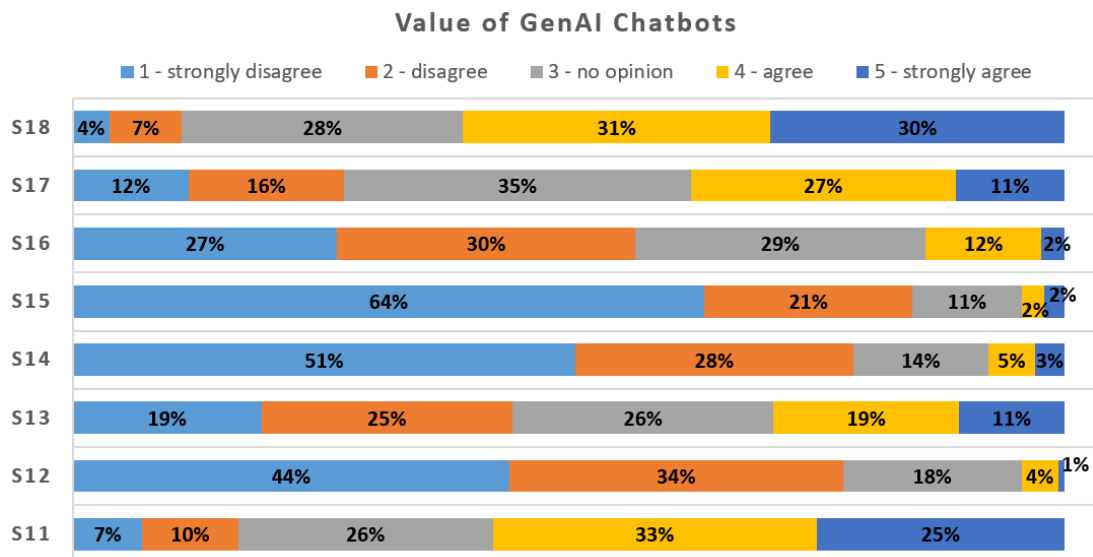|	1	2	3	4	5
S18	4%	7%	28%	31%	30%
S17	12%	16%	35%	27%	11%
S16	27%	30%	29%	12%	2%
S15	64%	21%	11%	2%	2%
S14	51%	28%	14%	5%	3%
S13	19%	25%	26%	19%	11%
S12	44%	34%	18%	4%	1%
S11	7%	10%	26%	33%	25%

Figure 3. Value-Based Adoption Model (VAM) results

The second open-ended question was: *In your opinion, should the requirement to use GenAI chatbots during studying be increased (by incorporating them into organized educational activities), and why?* Five most common answers were:

1. *Support for Increased Use*: Students believe that the use of chatbots enhance their learning. They argue that quick access to information and explanations make learning more efficient.

2. *Support for Optional Use*: Students feel that while GenAI chatbots are beneficial, their use should remain optional rather than mandatory. They suggest that students should be free to choose whether or not to use these tools.

3. *Concern Over Dependency and Creativity*: Students have expressed concern that mandatory use of GenAI chatbots could reduce students'

creativity and critical thinking skills, making them overly reliant on technology.

4. *AI as a Future Necessity*: Students have highlighted that AI represents the future, and students should be familiarized with these tools to be prepared for their professional lives.

5. *Educational Value and Proper Use*: Students also emphasized the importance of learning to use GenAI chatbots correctly to maximize their benefits and avoid potential pitfalls.

The answer to RQ5 based on these results is that students would like for GenAI chatbots to be included in organized educational activities but that they should also be properly educated in a correct way of using them in order to achieve the desired effect in teaching and learning activities.

5 Discussion

5.1 Motivation to Use GenAI Chatbots in Studies

To address RQ1, the results indicate that GenAI chatbots are not currently a mandatory part of study programs. This suggests that, at present, the integration of GenAI chatbots into educational settings is largely driven by students' personal interest, as reported in (Lee et al., 2022), rather than by formal requirements or to avoid negative consequences. However, the observation that 35% of students selected "no opinion" regarding the interest in GenAI chatbots indicates there is considerable uncertainty or indifference towards the value of these tools. This highlights the need to enhance the perceived relevance and attractiveness of GenAI chatbots within the educational context. Additional efforts should be made to motivate students to incorporate GenAI chatbots into their self-directed learning activities, as noted by Esiyok et al. (2024).

Demonstrating the practical benefits of using chatbots and providing personalized recommendations based on students' individual needs could enhance the motivational aspects associated with these tools. As there are no significant differences between male and female students, the strategies can be developed without gender-specific adaptations.

5.2 Acceptance and Use of GenAI Chatbots

In relation to RQ2, the results indicate that the use of GenAI chatbots is widespread among students, suggesting a general acceptance and integration of this technology into their study routine but also the growing role of GenAI chatbots in education. However, the results also highlight areas where further support and training could be beneficial. A significant proportion of students neither agreed nor disagreed with the perceived usefulness and ease of use of these tools.

This is in line with the findings of Stöhr et al. (2024) and Haindl & Weinberger (2024), who suggest that the usefulness and ease of use of these tools are still perceived differently. These findings suggest that more structured guidance is needed to ensure effective use.

While many students find the chatbots easy to learn, the results also suggest that more personalized support is needed to help students interact with this technology. Results indicate that strategies to enhance interaction are likely to impact male and female students similarly, but this needs to be verified in future studies since research by Stöhr et al. (2024) reported differences in attitudes across genders.

The observation that some students receive incorrect responses suggests that they need to be better trained in writing prompts. This emphasizes the importance of teaching students not only how to use chatbots, but also how to critically evaluate the answers provided. This is in line with related research done by Al-Abdullatif (2023) and Chiu (2024) who also emphasize the need for structured educational initiatives to improve students' ability to effectively use chatbots.

5.3 Value of GenAI Chatbots for Studies

Results related to RQ3 reveal that although a significant number of students believe that GenAI chatbots assist in achieving their study goals, a notable proportion remain unconvinced about their overall benefits. In addition, there is a substantial number of students who do not find them as effective or valuable. Students are divided on whether these tools make learning enjoyable but the overall impression is that chatbots can enhance the quality of their work. According to Al-Abdullatif (2023), by making GenAI chatbots more compelling and relevant to students' educational experiences, educators can potentially increase their perceived value.

The analysis of perceived costs reveals that the effort required to use chatbots is seen as minimal, but the psychological costs are higher, as some students express frustration when encountering problems. This indicates the need for enhanced support and training to help students navigate these tools more effectively and reduce potential problems, which will also help to increase the perceived value (Al-Abdullatif, 2023). Integration into formal education is certainly a good opportunity to achieve that. Perceptions of chatbots in terms of time spent and social impact vary. Although many students do not perceive chatbots as particularly time-consuming or socially burdensome, some students do, suggesting that the impact of chatbots on students' time management and social interactions may be shaped by personal experiences and specific contexts. Providing personalized recommendations and feedback may contribute to overall satisfaction, but future research is needed to understand what makes chatbots attractive to students in order to maintain their interest in using them (Shoufan, 2023).

5.4 Advantages and Disadvantages of GenAI Chatbots

When analyzing the results from open-ended questions, it can be concluded that students are aware of the advantages and disadvantages of GenAI chatbots. From their answers five advantages were identified: *Quick Access to Information*, *Simplicity and Efficiency*, *Aid in Understanding Material*, *Reduced Mental Effort* and *Support in Problem Solving*. On the other hand, five disadvantages were identified: *Inaccuracy of Information*, *Dependency on Technology*, *Confusing or Incomplete Information*, *Potential for Academic Misconduct* and *Language and Contextual Barriers*. Identified advantages and disadvantages are in line with those reported by Lee et al., (2022) and Chan & Hu (2023). Although listed advantages are indicated in the results given to statements with Likert scale, some of the disadvantages were not. Students independently indicated that there was a possibility of academic misconduct when using GenAI chatbots and that some of them encountered language and contextual barriers.

These findings also suggest that students should be formally trained in the proper use of chatbots for learning in order to engage them in their learning activities in a way that helps them in desired ways while minimizing the stated drawbacks. Tailoring interactions with chatbots to students' needs and learning styles could significantly reduce the perceived disadvantages and encourage a more positive reception of these tools.

5.5 Introduction of GenAI chatbots in Educational Activities

The results addressing RQ5 indicate that while students support the integration of GenAI chatbots into structured educational activities, there is a clear need for comprehensive training on their effective use to maximize their impact on teaching and learning outcomes. Students' opinions vary on whether introduction of chatbots should be mandatory or optional. Students have expressed their concern over dependency and reduced creativity if GenAI chatbots are used but are also aware that they are a future necessity and cannot be avoided. A particularly important opinion stated by students is that they see value in educational use of chatbots if used in a proper way, and they do expect to be taught how to use them in a formal and organized way. This result is consistent with results indicating that at least a third of the students would greatly benefit from formal education regarding the proper use of chatbots.

Several strategies and resources can be utilized to effectively implement in practice the recommendation of appropriate prompts in educational activities. First, recommendations of interactive tutorials and online courses focused on effective communication with GenAI chatbots can provide students with flexible and self-paced learning opportunities which, in addition to developing skills, will also increase their motivation to use these tools. These resources may include video demonstrations, interactive simulations, and quizzes designed to reinforce key concepts and techniques. Second, appropriate prompt libraries could be created, containing a repository of example prompts and responses that can be used as a valuable resource by both educators and students. The quality of the language model response is related to the structure and precision of the query (Beurer-Kellner et al., 2023), so recommending appropriate prompts could help students to communicate effectively with conversational agents. Those recommendations could be in accordance with their characteristics and preferences (learner persona). For this purpose educators can develop a set of guidelines or frameworks that outline the characteristics of effective prompts and that are used to generate recommendations for students. These frameworks should include templates for well-structured questions, the use of specific keywords, and strategies for refining queries to obtain more precise and relevant responses from the chatbots. Finally, within educational recommender system, students could receive feedback on their prompts with recommendations on how to improve them.

6 Conclusions and Future Work

The study presented in this paper was conducted within the project "Support for Personalized Learning in STEM Based on Learner Personas and Recommendations" with the aim to explore University of Rijeka students' perceptions of using GenAI chatbots in learning. The results indicate that most students use GenAI chatbots for their studies. While external motivational factors are not significant, many students show intrinsic motivation. There is potential for improvement through external motivation, such as integrating tools into study programs. Regarding perceived value, students see value in using GenAI chatbots, though many remain uncertain.

The results suggest that formal education on using GenAI chatbots would benefit students. While students acknowledge both the advantages, like quick information access, and disadvantages, such as inaccuracy, they generally do not find them alarming. Most students support integrating GenAI chatbots into learning, given proper training. Despite intrinsic motivation among many, some students are indifferent or face challenges, highlighting the need for structured integration and education on these tools.

The results from this paper and future work will enhance personalized STEM education, preparing students for 21st-century careers. By generating recommendations for interaction with GenAI chatbots based on student characteristics and educational personas, personalized learning support for STEM

education will be implemented in the new version of the educational recommender system ELARS.

In terms of limitations, this study's convenience sampling limits generalizability to all University of Rijeka students. Future research should include a more diverse student population from various faculties and universities in Croatia. Additionally, the study assumes a uniform level of technological familiarity, which may vary. Future studies should analyze results by subgrouping students based on this criteria and field of study.

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