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PAPER

Exploring Students' and Teachers' Perceptions about Using ChatGPT in Programming Education

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ABSTRACT

This paper aims to study the opinions of teachers and students regarding the opportunities and challenges of using ChatGPT in programming education. The research combines quantitative data from Likert-scale questions with qualitative data from open-ended responses. The findings reveal similarities between students' and teachers' views on the advantages of using ChatGPT in programming education and its potential to develop soft skills. A difference appears in assessing the attitudes of both groups toward the disadvantages of integrating ChatGPT in education. Compared to students, teachers express much greater concern about the negative effect of artificial intelligence (AI) on academic integrity and teaching quality. The results showed that both groups positively evaluate ChatGPT as a supplementary tool in education. They believe it should complement traditional teacher-student communication rather than replace it. Based on the research findings, the authors recommend that the integration of ChatGPT into education should be preceded by adopting university AI usage policies and training for the effective use of ChatGPT. Pedagogical guidelines for integrating ChatGPT into programming education are proposed to minimise the effect of students' over-reliance on AI and achieve the learning outcomes defined by Bloom's Taxonomy.

KEYWORDS

ChatGPT, artificial intelligence (AI), programming education, higher education

1 INTRODUCTION

ChatGPT is an artificial intelligence (AI) chatbot developed by OpenAI that uses the generative pre-training transformer (GPT) model to interact with humans in a conversational way [1]. The model is trained on vast amounts of text data from various sources, which makes it capable of answering a wide range of questions and solving different types of problems. Immediately after its release for free use in November 2022, ChatGPT became the subject of severe debates on the appropriacy of its use in educational institutions due to fears of the impossibility of distinguishing between human writing and chatbot-generated content. Exploring ChatGPT's potential to support the educational

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process and the discussion of its limitations and ethical issues significantly contributes to its effective integration in education, particularly in programming learning. ChatGPT can write source code in almost all programming languages, convert source code from one language to another, detect errors, and respond to technical problems [2]. ChatGPT responds to queries given by the user in natural language. Therefore, even people with little programming knowledge can use it to solve programming problems [3], [4]. All this makes it a powerful and easy tool for software developers.

In the fast-paced development of technology and digitalisation, programming plays a crucial role in solving complex problems and providing innovative solutions in many areas of life [4]. The digital age has made programming an essential skill, requiring creativity, problem-solving skills, recognising relationships, identifying similar situations and patterns, developing an algorithm, and converting it into executable code. Learning programming is challenging and complex for most people [5], [6]. Programming is a discipline that is learnt gradually, in a logical sequence. That is why absence from class hurts further learning and can discourage learners. Programming is a core course in the computer science curriculum at many educational institutions.

Our experience shows that students studying programming often need help solving assignments the teacher sets, regardless of having received all the necessary theoretical training. This makes them look for online information and ask relatives and friends. Given the ever-increasing use of ChatGPT, it is predictable and inevitable that many students will independently seek answers from ChatGPT to their queries due to its accessibility and potential to provide personalised responses in different languages.

However, effective use of new technology for educational purposes largely depends on the teachers' motivation. Therefore, we believe that educators should be familiar with the main functionalities of ChatGPT, its advantages, limitations, and problems that its use for educational purposes may cause. Moreover, they should be informed about how the chatbot can be tied to the specific educational goals and different needs of the students.

A review of the existing literature has shown that there is a scarcity of research that simultaneously investigates the views of both students and teachers regarding the use of ChatGPT in programming education. Furthermore, almost no research presents educational practices and pedagogical guidelines for effectively implementing ChatGPT in the teaching process. In this context, the main objective of the study is to explore the attitudes and expectations of students and teachers from the Faculty of Physics and Technology at Paisii Hilendarski University of Plovdiv, Bulgaria, towards using ChatGPT in programming education and to identify its potential advantages and disadvantages. Taking into account our research results and the existing studies, we will propose pedagogical guidelines that align with the educational goals and expectations of both groups and the limitations of the technology.

The main research questions are:

RQ1. Is there a difference between teachers' and students' opinions about the advantages of using ChatGPT in programming learning?
RQ2. Is there a difference between teachers' and students' opinions about the disadvantages of using ChatGPT in programming learning?
RQ3. Is there a difference between teachers' and students' opinions about ChatGPT's potential for developing soft skills in students?

This study is one of the few that explores both the positive and negative implications of incorporating ChatGPT into programming education, considering the perspectives of both students and educators. The research findings offer valuable practical guidance

on using the chatbot as a complementary tool in the educational process, considering both the potential benefits and possible challenges for learners and educators.

2 LITERATURE REVIEW

2.1 Potential of ChatGPT in education

Artificial intelligence is a constantly advancing technology that provides enormous application opportunities in various fields, including education [7]. AI tools have the potential to complement and improve traditional teaching methods and increase the effectiveness of teaching and learning by providing personalised learning adapted to the needs and interests of each learner [8], [9].

[10] analyses the factors influencing students' intention and actual use of AI applications for academic purposes. The unified theory of acceptance and use of technology (UTAUT2) model is used for this purpose. Results show that expected performance, habit, and positive emotional outcomes are the dominant factors that influence students' intention to use AI applications. Students' actual usage of AI applications is impacted by factors such as behavioural intention, habit, and the presence of facilitating conditions.

One of the most recent advancements in AI is the Chat Generative Pre-Trained Transformer (ChatGPT), a language model that can understand and respond to natural language queries [11]. ChatGPT's ability to provide fast and personalised responses makes it an innovative tool offering immediate feedback and continuous support in the learning process [12]. This potential has sparked several studies regarding its applications in education.

ChatGPT can assist educators in creating lesson plans and course syllabi, automatically generating practice tasks, examples, additional educational resources, and tests with different levels of difficulty [9], [13], [14], [15]. The research in [16] highlights the potential benefits and limitations of using ChatGPT to develop course curricula and lesson plans. The authors of [17] evaluate the ability of ChatGPT to generate unit tests. The quality of the tests is assessed based on criteria such as accuracy, sufficiency, readability, and usability. The analysis shows that the chatbot has excellent potential for generating unit tests, although there is still room for improvement in the tests' correctness. According to the research results in [18], ChatGPT can potentially assist educators in generating multiple-choice questions. The survey shows that students are satisfied with the generated questions' wording, clarity, and coherence. Several studies have shown the potential of ChatGPT for faster and automated grading of learner assignments and tests [9], [13]. According to [19] and [20], automating teachers' routine tasks through ChatGPT will give them more free time to apply new teaching activities and focus on learners' tasks and gaps.

ChatGPT can also be used as a platform for interactive classes [19]. Educators can ask questions on ChatGPT and challenge learners to engage in discussion actively, resulting in maintaining interest in the topic [21].

One of the most commonly used features of ChatGPT is providing learners with instant feedback by answering questions in real time. This feature significantly enhances the learning process, making it more efficient and engaging for students [13], [21], [22].

In [23], the potential of ChatGPT for language teaching and learning is explored, particularly its possibilities to support the development of reading and writing skills. This is achieved through its ability to identify and correct syntactic and grammatical

errors and to foster the development of diverse writing styles depending on the subject or topic [9], [13]. A chatbot can be a powerful educational tool in teaching and learning foreign languages. In [24], the use of ChatGPT in teaching English as a foreign language is explored. Teachers recognise its potential for lesson planning, idea generation, automated assessments, and providing constructive feedback. The research also identifies some of ChatGPT's shortcomings, particularly the need for constant verification of the content it generates.

According to [13] and [25], ChatGPT is useful for writing reports, essays, and research papers on specific topics. For example, [26] describes how students used ChatGPT to prepare application letters or personal statements. The analysis of the results shows that the chatbot's strengths include generating relevant content, suggesting templates, having a good writing style, and providing ideas, while its weaknesses are a tendency to use common language, a robotic tone, and a lack of emotions.

The chatbot can guide learners through a sequence of steps to solve a problem, thereby developing critical thinking and problem-solving skills [13]. Learners can benefit from ChatGPT's ability to explain complex concepts simply and understandably [27].

ChatGPT can personalise learning by providing content adapted to learners' knowledge and needs. [22], [28]. For example, [29] examines the possibilities of ChatGPT for supporting self-regulated learning in programming education, exploring aspects such as accessing learning materials, tools for specific content areas, self-study planning, feedback, and assessment. The results show that ChatGPT provides the necessary support to help students achieve their learning goals. Educators can use ChatGPT to analyse a learner's written assignments or test results and identify areas where the learner struggles [9], [13]. In this case, the educator can take advantage of ChatGPT to generate personalised learning resources and materials that are aligned with the learner's interests, preferences, and skill level [9], [13], [28]. According to [9], [20], and [28], ChatGPT provides adaptive and personalised approaches that can make learning a subject or topic more engaging and effective for learners. According to [30], ChatGPT can motivate higher education students to learn, resulting in improved learning outcomes. [31] discusses the combined effects of ChatGPT and gamification on students' academic performance and motivation in physics education. The results show greater student satisfaction with the learning methods, a more positive perception of the usefulness and relevance of the Physics 1 course content, and increased engagement in the learning process.

ChatGPT can expand access to education, especially for learners in remote or sparsely populated areas. By offering easily accessible, personalised, and engaging learning materials, the chatbot can reduce the knowledge gap between learners with access to high-quality educational resources and those without [32].

The rapid development of technology leads to the need for lifelong learning and the development of new skills. ChatGPT can support individuals in acquiring new skills by offering tailored educational resources, assessments, and practical guidance depending on their needs and professional goals [33]. Such an approach extends the scope of education beyond school and university, making learning an ongoing process throughout life.

2.2 Ethical concerns related to using ChatGPT in education

The application of ChatGPT in educational settings raises issues regarding ethics and liability [34]. According to [13], [27], [34], and [35], the main ethical issues in using

ChatGPT in education are privacy and security, plagiarism, bias and discrimination, and accuracy and reliability of information.

Since ChatGPT is trained based on massive data sets obtained from the Internet, protecting users' data privacy is essential. This is of primary importance for the field of education [34]. Before using the chatbot, teachers and learners should be well-informed about the data collection, usage, and storage processes, as well as the existing data security measures. Users should be careful when sharing personal information with ChatGPT [27].

ChatGPT's use in education raises serious concerns about academic integrity and the challenge of detecting plagiarism [25], [36]. There is a risk that students or teachers might exploit it to produce academic content without proper citation [35].

When students use ChatGPT to cheat on an exam or submit entirely chatbot-generated assignments, instructors face a significant challenge in assessing their understanding of the course material. This raises the question of rethinking assessment strategies in education [19], [37].

If ChatGPT's training data contains bias and discrimination, this may be reflected in the text it generates. This could negatively affect teachers, students, and educational materials incorporating text from ChatGPT [34], [35].

Information precision and accuracy are crucial in education because they guarantee that the material taught and learnt is accurate and reliable. Due to the ChatGPT training process's peculiarities, it tends to generate misleading or factually incorrect results. Therefore, educators and learners should check the credibility of information obtained from ChatGPT with authoritative and reliable sources [19], [34], [35].

2.3 Examples of using ChatGPT in programming education

The advantages and disadvantages of using ChatGPT in different fields of education are still being investigated. Given the present study's focus, 12 literature sources, all from the last two years, regarding the use of ChatGPT in programming education were examined.

The research described in [38] studies the opinion of programming lecturers about the effectiveness of using ChatGPT to support the training process in programming. According to the participants in the study, ChatGPT can improve learning by providing personalised assistance in writing programs, debugging capabilities, feedback, and code explanations. The respondents believe that ChatGPT can support the work of the programming lecturers, saving them time and effort by providing new learning approaches and assisting them in assessing their trainees. On the other hand, the research identifies the potential disadvantages and concerns of using ChatGPT in programming education, such as giving inaccurate and incomplete answers, replacing human-to-human interaction, and unethical use. Overall, the respondents attribute a complementary role for ChatGPT in the programming training process.

The authors of [39] explore both the potential possibilities and the negative effects of using ChatGPT in programming education. Their study concludes that ChatGPT technology can help improve the programming training process and provide new teaching and learning practices, but it also makes cheating easier and could mask a lack of understanding.

The study in [40] analyses students' opinions about using ChatGPT in programming education. Within the framework of the study, students solve problems using

ChatGPT. According to these students, the main advantages of using chatbots are the provision of fast and, to a great extent, correct answers to questions and the facilitation of debugging the program code. The same students point out the following significant disadvantages of using ChatGPT in programming education: getting used to laziness, the inability of ChatGPT to answer some questions, and incomplete and incorrect answers.

According to [41], personalised assistance and feedback enabled by ChatGPT can help students understand the concept of Visual Basic language more efficiently and facilitate their completion of programming tasks. The study strongly emphasises the potential of ChatGPT to be integrated into programming education as an additional tool, meeting the individual needs of trainees.

An analysis in [42] illustrates the effectiveness of GPT-3.5 for personalised feedback by detecting errors in programming tasks submitted by students and making suggestions for improving the programming code. The results show that GPT-3.5 correctly determines 73% of the student submissions as correct or incorrect. In 47% of the cases, GPT-3.5 provides effective feedback. However, it is also reported in [42] that GPT-3.5 exhibits scoring inaccuracies, including locating errors, which are not errors. Due to the identified issues, it is recommended that GPT-3.5 be used to facilitate rapid error detection and the generation of drafts for personalised feedback.

In [43], the effectiveness of using ChatGPT to teach programming is investigated. Two groups of students participated in the experiment: one supported and directed by ChatGPT, and the other worked without external support. The two groups write a program code to solve standard programming problems. The results show that using ChatGPT as a supporting programming tool leads to better outcomes than work without external assistance. ChatGPT is reported to provide guidance or suggestions to students on good coding practices, such as including detailed comments and adopting a standardised approach to writing a program code.

The experiment detailed in [44] compared two student groups studying programming: one receiving traditional instruction and the other using ChatGPT. Both groups were tasked with solving the same programming problems. The results show that the group instructed by ChatGPT demonstrates better programming skills and a deeper understanding of the information. However, difficulties are also noted when using ChatGPT to solve more complex problems.

[45] studies the implementation of ChatGPT for solving tasks from the programming basics. The results show a high success rate in program code generation, ranging between 94.4% and 95.8%.

The study described in [46] shows that the students using ChatGPT do their programming tests twice as fast as the ones working without using ChatGPT. It also shows that the program codes generated by ChatGPT are sometimes too complicated for students who are beginners in programming. Based on the study results, it is recommended to use ChatGPT as a learning assistant when solving programming tasks and searching for additional information and examples. The participants in the study emphasise the need for logical and critical thinking when validating the code generated by ChatGPT.

Authors in [47] analyse GPT-4's capabilities of performing tests containing multiple-choice questions and code generation tasks at different levels of programming education. Although certain limitations in GPT-4 performance are identified, the paper also points out ChatGPT's potential to address almost any assessment widely used in higher education programming courses. The study reports a high

risk of learners becoming overly dependent on ChatGPT when being assessed on programming.

The research in [48] provides practical insights into the use of ChatGPT in programming education. It evaluates ChatGPT's performance in answering multiple-choice questions for knowledge testing, the accuracy of its explanations, and its ability to determine question levels by Bloom's taxonomy and generate similar questions. The findings suggest that ChatGPT can be a valuable supplementary tool for teachers. Guidelines for using it in formulating multiple-choice questions in programming have been developed based on these results.

In [4], a study is described in which 45 students who are studying programming participate. Students are randomly divided into two groups: experimental and control. During programming classes, students in the experimental group used ChatGPT, while students in the control group did not. After the experiment, the results are analysed and show that the computational thinking skills, programming self-efficacy, and learning motivation of the experimental group students are statistically significantly higher than those of the control group students.

As a summary of the performed literature overview, it can be noted that the use of ChatGPT in programming demonstrates several advantages, such as the provision of personalised assistance in writing programs, facilitation of the debugging process, personalised feedback, and code explanations. At the same time, the following disadvantages and concerns can be pointed out: giving inaccurate and incomplete answers, replacing human-to-human communication, and unethical use. In general, all considered literary sources show that ChatGPT can have a complementary role in programming education but not as a tool capable of completely replacing the role of the teacher.

3 MATERIALS AND METHODS

3.1 Context

The Paisii Hilendarski University of Plovdiv is the largest in southern Bulgaria and the second largest in Bulgaria. The Faculty of Physics and Technology is one of its leading academic and scientific divisions. The faculty prepares future physicists, physics teachers, engineer-physicists, and engineers.

Software courses are essential for engineering majors at the Faculty of Physics and Technology. After the Fundamentals of Programming course, the training continues with studying object-oriented programming, algorithms and data structures, visual programming, etc. Students are given assignments to help them develop active and independent learning habits. Practical programming classes are held in computer rooms with groups of 10–15 students, making it difficult for teachers to give individual attention to each student. Throughout the semester, students work on individual projects that require continuous supervision, support, and guidance from the teachers, which increases their workload. Due to heavy workloads and time constraints, teachers often cannot immediately respond to students' questions during their independent study.

Based on the literature review and our experience with AI-based chatbots, we have identified ChatGPT as a promising solution that can help address the challenges mentioned above.

The study's main purpose is to assess the attitudes of students and teachers from the Faculty of Physics and Technology at the Paisii Hilendarski University of Plovdiv

toward using ChatGPT in programming education while identifying its potential advantages and disadvantages.

3.2 Participants

The participants in the study were divided into two groups: programming teachers and students. Two questionnaires were developed for each group. The sample comprises students and teachers from the Faculty of Physics and Technology of the Paisii Hilendarski University of Plovdiv, Bulgaria, where the authors work as teachers. This convenience sampling assisted in identifying and recruiting an adequate sample of participants within a limited timeframe. To ensure the reliability of the findings, an additional criterion was established for selecting participants who had utilised ChatGPT in programming training. Participation in the study was voluntary and anonymous.

The teacher survey was distributed via e-mail to all ten educators teaching software courses at the faculty. Data collection took place at the beginning of April 2024. It was explicitly stated that the questionnaire targeted programming educators who use ChatGPT in their work. Eight teachers completed the survey. The teachers' age distribution is shown in Figure 1.

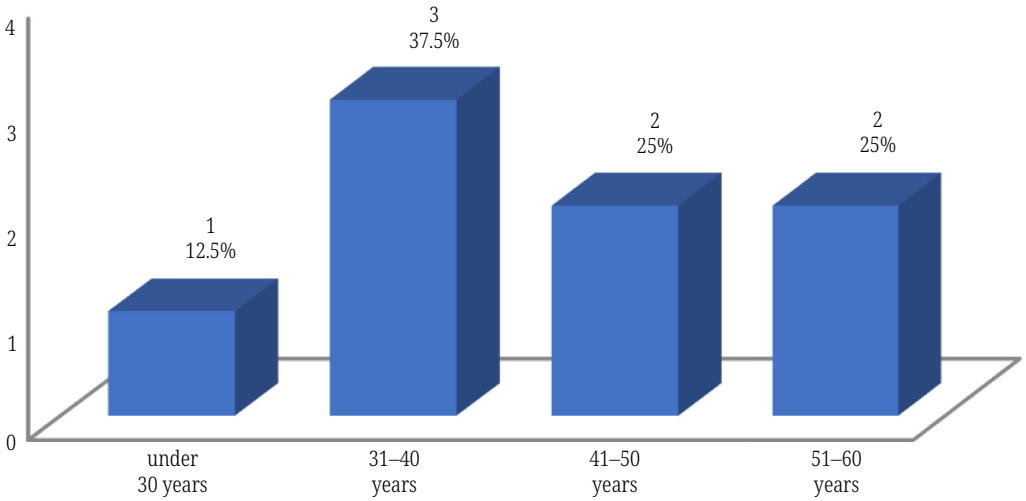

Fig. 1. Teachers' age distribution

The study includes second-year students from three Bachelor's engineering majors: Telecommunications with Management, Telecommunications and Information Systems, Information, and Computer Engineering. In all three majors, the programming courses are the same through the third semester. All students have completed the "Fundamentals of Programming" course, which includes studying C++, ensuring that every student involved in the research has programming experience. Data was collected at the beginning of the fourth semester in March 2024. For the 2023/2024 academic year, the number of second-year students enrolled in the three majors is 111. A total of ninety-two students chose to participate in the survey. However, five responding students indicated that they had never used ChatGPT in their programming studies, and their opinions were excluded from the analysis. As a result, the responses of 87 students were processed.

3.3 Data collection techniques

This study used a mixed-method design, which combines quantitative data collected by the Likert-scale questions with qualitative data from open-ended responses. Two questionnaires are created for the survey-one for the students and one for the teachers. The student questionnaire consists of 20 questions, including one multiple choice and 19 on a Likert scale. The questionnaire for teachers comprises 21 questions, including one multiple-choice, 14 on a Likert scale, and six open-ended questions. The questionnaires are interrelated with a view of their analysis. Three factors that correspond to the research questions were selected to be examined for the present study:

- Attitude towards the advantages of using ChatGPT in teaching/learning programming;
- Attitude towards the disadvantages of using ChatGPT in teaching/learning programming;
- The potential of ChatGPT to develop soft skills in students.

The questionnaires consist of three parts. The first part includes two closed-ended questions to establish the frequency (F) and purpose of the respondents' use of ChatGPT.

The second part contains questions measuring the studied factors using the Likert scale. Each question is rated on a 5-point Likert scale based on the following responses: 1 = strongly disagree (SD), 2 = disagree (D), 3 = neutral (N), 4 = agree (A), 5 = strongly agree (SA).

As there is little difference between the number of items in the student and teacher versions, a reliability analysis for each of these factors was performed for both questionnaires. The calculated Cronbach's alpha coefficient for each scale was greater than 0.700, indicating that each factor has good internal consistency (refer to Table 1).

Table 1. The results of Cronbach's alpha reliability test

No.	Factor	Number of Items – Students Questionnaire	Cronbach's Alpha Value – Students Questionnaire	Number of Items – Teachers Questionnaire	Cronbach's Alpha Value – Teachers Questionnaire
1	Advantages of use ChatGPT in teaching/learning programming	6	0.709	5	0.844
2	Disadvantages of use ChatGPT in teaching/learning programming	5	0.758	5	0.843
3	Potential of ChatGPT to develop soft skills in students	3	0.902	3	0.857

The two questionnaires have a different third part. The teacher questionnaire includes six open-ended questions, which allow respondents to share in freestyle their experiences of using ChatGPT in their work. We decided to include only teachers in the qualitative research, as the effective use of any new technology in education largely depends on them. We chose open-ended questions over the interview

because our faculty is located in two cities, so using this method greatly accelerated data collection. As the students completed the questionnaires at the university, Likert scale questions were included in the third part of their version. These questions aim to establish the students' general attitude and trust in using ChatGPT as a supporting tool when writing programs.

The quantitative data analysis is conducted using SPSS statistics software.

3.4 Ethical considerations

All participants were briefed about the study's purpose, how their data would be used, how their anonymity would be protected, and that participation was voluntary. The teacher questionnaire was anonymous, completed online, and accompanied by an informed consent section so that respondents could confirm their willingness to participate in the study. Students were asked to anonymously complete a paper copy of the questionnaire at the university.

4 RESULTS

4.1 Quantitative data analysis of teacher survey

The first question, "Q1. How often do you use ChatGPT when teaching programming?" allows for a response using a 5-point Likert scale (from 1 = Never to 5 = Very often). 62.5% of the respondents answer often, 25% sometimes, and only 12.5 % rarely (see Figure 2).

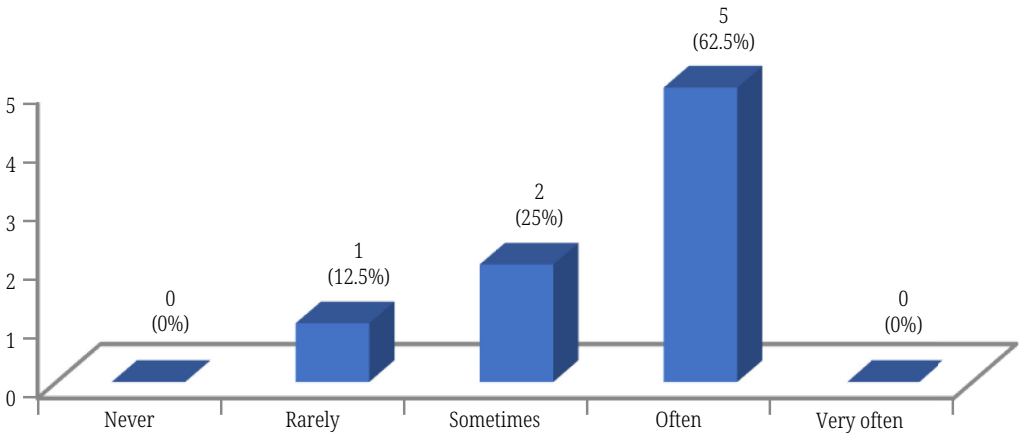

Fig. 2. Frequency distribution of the answers to the question "Q1. How often do you use ChatGPT when teaching programming?"

The second question, "Q2. What do you most often use ChatGPT for when teaching programming?" suggests more than one correct answer. The lecturers use the chatbot most often for code generation. Six of them chose this option, which accounts for 30% of all responses (refer to Table 2). The following are the answers: "To create tests and exam materials" and "To create homework assignments," which are present in the answers of four respondents (20% of all answers). None of the lecturers use ChatGPT to prepare teaching materials.

Table 2. Distribution of the answers to question Q2. "What do you most often use ChatGPT for, when teaching programming?"

	Frequency	Percent
Preparation of learning materials	0	0.0
Code generation	6	30.0
Creation of tests and exam materials	4	20.0
Creation of homework assignments	4	20.0
Creation of more complex collective projects	2	10.0
Checking student' assignments	2	10.0
As a tool supporting students' independent work in class	2	10.0
Total number of answers	20	100.0

Table 3 presents the descriptive statistics for the questions regarding the advantages of using ChatGPT in teaching programming. The descriptive statistics include F, percentage frequency (%), median (Me), mean (M), and standard deviations (STD).

All respondents agree with the statement that "ChatGPT saves time for searching information on the Internet" (62.5% A and 37.5% SA). Also, 75% of the lecturers highly appreciate the possibility of using ChatGPT as an assistant during classes, as it allows natural language communication (37.5% A and 37.5% SA). Only two lecturers have marked the options "Disagree" and "Neutral" to this statement, respectively. The calculated M value for both statements is M>=4, which shows that, according to the respondents, these two features of the chatbot are significant for the process of teaching programming.

Only half of the respondents positively assess the possibilities provided by ChatGPT for immediate feedback in case of a problem occurrence (Q3.3), personalised training (Q3.4), and generating comments to a program code (Q3.2). The distribution of the answers for the three statements is the same. Their calculated M values are M>=3.5, which again shows agreement between the lecturers regarding the significance of these characteristics.

Table 3. Answers distribution and descriptive statistics for the teachers' attitude towards advantages of using ChatGPT in teaching programming

Statement		SD	D	N	A	SA	Me	M	STD
Q3.1. ChatGPT saves time for searching information on the Internet	**F**	0	0	0	5	3	4	4.38	0.518
	%	0	0	0	62.5	37.5			
Q3.2. ChatGPT provides detailed comments, clarifying the logic of the program code	**F**	0	2	2	2	2	3.5	3.5	1.195
	%	0	25.0	25.0	25.0	25.0			
Q3.3. ChatGPT gives the students an opportunity for an immediate feedback in case of a problem occurrence	**F**	0	2	2	2	2	3.5	3.5	1.195
	%	0	25.0	25.0	25.0	25.0			
Q3.4. ChatGPT provides an opportunity for personalized training	**F**	0	2	2	2	2	3.5	3.5	1.195
	%	0	25.0	25.0	25.0	25.0			
Q3.5. ChatGPT can be used as an assistant during class as it allows natural language communication	**F**	0	1	1	3	3	4	4	1.069
	%	0	12.5	12.5	37.5	37.5			

Table 4 presents the results from the questions concerning the disadvantages of using ChatGPT in teaching programming. The teachers express a strong consensus on the risk of memorising incorrect information if only ChatGPT is relied on—75% of them answer with "Strongly Agree" and 25% with "Agree."

Equal distribution of the answers has been obtained for the statements "Q4.3. The use of ChatGPT may cause loss of students' interest in searching for information in different sources to solve a given problem" and "Q4.4. The use of ChatGPT can cause a loss of interest in the students to look for the solution to more complex problems on their own." Six lecturers answered "Strongly Agree," one with "Agree," and one had not expressed an opinion. The calculated M value for both statements is M>=4, and the Me = 5, further highlighting the unanimity of these concerns.

Most teachers, 75%, agree with the statement, "Q4.5. Using ChatGPT can lead to loss of contact with the instructor" (50% A and 25% SA). The calculated M value, M = 3.88 is again higher than 3.5, which shows a general agreement among teachers that this is a potential issue.

Table 4. Answers distribution and descriptive statistics for the teachers' attitude towards disadvantages of using ChatGPT in teaching programming

Statement		SD	D	N	A	SA	Me	M	STD
Q4.1. ChatGPT facilitates test/exam fraud	**F**	0	0	1	2	5	5	4.5	0.756
	%	0	0	12.5	25.0	62.5			
Q4.2. There is a risk of memorizing incorrect information if only ChatGPT is relied upon	**F**	0	0	0	2	6	5	4.75	0.463
	%	0	0	0	25.0	75.0			
Q4.3. The use of ChatGPT may lead to loss of students' interest in searching information from different sources to solve a problem	**F**	0	0	1	1	6	5	4.63	0.744
	%	0	0	12.5	12.5	75.0			
Q4.4. The use of ChatGPT may cause students to lose interest in finding the solution to more complex problems on their own	**F**	0	0	1	1	6	5	4.63	0.744
	%	0	0	12.5	12.5	75.0			
Q4.5. The use of ChatGPT may result in loss of contact with the instructor	**F**	0	1	1	4	2	4	3.88	0.991
	%	0	12.5	12.5	50.0	25.0			

Table 5 presents the results related to the teachers' opinions about ChatGPT's potential to develop soft skills in the students.

Table 5. Answers distribution and descriptive statistics for the teacher's attitude towards the potential of ChatGPT to develop soft skills in students

Statement		SD	D	N	A	SA	Me	M	STD
Q5.1. The use of ChatGPT may affect students' development regarding problem formulation and solution seeking abilities	**F**	0	0	1	6	1	4	4	0.535
	%	0	0	12.5	75.0	12.5			
Q5.2. The use of ChatGPT can influence critical thinking development in the students	**F**	0	3	3	1	1	3	3	1.069
	%	0	37.5	37.5	12.5	12.5			
Q5.3. The use of ChatGPT can influence on the development of creative thinking in the students	**F**	0	3	3	1	1	3	3	1.069
	%	0	37.5	37.5	12.5	12.5			

Almost all lecturers agree that ChatGPT can influence the development of students' problem-solving abilities and search for solutions (75.0% A and 12.5% SA). The calculated M value, M = 4 also supports this conclusion.

The calculated M values (M = 3) of the statements that the use of ChatGPT can influence the development of students' critical thinking and creativity show that the teachers have yet to form a concrete opinion on the matter.

4.2 Qualitative data analysis of teacher survey

The last six questions in the teachers' questionnaire are open-ended, allowing the respondents to share their opinions and experiences of using ChatGPT in their teaching.

The first question aims to determine how surveyed teachers perceive the reliability and accuracy of code generated by ChatGPT. The second question seeks to understand how easily they can distinguish ChatGPT-generated code from human-written code. The third question investigates educators' opinions about the usefulness of ChatGPT as an educational tool. The fourth question evaluates ChatGPT's impact on student knowledge. The fifth question focuses on the need for students to be trained to use ChatGPT effectively in their studies. The final question aims to determine whether educators also need training on working with ChatGPT in the teaching process.

Qualitative thematic analysis of these questions will help us identify potential advantages and disadvantages of integrating ChatGPT into programming education that may not be reflected in the Likert scale responses. The thematic analysis involved several steps. The data were carefully analysed and hand-coded to identify relevant themes from the participants' responses. The generated codes were organised into potential themes. After thorough deliberation and discussion, we defined the following themes and subthemes, which accurately represent the nature of the data and correspond to the research questions:

1. Generating accurate code for simple tasks

ChatGPT is seen as a valuable tool for generating code for routine tasks. Terms such as *suitable for basic tasks* and *generates correct code for certain lighter assignments* reflect users' appreciation of the code accuracy of simple tasks.

2. ChatGPT as an educational tool

2.1. Useful as supplementary educational tool

Responses such as ChatGPT can *support education* and *be useful as a supplementary tool* recognise the chatbot as a tool that can complement classroom teaching and learning. There is also an answer that the chatbot *can significantly ease the work of the teachers during practical classes, especially when dealing with a large number of students*.

2.2. Advanced users-benefits

Some responses suggest that students who are advanced in programming can benefit significantly from ChatGPT. This is reflected in comments such as *it is suitable for advanced users* and *it benefits advanced students*.

2.3. Assistance in debugging

ChatGPT is mentioned as a helpful assistant in debugging by identifying errors or suggesting corrections, which is reflected by keywords such as *useful for debugging* and *supply assistance in writing and testing code.*

One of the teachers shares the experience of using the chatbot to debug programming assignments: *In simpler assignments (for example, Programming Basics), it immediately detects the problems and gives a solution to correct them. In more complex projects, it only gives guesses about where the problem might be and guidelines for its elimination. However, if you run the program in the debugger and tell ChatGPT exactly which line the program is giving an error on, in 90% of the cases, it will find the problem right away.*

3. Inaccurate code generation

Respondents caution that ChatGPT's code can be error-prone, especially in more complex tasks. Phrases such as *code is not always correct* and *everything generated by ChatGPT should be checked* indicate that generated code may contain errors that need careful review.

4. Potential overreliance by students

There is concern that students may become too dependent on ChatGPT for answers. Using ChatGPT may lead to a superficial understanding of programming concepts if students rely solely on generated code. This is proven by phrases such as *potential overreliance* and *lead to missing foundational knowledge*.

5. Difficulty in differentiating AI-generated code

Some teachers noted that ChatGPT-generated code significantly differs in structure and style, making it easy to identify as it *normally uses ready-made functions to solve specific tasks*, and *is not aligned with students' current knowledge*. However, as ChatGPT improves, it becomes harder to distinguish AI-generated from human-written code. This can complicate teachers' ability to assess their students' understanding. Therefore, teacher control should be increased to address these challenges effectively.

6. Need for training

6.1. Student training for responsible use of ChatGPT

There is a consensus on the need for training students to use ChatGPT responsibly, with terms such as *should be taught* and *should be trained* frequently mentioned. As an argument, the respondents have pointed out that students should know *how to correctly formulate the problem so that they get the most accurate answer from AI* and *how to use ChatGPT to tailor the training to their personal needs*.

6.2. Educator familiarity with ChatGPT

The common opinion is that teachers should learn new technologies' advantages and disadvantages and *should not be afraid to integrate them into the learning process*. Terms such as educators should be *acquainted with new technologies* and *informed about ChatGPT's capabilities* highlight the importance of educator training.

This thematic analysis shows that ChatGPT can quickly solve fundamental programming problems but is less effective for more complex projects. Participants believe that ChatGPT would be more useful for students advanced in programming. As challenges, respondents indicate the need to verify the generated code and increased control by teachers to prevent falsely inflating programming grades. Training is needed for both students and teachers to ensure that ChatGPT is used responsibly and effectively as an additional tool in programming education.

4.3 Quantitative data analysis of student survey

The percentage of students who use ChatGPT sometimes (34%) and often (36%) is similar. Only 8% of students reported using the chatbot very often (see Figure 3).

The next question, "Q2. What do you most often use ChatGPT for in your programming education?" is a multiple-choice question. Approximately equal percentages of students use the chatbot to search for theoretical information and to troubleshoot code problems, 25.2% and 26%, respectively (refer to Table 6). The lowest number of students (9.8%) said they use ChatGPT for complete code generation.

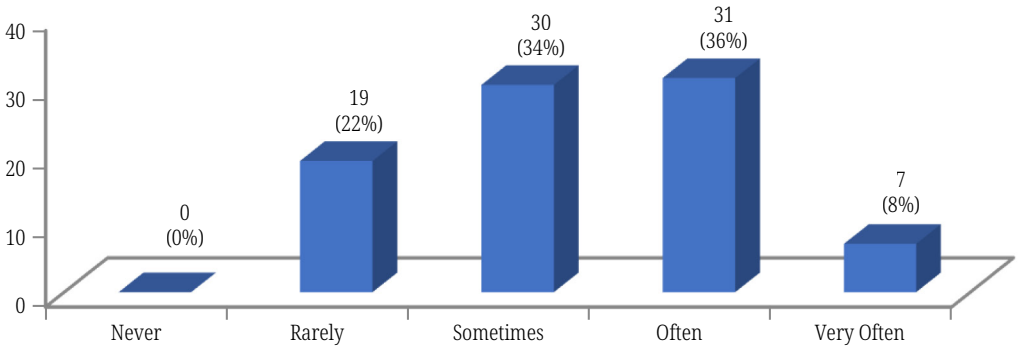

Fig. 3. Frequency distribution of the answers to the question "Q1. How often do you use ChatGPT in your programming training?"

Table 6. Distribution of the answers to the question "Q2. What do you most often use ChatGPT for in your programming education?"

	Frequency	Percent
To search for additional theoretical information	62	25.2
To generate a complete code	24	9.8
To fix code problems	64	26.0
To find different solutions to the same problem	55	22.3
To provide explanations of a ready-made program code	41	16.7
Total number of answers	246	100.0

Table 7 presents the results concerning the advantages of using ChatGPT in programming education. Most respondents (80.4%) agree that ChatGPT saves time for searching for information on the Internet. The second highest rated (75.9%) is the statement that ChatGPT enables instant feedback.

In this part of the students' questionnaire, we introduced a new statement: "Q3.5. ChatGPT enables communication in Bulgarian." Recognizing that a significant portion of the students have a foreign language proficiency around or below the average, we saw the inclusivity provided by ChatGPT to communicate in Bulgarian as a significant advantage. The M of the answers to this statement is higher than the mean of the responses to the question, stating that ChatGPT provides an opportunity for natural language communication, further underlining its inclusivity.

For five of the considered features, the calculated M is M>=3.5, which shows that, according to the students-respondents, these characteristics are significant for their programming education. Only the statement "Q3.4. ChatGPT provides an opportunity

for personalised training/learning" has a calculated M value of 2.91, indicating an N position. This result may also be due to some of the respondents' unfamiliarity with the concept of "personalised training or learning."

Table 7. Answers distribution and descriptive statistics for the students' attitude towards advantages of using ChatGPT in studying programming

Statement		SD	D	N	A	SA	Me	M	STD
Q3.1. ChatGPT saves time for searching information on the Internet	F %	2 2.3	4 4.6	11 12.6	45 51.7	25 28.7	4	4	0.902
Q3.2. ChatGPT provides detailed comments, clarifying the logic of the program code	F %	3 3.4	8 9.2	25 28.7	33 37.9	18 20.7	4	3.63	1.024
Q3.3. ChatGPT gives opportunities for an immediate feedback	F %	1 1.1	4 4.6	16 18.4	42 48.3	24 27.6	4	3.97	0.869
Q3.4. ChatGPT provides an opportunity for personalized training/learning	F %	9 10.3	24 27.6	28 32.2	18 20.7	8 9.2	3	2.91	1.127
Q3.5. ChatGPT enables communication in Bulgarian	F %	1 1.1	5 5.7	22 25.3	42 48.3	17 19.5	4	3.79	0.865
Q3.6. ChatGPT enables natural language communication	F %	2 2.3	5 5.7	31 35.6	30 34.5	19 21.8	4	3.68	0.958

Table 8 presents the results from the questions concerning the disadvantages of using ChatGPT in programming education. The students expressed the highest degree of agreement (73.5%) regarding the existing danger of memorising incorrect information if relying only on ChatGPT, as did the lecturers in their questionnaires.

The greatest variation in responses SD = 1.185 occurs when the students assess the statement, "Q4.5. Using ChatGPT may result in loss of contact with the instructor." The calculated M of the responses to this statement is 2.94, which indicates an N position.

Also of interest are the obtained results regarding the statement "ChatGPT facilitates test/exam fraud." The calculated M here is lower than 3.5 again, which indicates an N position among the students, while for the educators this value is 4.5, which signifies strong agreement with the claim.

Table 8. Answers distribution and descriptive statistics for the students' attitude towards disadvantages of using ChatGPT in studying programming

Statement		SD	D	N	A	SA	Me	M	STD
Q4.1. ChatGPT facilitates test/exam fraud	F %	8 9.2	16 18.4	27 31.0	28 32.2	8 9.2	3	3.14	1.112
Q4.2. There is a risk of memorizing incorrect information if only ChatGPT is relied upon	F %	3 3.4	7 8.0	13 14.9	47 54.0	17 19.5	4	3.78	0.97
Q4.3. The use of ChatGPT may cause a loss of interest in seeking information from different sources to solve a given problem	F %	4 4.6	13 14.9	21 24.1	33 37.9	16 18.4	4	3.51	1.098
Q4.4. The use of ChatGPT can cause you to lose interest in finding the solution to more complex problems on your own	F %	2 2.3	4 4.6	36 41.4	36 41.4	9 10.3	4	3.53	0.833
Q4.5. The use of ChatGPT may result in loss of contact with the instructor	F %	12 13.8	19 21.8	26 29.9	22 25.3	8 9.2	3	2.94	1.185

The distribution of the students' answers to the questions, considering the potential of ChatGPT to develop soft skills, is presented in Table 9.

The results are similar to those obtained from surveying with the teachers. 62% of the respondents express the opinion that ChatGPT can influence the development of problem formulation and solution-seeking abilities. The calculated M value, M = 3.64 also supports this conclusion.

The calculated M values of the responses to the claims that ChatGPT can influence the development of critical and creative thinking in the students are lower than 3.5, which shows that the students do not have an opinion about the statement.

Table 9. Answers distribution and descriptive statistics for the student's attitude towards the potential of ChatGPT to develop soft skills in students

Statement		SD	D	N	A	SA	Me	M	STD
Q5.1. Using ChatGPT can influence the development of problem formulation and solution seeking abilities.	**F** **%**	2 2.3	9 10.3	22 25.3	39 44.8	15 17.2	4	3.64	0.964
Q5.2. Using ChatGPT can influence on the development of critical thinking	**F** **%**	1 1.1	15 17.2	30 34.5	27 31.0	14 16.1	3	3.44	0.997
Q5.3. Using ChatGPT can influence on the development of creative thinking	**F** **%**	2 2.3	13 14.9	37 42.5	28 32.2	7 8	3	3.29	0.901

The students were asked to rate three more statements in the third part of their questionnaire. Table 10 presents the results concerning their preferences for receiving support when writing programs from ChatGPT instead of assistance from teachers, colleagues/friends, or the Internet. The results show that only 18.4% of the students prefer to use ChatGPT in case of a problem occurrence rather than to ask for help from their teachers. The highest number of students (35.6%) prefer to seek help from the chatbot rather than looking for information on the Internet. The mean values for all three questions fall between 2.5 and 3.49. This range indicates that while some students see advantages in using ChatGPT, they do not strongly prefer AI-based support over the other methods indicated.

Table 10. The questionnaire results regarding preferences for support from ChatGPT in comparison to assistance from teachers, friends, and Internet

Statement		SD	D	N	A	SA	Me	M	STD
Q6.1. If I need assistance in writing programs, I prefer to seek help from ChatGPT rather than from the teacher.	**F** **%**	14 16.1	27 31.0	30 34.5	12 13.8	4 4.6	3	2.6	1.062
Q6.2. If I need assistance in writing programs, I prefer to seek help from ChatGPT rather than from colleagues or friends.	**F** **%**	11 12.6	20 23.0	28 32.2	23 26.4	5 5.7	3	2.9	1.111
Q6.3. If I need assistance in writing programs, I prefer to seek help from ChatGPT, rather than looking for information on the Internet (on sites, forums, etc.).	**F** **%**	7 8.0	17 19.5	32 36.8	21 24.1	10 11.5	3	3.11	1.104

Figure 4 presents the answers to the last question, "Q7. Do you think that ChatGPT is a useful tool in learning programming?". 65% of the respondents answered positively to this question, and a very small number of students expressed a negative opinion–only 12%. The calculated M value M = 3.75 also gives grounds to consider that the more significant part of the students positively evaluates the use of ChatGPT in learning programming (M>=3.5).

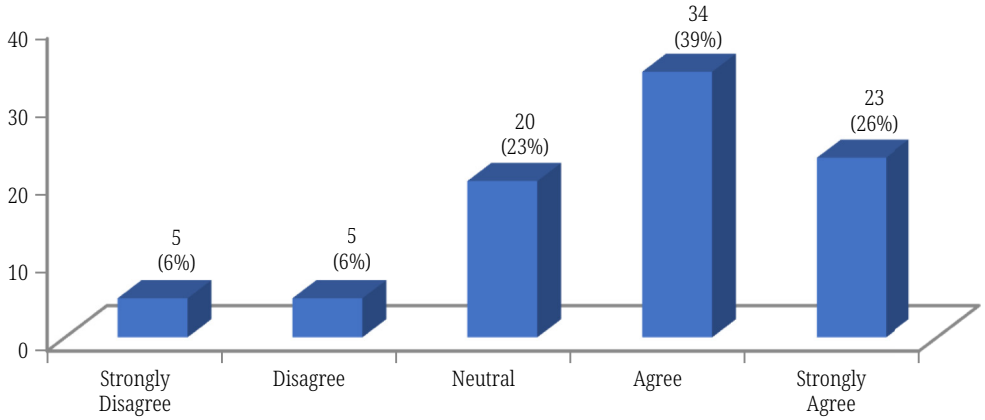

Fig. 4. Frequency distribution of the answers to the question "Q7.Do you think that ChatGPT is a useful tool in learning programming?"

5 DISCUSSION

The main objective of the study is to investigate students' and teachers' perceptions regarding the use of ChatGPT in programming education. Three factors corresponding to the research questions were examined. The study shows significant similarity in the opinions of students and teachers on two factors studied: attitudes towards the advantages of using ChatGPT in programming education and the potential of ChatGPT to develop soft skills in students. A difference appears in assessing the factor—attitude towards the disadvantages of using ChatGPT in programming education. Compared to students, teachers express much greater concern about the negative effect of ChatGPT on academic integrity and teaching quality. The results of our study confirm, to a great extent, the results of other studies investigating the integration of ChatGPT into education in general.

Both groups of respondents highly appreciate the advantages provided by ChatGPT in programming education. Both students and teachers rate the statement that ChatGPT saves time when searching for information on the Internet as the highest, which is consistent with [49], [50], and [51]. The second highest-rated statement by students is that ChatGPT allows instant feedback, which is also reported in [40], while teachers appreciate its utility as an assistant during class. The last finding is similar to [52], which states that ChatGPT can support programming instructors' work in classes with high student-to-teacher ratios.

Although almost all of the teachers surveyed think that ChatGPT could be helpful to students as a tool for providing explanations and advice when writing programs, very few (only 10%) use it to help students with their independent work in the classroom. This could be due to the lack of strict university regulations for integrating AI in education and pedagogical guidelines for incorporating ChatGPT into programming education.

Most of the surveyed teachers primarily use ChatGPT to generate code. Furthermore, they think that ChatGPT can quickly solve basic coding problems, but its effectiveness is limited in more complex projects. That is why some teachers in our study recommended using ChatGPT only in advanced programming courses. Another curious finding is that none of the surveyed educators use ChatGPT to prepare learning materials. This finding contrasts with [51], which reports that educators highly evaluate the possibilities of ChatGPT in creating learning scenarios and educational resources for lectures and exercises. The student questionnaire results significantly contrast the teachers' responses to the same question—nearly 26% of students use ChatGPT to access theoretical information.

The results of our research show difference in the evaluation of the second factor—attitude toward the disadvantages of using ChatGPT in programming education. Both groups of respondents expressed the highest degree of agreement regarding the existing danger of memorising incorrect information if relying only on ChatGPT. Previous studies such as [51], [53], [54], [55] also indicated that ChatGPT can provide biased or unreliable information and produce false or outdated data.

The results from the teacher questionnaire show that the educators strongly agree with the statement, "ChatGPT facilitates test/exam fraud." This finding aligns with the observations reported in [51] and [56], where some faculty and staff expressed an opinion that ChatGPT is primarily a tool for cheating on exams. The results from the students' questionnaire indicate an N position, which is consistent with [57]. A potential reason for the students' neutral stance, as noted in [56], is the view that each student is responsible for using ChatGPT ethically during exams. In other words, it is up to students to decide whether to use or misuse the technology in educational settings.

Most surveyed students do not strongly feel that using ChatGPT will diminish their interaction with teachers. Additionally, only 18.4% of students prefer to use ChatGPT in case of a problem rather than ask for help from their teachers, which shows that most students still value and trust their educators to assist them with learning challenges. This view is consistent with [58] and [59], which emphasise the irreplaceable roles of teachers due to the unique human qualities they bring to the learning experience. The results show that teachers are increasingly worried about the danger of losing student-teacher contact due to ChatGPT, which is consistent with findings in [51].

Regarding ChatGPT's potential to develop soft skills in students, both groups of respondents agree that the chatbot can influence the development of problem formulation and solution-seeking abilities, which aligns with the findings in [51]. According to [40], ChatGPT can enhance student's computational thinking and problem-solving skills only when they tackle complex and unstructured problems with the chatbot's assistance. In [56], the authors express a different opinion, stating that ChatGPT had the most negative impact on critical thinking and problem-solving skills. However, neither the students nor the teachers in our study have formed an opinion on whether ChatGPT can influence the development of student's critical thinking and creativity. This is understandable, given that ChatGPT has recently been introduced, and it is still relatively early for the respondents to have a firm opinion on the given statement.

As a result of our research, we can summarise that both surveyed groups view ChatGPT positively as a supplementary tool in programming education, but teachers are more cautious. The differences in responses indicate varying perceptions between students and teachers, possibly influenced by students' limited experience

with AI in educational settings. [60] indicates that students' strong positive attitude towards the integration of AI can be explained by the fact that they are aware of the benefits of AI but are not aware of its ethical threats.

Conversely, teachers have more experience or awareness of how ChatGPT tools could change the educational process. The reserved attitude of educators towards the use of ChatGPT in programming education can be explained by the following:

- The lecturers are concerned that the students could use ChatGPT to create content without understanding or learning it. A similar issue has been identified in [56]. [40] states that ChatGPT may hinder students' cognitive development by offering immediate answers, reducing the need for deep thinking. To address this, teachers should assign complex, modular projects that force students to think critically.
- Another concern of the lecturers is that assessing the students' knowledge and skills is difficult if they use ChatGPT to prepare their assignments. This raises the question of reevaluation and adaptation of traditional assessment methods in educational settings incorporating innovative technologies such as ChatGPT. [61] states that the use of ChatGPT threatens the integrity of online exams, particularly in higher education. According to [62], using AI-generated content detectors is not very applicable in teaching programming because they perform poorly in distinguishing between human-written and AI-generated code. To address this problem, some authors suggest returning to oral exams, using AI to automatically compare code between different students [63], using customised assignments, complex and unstructured problems, etc.

Most teachers believe students should be taught how to use ChatGPT effectively, focusing on correctly formulating questions and tailoring the AI's use to their individual learning needs. All educators unanimously agree that they should also receive training on integrating ChatGPT into their teaching. They emphasise the importance of understanding new technologies to maximise their benefits and effectively incorporate them into the educational process. This conclusion aligns with findings in [56], which emphasise that educators should help students use ChatGPT to foster critical thinking, and students should learn to use it as a learning tool rather than as a tool to cheat. According to [60] and [64], students should have AI literacy to understand AI capabilities and risks.

The study results emphasise the importance of considering how AI tools are integrated into educational practices. Responses from both surveyed groups show that educational strategies should focus on integrating ChatGPT in ways that complement traditional teaching methods. These findings are consistent with [58] and [65], suggesting that universities can create compelling educational environments by combining human teachers' strengths with generative AI. Additionally, authors in [60] argue that future higher education should prepare students for employment in a generative AI-driven society. They also suggest new learning outcomes: skills in learning and teaching with generative AI and AI literacy.

6 CONCLUSION

This study is one of the few studies that focus on simultaneously examining the views of both students and teachers on the use of ChatGPT in programming education. Both groups consider ChatGPT a useful supplementary tool in the educational process, but teachers are more cautious about its integration. This is understandable

due to the lack of strict regulations for using AI in education and pedagogical guidelines for integrating AI into programming education. Based on the valuable results of the study, the following recommendations for the effective use of ChatGPT in programming education were formulated:

1. **Establishing university AI usage regulations.** Each university should develop precise guidelines defining responsible AI usage in academic settings. The regulation should result from the collaborative work of a wide range of experts at the university [66]: faculty members, experts in technology-enhanced learning, experts in didactics, legal experts, IT professionals, etc. The university regulations should include a framework for the ethical use of AI in education, addressing the risks of dishonest practices such as cheating during exams, plagiarising, or submitting completely AI-generated homework solutions. Universities should consider adopting plagiarism detection tools to help identify AI-generated content.
2. **Providing training for students and teachers on using ChatGPT.** Students and teachers should be familiar with the functionalities and potential of ChatGPT that directly relate to education and should understand the principles of this technology. They should be trained to work with the chatbot, including formulating questions properly to avoid mistakes and misunderstandings. Educators could benefit from training that shares best practices and successful cases where ChatGPT has improved learning outcomes [67]. Students must receive training on the responsible use of AI. They should be informed about the importance of academic integrity. Students should be encouraged not to accept ChatGPT's answers without checking their correctness. Additionally, students should compare the accuracy of AI-generated information with reliable academic sources. This practice will help develop their critical thinking skills and cognitive abilities.
3. **Creating pedagogical guidelines for integrating ChatGPT into programming education.** The integration of ChatGPT in programming education should align with the course's learning objectives, defined according to Bloom's Taxonomy levels: Remembering, Understanding, Applying, Analysing, Evaluating, and Creating [68]. ChatGPT can support learning outcomes at each level by providing personalised feedback, code-writing assistance, and help with debugging:
    - Remembering—providing quick explanations of key terms and syntax rules for various programming languages, offering quiz questions to help students memorise common coding patterns or functions.
    - Understanding—providing detailed code explanations and examples where students can guess the result.
    - Applying—offering programming tasks where students apply what they have learned, helping them debug and refine their code.
    - Analysing—helping students identify bugs or inefficiencies in code, optimising code.
    - Evaluating—providing opportunities for students to compare different ways to solve the same problem.
    - Creating—supporting students in designing and developing original projects or solutions.

The results from the teachers' questionnaire and the literature review indicate that ChatGPT can quickly solve fundamental coding problems. However, this may lead students to depend on AI solutions without understanding or learning them [69]. This overreliance can affect students' problem-solving skills, which is consistent with the findings in [68] and [40]. Therefore, we recommend limiting the use of

ChatGPT by students in introductory courses such as Fundamentals of Programming. In this context, we propose that only teachers use ChatGPT to generate test questions, coding examples, and individual assignments and assess students' solutions. Given the challenges associated with monitoring student interactions with ChatGPT during their homework assignments, educators should increase their control to prevent the submission of solutions entirely generated by ChatGPT. This control could involve oral examinations or direct observation of students' work during class.

In advanced programming courses, the complexity of students' software projects increases significantly. These projects often require cognitive skills associated with analysing, comparing, and creating levels of Bloom's taxonomy. Furthermore, there is an increasing focus on independent assignments undertaken by students. The surveyed teachers share an opinion that ChatGPT's ability to generate ready-made code diminishes when dealing with more complex projects, particularly those that involve visual programming. In this context, we recommend encouraging students to utilise the chatbot as a personal assistant during class and independent work. This approach can reduce lecturers' workload and enhance students' project completion.

7 LIMITATIONS OF THE STUDY AND FUTURE RESEARCH DIRECTIONS

This study was conducted at a specific time and reflects the current attitudes of teachers and students toward a rapidly evolving technology. However, the study has limitations related to its sample size, as it was conducted in a single faculty with students from the second course. Consequently, the results may not be applicable across universities and subjects and may not apply to students from other courses. Despite the limitations, the results will provide valuable information about teachers' and students' perceptions of using ChatGPT in programming education. The results can serve as a basis for future research on the efficacy of using ChatGPT in other subjects, at other universities, and in different contexts.

Further research is needed to evaluate the effectiveness of the proposed recommendations. In this regard, we plan to conduct a pedagogical experiment to determine whether integrating ChatGPT into programming education can enhance students' learning.

8 ACKNOWLEDGMENTS

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