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Early insights into SLA with chatGPT: Navigating CS teachers and student perspectives in an opinion-based exploration

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Abstract: This study explores the integration of ChatGPT into Social Learning Analytics (SLA) to support programming education among computer science students at Mustapha Stambouli University, Mascara, Algeria. Utilizing a mixed-methods approach, the research combines quantitative surveys and qualitative analysis of recorded interactions of one example and interviews to examine the effectiveness, challenges, and perceptions of ChatGPT's use in programming tasks across Arabic, French, and English. The study involved 57 students and five teachers, providing a comprehensive view of ChatGPT's impact on learning experiences, engagement patterns, and programming performance. Results indicate that ChatGPT is frequently used as a supplementary tool, especially for programming-related queries, debugging, and last-minute assistance before deadlines. The tool's adaptability to students' needs, combined with its ease of use, enhances its perceived value in supporting independent learning. However, the limitations of the free version—such as restricted access, slower response times, and occasional inaccuracies—were frequently cited as barriers to consistent, effective use. Teachers acknowledged ChatGPT's role in easing instructional burdens but emphasized the need for critical oversight to prevent over-reliance on AI-generated content. Ethical concerns regarding data privacy, academic integrity, and the quality of AI feedback were highlighted as key issues requiring attention. Interestingly, a significant portion of students expressed the belief that AI, including ChatGPT, could potentially replace human programmers in the near future, reflecting both optimism and concern about the evolving role of AI in the field. Despite this, educators maintained that while ChatGPT can augment programming education, human intuition, creativity, and contextual understanding remain irreplaceable. The study concludes that ChatGPT's integration into SLA offers substantial opportunities to enhance educational support and enrich data on student learning behaviors. However, addressing accessibility issues, enhancing multilingual support, and mitigating ethical challenges are critical for maximizing the tool's effectiveness. The findings underscore the importance of a balanced approach that leverages AI's strengths while maintaining the essential role of human expertise in education and programming.

Keywords: *Artificial intelligence, ChatGPT, Collaborative learning, Higher Education, Programming, Social learning analytics.*

1. Introduction

In recent years, the advent of advanced language models such as ChatGPT has transformed various sectors, including education. As these AI-driven tools become increasingly integrated into academic settings, understanding their impact on learning and teaching practices is crucial [1], [2], [3]. Particularly in the realm of computer science education, leveraging ChatGPT alongside Social Learning Analytics (SLA) presents a unique opportunity to enhance student engagement,

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understanding, and collaborative learning through interactive dialogue and personalized feedback [4], [5], [6].

Context and Motivation: The integration of AI-driven tools like ChatGPT into educational environments is rapidly gaining traction due to their potential to support individualized learning paths and offer scalable teaching solutions. With the growing importance of programming literacy [7], problem-solving skills [8], and communication within the field of computer science, educators and institutions are continuously exploring innovative methods to enrich the learning experience[9]. ChatGPT, known for its ability to engage in human-like dialogue, provides an accessible and responsive tool for students to seek instant feedback and assistance with their academic tasks. SLA plays a crucial role in understanding how students interact and learn collaboratively in digital environments by analyzing social interactions and engagement patterns. When combined with ChatGPT, SLA can reveal insights into how students use conversational AI tools to enhance their learning, overcome challenges [6], and engage in collaborative programming tasks[10] [11],[12]. This integration not only aids in personalizing learning experiences but also contributes to a deeper understanding of student needs, preferences, and behaviors. The motivation behind this study is rooted in the need to explore how computer science students perceive and interact with ChatGPT as a tool within SLA frameworks. As students increasingly rely on AI for academic support, it is vital to examine both the benefits and challenges associated with its use, as well as the broader implications for educational practices in computer science.

Objective of the Study: The primary objective of this study is to explore the perspectives of computer science students on using ChatGPT within SLA, focusing on their experiences, opinions, and interactions. Specifically, the study aims to:

1. Assess Student Perceptions: Understand how students perceive ChatGPT as a learning tool, including its effectiveness, usability, and impact on their academic performance.

2. Identify Benefits and Challenges: Explore the advantages that ChatGPT offers to students, such as enhanced understanding and instant feedback, as well as the challenges, including limitations in domain-specific accuracy and ethical concerns like dependency and academic integrity.

3. Evaluate AI's Impact on Learning Dynamics: Analyze how ChatGPT influences learning behaviors, collaborative programming efforts [13], and student engagement, providing insights into its role in shaping future educational landscapes.

Contributions of the Study: This study makes several significant contributions to the field of educational technology and computer science education:

1. Insight into Student Perspectives: By capturing the opinions and experiences of computer science students, this research provides valuable insights into how ChatGPT is perceived as a tool for SLA, highlighting both its benefits and areas needing enhancement.

2. Evaluation of AI in Education: The study evaluates the role of AI in education, particularly in facilitating collaborative learning for technical students, contributing to a broader understanding of AI's impact on learning outcomes, engagement patterns, and student-teacher interactions.

3. Guidance for Future Integration: The findings offer practical guidance for educators, developers, and policymakers on effectively integrating AI tools into computer science curricula. This includes recommendations on addressing language barriers, improving AI response accuracy, and designing features that cater to the diverse needs of students.

4. Ethical Considerations and Future Implications: The study delves into the ethical implications of using AI in academic settings, such as the risks of over-reliance and the potential for AI to replace human elements in learning. This research highlights the need for strategies that balance AI support with critical thinking and independent problem-solving skills.

The remainder of this paper is structured as follows: Section 2 reviews the related literature

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on AI in education and SLA. Section 3 describes the methodology employed in this study, including participant selection and data collection techniques. Section 4 presents the results of the opinion-based exploration, highlighting key findings and insights. Section 5 discusses the implications of these findings for educators and technology developers. Finally, Section 6 concludes the paper by summarizing the study's contributions and suggesting directions for future research.

2. Literature Review

To provide a deep analysis and background review based on a recent paper released from 2023 up to now, we will focus on synthesizing the key themes, trends, and insights related to the use of ChatGPT in education and SLA.

2.1. ChatGPT in Education

The analysis is about the use of ChatGPT and other AI tools in education will cover the following aspects:

1. Adoption and Integration of AI in Education: The adoption of AI tools, such as ChatGPT, continues to reshape the educational landscape across various levels of education. Educational institutions are increasingly embracing AI for diverse applications, ranging from classroom instruction to administrative functions [1], [14], [15]. This growing trend includes the use of AI in higher education, K-12 schools, and even vocational training, where AI is being integrated to support both teaching and learning processes [16]. A notable trend in AI integration is the focus on creating AI-enhanced learning environments that cater to individual student needs. This trend is particularly evident in personalized learning platforms, where AI tailors educational content and experiences to suit each learner's pace and style [17]. Additionally, AI is being adopted in teacher professional development, helping educators stay abreast of the latest technological advancements and effectively incorporate AI into their teaching methodologies [18]. The collaboration between educational institutions and technology companies is also facilitating the smoother integration of AI tools into curricula, with a focus on co-developing AI-driven educational solutions [19].

2. Benefits of AI in Education: AI's benefits in education are broad, ranging from personalized learning to increased accessibility and efficiency. One of the most significant advantages of AI is its ability to provide personalized learning experiences [3]. By analyzing student data in real-time, AI can adapt instructional content to meet the unique needs of each student, thereby improving learning outcomes [9]. This personalization extends beyond academics to include social and emotional learning, where AI can help students develop essential soft skills [20]. Moreover, AI tools are breaking down traditional barriers to education. For students with disabilities or those in remote locations, AI provides access to resources and support that might otherwise be unavailable [15], [21]. This has been particularly beneficial in enhancing the inclusivity of educational systems, ensuring that all students, regardless of their circumstances, can access quality education. The use of AI in automating administrative tasks is another critical benefit [22]. By handling tasks such as grading, scheduling, and attendance tracking, AI allows educators to focus more on teaching and mentoring, thereby enhancing the overall educational experience [23]. Additionally, AI supports educators in content creation and curriculum development, making it easier to design and deliver educational programs that meet the needs of diverse student populations [1].

3. Challenges and Risks: Despite the numerous benefits, the integration of AI in education presents significant challenges and risks. One major challenge is the digital divide, where unequal access to technology can exacerbate educational inequalities. Students from low-income families or underserved regions may lack access to AI tools, creating a gap in learning opportunities. This challenge is particularly pressing as AI becomes more integral to educational

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processes [14]. Another significant risk is the potential for AI to perpetuate biases [2]. AI systems, which rely on existing data for learning, can inadvertently reinforce societal biases present in the data, leading to discriminatory outcomes, particularly in grading and assessment [24]. Addressing this issue requires careful design and implementation of AI systems to ensure fairness and equity. Privacy and data security concerns also loom large as AI becomes more prevalent in education [9], [25] . The extensive use of AI involves collecting and analyzing large amounts of student data, raising concerns about how this data is used, stored, and protected [26]. Ensuring robust data security measures and transparent data usage policies is crucial to maintaining trust and protecting student privacy. Moreover, the rapid pace of AI integration has led to concerns about the readiness of educational institutions to fully embrace these technologies. Issues such as inadequate infrastructure, insufficient training for educators, and resistance to change can hinder the effective implementation of AI in education [27]. These challenges underscore the need for comprehensive strategies that address both the technological and human aspects of AI integration.

4. Methodologies and Approaches: Various methodologies are being employed to integrate AI into education effectively. One common approach is the blended learning model, where AI tools complement traditional teaching methods [28]. In this model, AI provides supplementary instruction, adaptive assessments, and personalized feedback, while teachers continue to play a central role in guiding students. This approach allows for a more individualized learning experience while maintaining the benefits of human interaction. Project-based learning is another methodology where AI is proving to be particularly effective [18]. AI tools assist students in research, problem-solving, and project management, allowing for deeper exploration of topics and fostering critical thinking skills [14]. Additionally, AI is being integrated into STEM education through tools that facilitate experimentation, simulation, and analysis, thereby enriching the learning experience and preparing students for future careers in technology-driven fields [26]. Some educational institutions are also exploring fully AI-driven classrooms, where AI handles most instructional duties. Although still in the experimental stages, this approach raises important questions about the future role of teachers and the balance between human interaction and machine intelligence in education[29]. These methodologies highlight the diverse ways AI is being incorporated into education, each with its own set of benefits and challenges.

5. Future Directions and Implications: The future of AI in education is likely to see even greater integration, with AI becoming a central component of educational experiences across all levels of education [28]. Emerging trends suggest that AI will play an increasingly important role in personalized learning, offering more sophisticated tools for adapting educational content to individual student needs. As AI technologies continue to advance, we can expect improvements in real-time feedback, collaborative learning, and support for diverse learning styles. The development of more advanced natural language processing models, such as future iterations of ChatGPT, will enhance AI's ability to understand and respond to student needs, making learning more interactive and engaging. However, the future of AI in education also raises critical ethical and policy questions. Ensuring equitable access to AI tools, preventing bias, and safeguarding student data will require careful consideration and regulation [30]. Additionally, the role of educators will need to be redefined in an AI-enhanced educational environment. While AI can handle many instructional tasks, the importance of maintaining the human element in education, particularly in fostering creativity and critical thinking, cannot be overstated. Moreover, the long-term implications of AI integration in education include the potential for AI to redefine traditional educational models. As AI tools become more sophisticated, we may see a shift towards more flexible, learner-centered approaches that prioritize lifelong learning and continuous skill development [1], [3]. This evolution will require educators, policymakers, and technologists to work together to create an educational

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system that leverages the benefits of AI while addressing its challenges.

The integration of AI in education offers significant opportunities for enhancing personalized learning, increasing accessibility, and improving administrative efficiency. However, realizing the full potential of AI in education requires addressing challenges such as the digital divide, bias, and privacy concerns. As AI continues to evolve, its role in education will expand, necessitating careful consideration of the ethical, policy, and pedagogical implications. The future of education will likely be shaped by the successful integration of AI, balancing technological advancements with the need to preserve the human elements of teaching and learning [14], [21], [27], [31]. Building on the increasing adoption of AI in educational settings, social learning analytics emerges as a powerful tool to enhance collaborative learning experiences. As AI continues to integrate into the educational landscape, it brings about transformative changes not only in personalized learning but also in how social interactions within learning environments are understood and optimized. The growing body of research highlights the potential of AI-driven tools to analyze social learning patterns, providing educators with deeper insights into student collaboration, peer interactions, and the overall dynamics of learning communities. These advancements set the stage for a more nuanced exploration of how social learning analytics can be leveraged to foster more effective and inclusive learning environments.

2.2. Social Learning Analytics

The integration of Artificial Intelligence (AI) into educational systems, particularly through tools like ChatGPT, has significantly impacted the landscape of blended learning. The incorporation of AI in education has prompted extensive research into its potential to enhance sustainability, accessibility, and the effectiveness of learning environments. This literature review synthesizes insights from recent studies, each exploring different dimensions of social learning analytics, AI in education, and the influence of ChatGPT on blended learning systems. The integration of ChatGPT into blended learning systems is seen as a promising innovation in educational technology. [32] explores the potential of AI to enhance the sustainability of educational systems by personalizing learning experiences and increasing student engagement. The research highlights how ChatGPT can automate administrative tasks and optimize content delivery, making education more accessible and inclusive. The study concludes that ChatGPT promotes self-directed learning by providing immediate feedback, leading to improved learning outcomes and student motivation. It calls for further research to explore best practices for effectively integrating AI into educational systems. The role of ChatGPT in programming education is another significant area of study. The paper [14] uses social media data to analyze ChatGPT's role in code generation, finding that it is widely used across various programming languages, especially Python and JavaScript, for tasks like debugging and interview preparation. However, the analysis reveals that fear is the dominant emotion associated with AI-assisted coding, which suggests a need for further exploration into the psychological impacts of AI on learners. Another study [30] investigates how college students use ChatGPT in programming learning environments. It finds that while ChatGPT is a valuable resource, students might over-rely on it, potentially weakening their deep understanding of coding concepts. The study observes that high-performing students use ChatGPT more frequently, indicating that it can be beneficial when used strategically. Equity and fairness are critical concerns in the context of AI-facilitated learning. The study [15] discusses the potential inequities introduced by AI tools like ChatGPT, particularly in online learning environments [33]. The concept of "Ignorant Bias" is introduced, highlighting the risk of AI providing incorrect or misleading information in the absence of human oversight, which could be harmful to learners. This paper underscores the importance of ensuring that AI complements human instruction rather than replacing it, especially in contexts where equity and fairness are essential.

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The shift from predictive to prescriptive learning analytics represents a significant development in educational research. The authors in [34] critiques the traditional focus on predictive models, advocating for the integration of explainable AI to enhance transparency and provide stakeholders with a better understanding of predictive outcomes. The study proposes a framework that incorporates ChatGPT to deliver personalized, human-readable advice to at-risk students, making learning analytics more actionable and supportive of student success. The integration of prescriptive analytics into educational systems is still in its early stages, but it holds promise for improving interventions and outcomes. The role of AI in social learning and communities of practice is explored in another study [31]. This paper examines the implications of integrating large language models like ChatGPT into social learning environments. While AI can assist with tasks such as information retrieval and brainstorming, the study cautions against mistaking AI-generated contributions for genuine human participation. The study emphasizes the importance of collective consent, transparency, and critical reflection when using AI in social learning contexts, to ensure that AI supports rather than distorts the collective learning process.

The reviewed literature demonstrates the transformative potential of ChatGPT and similar AI tools across various educational contexts. While AI offers significant benefits, including personalized learning, enhanced engagement, and support in programming education, it also presents challenges related to equity, over-reliance, and transparency. Future research should focus on developing best practices for AI integration, understanding the psychological and social impacts of AI on learners, and ensuring that AI promotes educational equity and fairness. By addressing these challenges, educators and policymakers can better leverage AI's potential to create more effective, inclusive, and sustainable learning environments.

2.3. Collaborative Learning in Programming

Collaborative learning has been increasingly recognized as an effective approach in programming education, particularly in the context of object-oriented programming courses. Recent studies highlight the integration of collaborative strategies as a means to enhance student engagement, foster deeper understanding, and improve programming skills [10]. This section explores how collaborative learning, particularly when combined with AI tools like ChatGPT, influences programming education. [10] underscored the significance of collaborative strategies in teaching object-oriented programming, noting that such approaches encourage active student participation, peer interaction, and shared problem-solving. In their study at Mostafa Stambouli Mascara University, the collaborative strategy implemented not only improved students' grasp of programming concepts but also enhanced their confidence and motivation in learning programming languages such as Java and C++. Similarly, Efan et al. developed the Collaborative Learning and Programming (CLP) model, which merges collaborative techniques with programming instruction to facilitate deeper cognitive engagement among students. Their findings suggest that the CLP model not only improves academic performance but also develops critical thinking and teamwork skills essential for programming tasks [12]. In exploring the integration of AI-driven tools within collaborative learning environments, ChatGPT has been identified as a significant asset in programming education. [30] highlighted both the benefits and limitations of using ChatGPT in programming courses, emphasizing that while the tool can effectively assist students by providing instant feedback and guidance, it also has the potential to diminish collaborative efforts if not properly managed. The study suggests that ChatGPT can be used as a supplementary tool rather than a replacement for peer collaboration, thereby enhancing rather than undermining collaborative learning dynamics [24]. Further empirical evidence supports the positive impact of ChatGPT in collaborative programming settings. Yilmaz investigated students' perspectives on using ChatGPT for programming learning, finding that the tool facilitates a form of augmented intelligence where students can collaboratively interact with the AI to generate solutions, debug code, and learn programming concepts more efficiently.

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This collaborative interaction with ChatGPT allows students to validate their ideas and approaches, effectively turning the AI into a peer that supports collaborative problem-solving efforts [35]. Additionally, the work by Xu et al. examined the use of learning analytics to understand how students interact with ChatGPT in programming tasks. Their findings revealed that ChatGPT could complement collaborative learning by providing individualized feedback and suggestions that help students refine their code in group settings, thereby enhancing the overall learning experience. The integration of ChatGPT allows for a more dynamic collaborative learning environment where both human and AI inputs contribute to the learning process [6]. Collaborative learning strategies, when combined with AI tools like ChatGPT, offer a promising approach to programming education. These strategies not only enhance students' understanding and retention of programming concepts but also promote active engagement, critical thinking, and problem-solving skills. However, it is crucial to strike a balance between AI-assisted learning and traditional peer collaboration to ensure that the educational benefits of both methods are fully realized.

3. Methodology

This study employed a mixed-methods approach, combining quantitative surveys with qualitative analyses of recorded interactions and follow-up interviews. This design was chosen to provide a comprehensive understanding of the experiences of computer science students and teachers using ChatGPT in their programming tasks across Arabic, French, and English. The mixed-methods approach allowed for a more in-depth exploration of how ChatGPT supports programming activities in routine coursework and complex final graduation projects, capturing both quantitative data on usage patterns and qualitative insights into students' experiences. The study involved 57 computer science students from the graduation program at Mustapha Stambouli University, Mascara, Algeria during the period of September 22 to December 15, 2023. Participants were selected through purposive sampling to ensure a diverse range of programming experiences, academic levels, and language proficiencies (Arabic, French, and English). The sample included students enrolled in various programming courses and actively involved in final graduation projects, particularly those utilizing ChatGPT as part of their assignments and project work. Table 1 details the demographic characteristics of the participants.

Data were collected using a combination of online surveys, recorded ChatGPT interactions, and follow-up interviews. This multi-faceted approach was designed to capture both quantitative metrics and qualitative insights into students' experiences with ChatGPT. The survey comprised 20 Likert-scale questions assessing students' language use in programming, frequency and patterns of ChatGPT usage, perceived benefits, challenges, and ethical concerns. The surveys were administered electronically, ensuring accessibility and ease of participation. Students were instructed to use ChatGPT during their programming assignments and final graduation projects. All interactions were recorded and saved in separate files, which were submitted via email for analysis. This component provided direct evidence of ChatGPT's application in real-world academic tasks and allowed for analysis of language-specific challenges. Semi-structured interviews were conducted with a subset of participants to gather deeper insights into their experiences. The interviews focused on open-ended questions about specific programming challenges, the role of ChatGPT in addressing these challenges across different languages, and students' reflective insights on the tool's effectiveness.

Ethical approval was obtained from the ethics committee at Mustapha Stambouli University. All participants were fully informed about the study's objectives, procedures, and their right to withdraw at any time. Written consent was obtained from each participant, and they were made aware that their interactions with ChatGPT would be recorded. Data, including survey responses, recorded files, and interview transcripts, were anonymized to protect participants' identities and

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were securely stored, accessible only to the research team. While the mixed-methods approach provided a comprehensive view of ChatGPT's role in programming education, the study has some limitations. Self-reported data and recorded interactions may introduce bias, as students might alter their behavior knowing they were being observed. Additionally, the sample size was relatively small and limited to a single institution, which may affect the generalizability of the findings. Future studies should consider expanding the sample size and exploring additional qualitative methods, such as focus groups, to capture a broader range of student experiences.

Table1.
Demographic information of the participants.

Category	Details	Number of students	Percentage (%)
Gender distribution	**Male**	36	63
	Female	21	37
Age range	17-18 years	17	30
	19-20 years	15	26
	21-22 years	20	35
	23-24 years	5	9
Academic level	L3 (3rd year license)	15	26
	M1 (1st year master)	14	24
	Ing1 (1st year Engineer)	14	24
	Ing2 (2nd year engineer)	14	24
Residency status	Local	39	68
	Non-local	18	32
Programming experience	1-2 years	19	33
	3-4 years	23	40
	5+ years	15	27
Programming languages	Python	28	49
	Java	14	24
	C++	9	16
	Other	6	11
Extracurricular activities	Member of a CS club	20	35
	Participates in hackathons	17	30
	Engaged in projects	8	14
	No extracurricular activities	12	21

Table 2 provides a comprehensive overview of ChatGPT usage, benefits, challenges, and ethical concerns among computer science students, capturing a broader spectrum of their engagement and experiences with the tool.

Table 2.
Global overview of ChatGPT usage, benefits, challenges, and ethical concerns.

Category	Details	Number of students	Percentage (%)
Frequency of use	Always	10	18
	Daily	20	35
	Occasionally	27	47
Time per session	Less than 10 minutes	15	26
	10-30 minutes	25	44

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Category	Details	Number of students	Percentage (%)
	30-60 minutes	12	21
	More than 1 hour	5	9
Sessions per day	1 session	18	32
	2-3 sessions	22	39
	4-5 sessions	10	18
	More than 5 sessions	7	12
Peak usage times	Morning (6 AM - 12 PM)	10	18
	Afternoon (12 PM - 6 PM)	20	35
	Evening (6 PM - 12 AM)	22	39
	Late Night (12 AM - 6 AM)	5	9
Usage trigger	Before deadlines or exams	20	35
	When encountering a programming issue	18	32
	During study or revision sessions	12	21
	Randomly, as questions arise	7	12
Patterns of use	Consistent daily use	20	35
	Intense use around assignments/projects	15	15
	Mostly for last-minute assistance	12	12
	Sporadic use with no clear pattern	10	10
Mode of access	Phone	18	32
	Pc	35	61
	Tablet	4	7
Theme of use	General (e.g., casual queries)	15	26
	Specific to programming	20	35
	Course-related	12	21
	Assignment help	10	18
Time of use	During the course	18	68
	Outside the course	39	68
Purpose of use	Learning new concepts	25	44
	Debugging code	18	32
	Writing code snippets	20	35
	Research assistance	15	26
	Brainstorming ideas	22	39
Challenges (Free Version)	Understanding complex responses	12	21
	Lack of detailed explanations	14	25
	Limited domain-specific accuracy	20	35
	Privacy and data security concerns	11	19
Benefits perceived	Saves time	30	53
	Enhances understanding	28	49
	Improves coding skills	22	39
	Offers instant feedback	24	42
Perception of chatgpt	User-friendly	42	74
	Aware of limitations	38	67
	Uses it as an organizer	25	44
	Uses it as a practical information source	30	53
	Concerns about ChatGPT and ethics	20	35
Concerns and ethical	Plagiarism and academic integrity	18	32

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Category	Details	Number of students	Percentage (%)
considerations	Dependency on AI for answers	15	26
	Misinformation risks	12	21
Future Use	As a virtual tutor	20	35
	As a study companion	25	44
	As a tool for project management	15	26
	For automating repetitive tasks	17	30

4. Results and Discussion

The integration of ChatGPT into Social Learning Analytics (SLA) presents substantial opportunities to enhance educational support, particularly in programming education. The study's statistical analysis uncovers diverse student engagement patterns, demographic influences, and critical insights into ChatGPT's role in academic contexts. However, the evaluation also highlights areas needing improvement, especially regarding the free version's limitations and mixed perspectives from students and educators. Demographic insights reveal trends consistent with the broader landscape of computer science education. A notable gender disparity, with 63% male and 37% female participants, underscores the underrepresentation of women in STEM fields, which may affect the dynamics within SLA. The age distribution, with most students between 21-22 years old, reflects a cohort largely at similar academic stages, likely influencing how they engage with ChatGPT.

While this uniformity aids in generalizing findings, it also risks overlooking the distinct needs of different age groups, such as younger undergraduates or non-traditional, older students. The diverse academic representation, spanning third-year undergraduates to second-year engineering students, provides a comprehensive view of ChatGPT's impact across various academic stages. However, variations in programming experience and language preferences suggest that ChatGPT's effectiveness is contingent on students' technical skills and familiarity with supported programming languages. Advanced students tend to seek more nuanced assistance, whereas novices often rely on ChatGPT for basic guidance, underscoring the need for adaptable support tailored to varying expertise levels.

ChatGPT usage patterns indicate that while the tool is widely integrated into academic routines, its role remains supplementary rather than primary. Many students reported irregular usage, driven partly by the limitations of the free version, which include restricted access during peak times, slower response rates, and capped session limits. These constraints often hinder seamless integration into study routines, particularly during high-pressure periods such as exam preparation or project deadlines. Educators and students alike highlighted that the free version's limitations impede consistent, effective use, especially when immediate, reliable access is crucial. Teachers noted that while ChatGPT helps with quick clarifications and debugging, students often face interruptions due to service unavailability, leading to frustration and inefficiencies. This feedback points to a critical gap between the potential benefits of AI-driven support and the practical challenges experienced by users without access to premium features.

Teachers provided a balanced perspective on ChatGPT's impact, recognizing its strengths in fostering independent learning and providing instant feedback, which can alleviate some of the instructional burdens on educators. However, they also expressed concerns about the quality and depth of guidance, particularly when students rely solely on the free version. The limited domain-specific accuracy and occasional content inaccuracies can mislead students if not critically assessed, highlighting the need for careful oversight to ensure that ChatGPT is used effectively and ethically. Furthermore, educators emphasized the importance of preparing students to critically evaluate AI-generated content to avoid over-reliance on technology at the expense of developing foundational skills. The need for a human element in programming education remains strong, with teachers advocating for ChatGPT to complement—not replace—traditional learning methods and expert guidance.

Students' opinions regarding the future impact of ChatGPT on the programming field were notably varied. A significant number of students expressed the belief that AI tools like ChatGPT could

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eventually replace human programming in the coming years. They cited ChatGPT's ability to generate code snippets, debug errors, and provide near-instant solutions as indicators of its growing capabilities. Some students argued that as AI technology continues to advance, the role of human programmers might shift towards more supervisory and creative tasks, leaving routine coding and problem-solving to AI. However, this perception was met with mixed reactions from both peers and educators. While students acknowledged ChatGPT's efficiency and potential to streamline certain programming tasks, many also recognized its current limitations, such as a lack of deep contextual understanding, inability to handle highly complex or novel problems, and the occasional provision of incorrect or suboptimal solutions. These challenges, coupled with ethical considerations such as AI's impact on job security and the need for human oversight, suggest that while AI will continue to evolve, a complete replacement of human programmers remains unlikely in the near future. Educators also voiced concerns about the implications of students viewing AI as a potential substitute for human programming. They emphasized the irreplaceable value of human intuition, creativity, and ethical decision-making in software development, arguing that while AI can augment human capabilities, it cannot fully replicate the nuanced and context-sensitive decision-making that characterizes expert programming. The integration of ChatGPT into SLA enriches the understanding of student behaviors, engagement strategies, and learning patterns. By analyzing interaction data, educators can pinpoint common challenges, determine peak usage times, and identify key areas where students seek support, enabling more targeted educational interventions. However, the data also underscores the importance of ensuring accessibility and mitigating the limitations of the free version to fully realize ChatGPT's potential in SLA. Language support remains a critical area for improvement, as the current tool primarily caters to English-speaking students, limiting its effectiveness for those whose primary language differs. Expanding multilingual capabilities could significantly enhance ChatGPT's inclusivity and ensure that all students, regardless of language background, can benefit equally from its support.

5. Conclusion and Recommendations

This study provides a comprehensive analysis of integrating ChatGPT into Social Learning Analytics (SLA), highlighting its potential to enhance educational support and understanding of student learning behaviors. The findings reveal that ChatGPT is widely used by computer science students for a variety of purposes, including programming assistance and general academic support. The tool is perceived as user-friendly and valuable, particularly during high-pressure periods such as deadlines. Key insights from the study include the significant role ChatGPT plays in providing supplementary support to students, especially in programming-related queries. Its usage patterns indicate that students frequently interact with the tool outside formal coursework, reflecting its role as a supplementary resource rather than a primary learning tool. However, the study also identifies areas for improvement, particularly in addressing language barriers and ensuring ethical AI use. The statistical analysis underscores the importance of methodological rigor, user experience, and the impact on educational outcomes. Recommendations for future research and implementation include expanding the sample size, refining data collection methods, gathering detailed user feedback, and addressing ethical and cross-cultural considerations. These steps will help optimize ChatGPT's integration into educational frameworks and ensure it meets the diverse needs of students effectively. To optimize the integration of ChatGPT into Social Learning Analytics (SLA) and ensure its effectiveness in supporting educational outcomes, several key recommendations are proposed. These recommendations address gaps identified in the current study and provide actionable insights for enhancing the tool's impact. Firstly, methodological rigor is crucial for improving the reliability and validity of the findings. Expanding the sample size to include a diverse range of students from various institutions and regions will enhance the generalizability of the results. Additionally, refining data collection methods by clearly documenting and standardizing processes will help minimize biases and ensure accurate data. Improving user experience and usability involves gathering in-depth qualitative feedback from students to better understand their interactions with ChatGPT. This can be achieved through interviews or focus groups

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that provide detailed insights into user challenges and experiences.

Alongside this, a thorough usability analysis should be conducted to evaluate the interface and functionality of ChatGPT, ensuring it meets user needs effectively. Assessing the educational outcomes associated with ChatGPT usage is essential for understanding its impact on learning. Integrating metrics to measure changes in academic performance and skill development will provide a clearer picture of the tool's effectiveness. Longitudinal studies are also recommended to track the long-term effects of ChatGPT on student learning and engagement, offering valuable insights into its sustained impact. Addressing ethical considerations is vital for maintaining the integrity of ChatGPT's use in educational settings. Implementing robust data privacy and security measures will protect student information and ensure compliance with data protection regulations. Additionally, exploring ethical issues related to AI use, such as biases and fairness, is necessary to develop guidelines for responsible and equitable AI integration. Considering cross-cultural and language needs will enhance the tool's accessibility and effectiveness for a diverse student population. Improving multilingual support and evaluating ChatGPT's performance in different languages will ensure that it caters to non-English speaking students. Furthermore, accounting for cultural differences and adapting responses accordingly will make ChatGPT more inclusive and responsive to varied educational contexts.

Integrating ChatGPT with existing educational tools is also important for maximizing its utility. Evaluating how ChatGPT interacts with learning management systems (LMS) and other educational technologies will facilitate seamless integration and enhance overall functionality. Ensuring interoperability with other resources will allow ChatGPT to complement existing tools effectively. Finally, planning for scalability and adaptation will ensure that ChatGPT can handle diverse and growing user needs. Customizing features for different educational levels and subjects will make the tool more adaptable to various contexts. Additionally, assessing its scalability will ensure that ChatGPT can accommodate large volumes of users and a range of use cases without performance issues.

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