Evaluating the Impact of Generative Ai Tools on Learning Outcomes of Computer Science Students in Tertiary Institutions in New Bussa Metropolis, Niger State, Nigeria

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Abstract

This study investigates the familiarity levels, perceived benefits, effectiveness, and challenges of using generative AI tool (ChatGPT) in computer science education, particularly in aiding students' understanding of programming concepts. A sample of 103 computer science students was surveyed, with the results analyzed using descriptive statistics, chi-square tests, and one-sample t-tests. The findings indicate that students are moderately familiar with generative AI tools, with differences observed by level of study. Students perceived ChatGPT as beneficial in enhancing their understanding and problem-solving skills, with statistically significant results supporting the positive influence of

ChatGPT on learning outcomes. Additionally, ChatGPT was found to be effective in helping students comprehend and apply complex programming concepts to real-world problems. While students reported some challenges, including issues with accuracy and engagement, these challenges were not statistically significant. The study concludes that ChatGPT is a valuable educational tool with potential to improve programming education, though proper training and ethical guidelines are recommended to maximize its benefits.

Keywords: ChatGPT, generative-AI, programming, student, challenges.

INTRODUCTION

The field of computing has different expertise and over some years the computer programming has been a front runner since software has been the soul driving the various developed hardware. Computer programming is a necessary skill for many lines of business in today's modern economy (Yilmaz and Yilmaz , 2023) and acquiring computer programming skills can give individuals the ability to create and build new technologies that can drive innovation and economic growth (Eteng, Akpotuzor, Akinola, & Agbonlahor, 2022). There are peculiar challenges faced by different students while trying to learn computer programming and to make learning easier, various institutions keep providing different platforms from the use of smart boards, e-learning platforms and some interactive tools. As computing serves as the foundation for global technological development, artificial intelligence, which is just one aspect of computing, has been pivotal to recent advancements. Artificial intelligence (AI) has gradually contributed to the creation of numerous products that people will use throughout their life (Lai *et al.,* 2022). Artificial Intelligence (A.I) is used as an umbrella term for several related technologies including but not confined to, classical machine learning, deep learning, robotics and natural language processing(O'Dea & O'Dea, 2023) and as a technology has existed for close to 70 years (Crawford, Cowling & Allen, 2023). The field has kept growing as its techniques enable computers to learn and perform human-like cognitive tasks, such as predictions, and decision making through processing and analyzing very large amounts of data (Holzinger et al., 2019). Artificial Intelligence is considered of great importance to the educational process, due to its ability to produce better outputs, and the impact of artificial intelligence extends to the development of the entire educational process by working to integrate artificial intelligence technologies that include display media and others (Elbrashy and Khalil, 2023). The emergence of generative artificial intelligence (GenAI) has been recognized as an innovative force, with chat-generative pre-trained transformer (ChatGPT) at the cutting edge of this technological revolution (Moreno-Guerrero *et al.,* 2022). In late 2022, OpenAI released a new version of ChatGPT, a sophisticated natural language processing system capable of holding natural conversations while preserving and responding to the context of the discussion (Malinka, *et al.,* 2023), based on deep learning algorithms that enable it to generate high-quality responses to a wide range of queries (Hassani and Silva, 2023) and have been shown to directly or indirectly affect educational environments and shape educational settings (Ipek *et.al*, 2023). Currently ChatGPT comes with two versions. The 3.5 and version 4 are available for use, though the version 3.5 can be accessed for free, version 4 requires a fee. ChatGPT-4(Guler et al., 2024), With the advent of language models such as ChatGPT, the use of AI in education has become even more accessible, as these tools offer a more human-like interface(Domenech, 2023) as Chat GPT has become one of the most popular tools for e-learning(Singh and Singh, 2023). The use of Chat GPT among the students has created a different atmosphere has it has becomes an interact platform in doing assignments and classwork given to them. With its ability to provide specific answer's it can be used to complete examinations on behalf of students, leading to concerns about AI-assisted cheating (Lo, 2023). As generative Artificial Intelligence (AI) continues to evolve rapidly, it will drive

innovation and improvements in higher education, but it will also create a myriad of new challenges (Dwivedi et.al., 2023). Precisely, ChatGPT has been attracting headlines and has become the center of ongoing debate regarding the potential negative effects that it can have on teaching and learning (Michel-Villarreal et.al, 2023). According to Ubowska and Krolikowski (2023) chat GPT has paved its way to various fields; chatbot development, content creation, language translation, text summarization, personal assistants, educational tools, healthcare and a wide range of applications in various industries and fields.

From the literatures; a study by Yilmaz and Yilmaz (2023) explored the impact of ChatGPT-supported programming education on university students' computational thinking, programming self-efficacy, and motivation. Two groups of students were taught Java programming, one using conventional methods and the other incorporating ChatGPT. The research reported that the use of ChatGPT in programming education significantly increased students' computational thinking skills, programming self-efficacy and motivation compared with the other groups. Though it was observed that for the students to benefit most effectively from AI tools and environments such as ChatGPT, it is important to provide students with prompt writing skills. Educational opportunities and challenges of AI code generator in computer programming was examined (Becker et al.,2023). The major code generator was listed and discussed; Codex, AlphaCode, and CodeWhisperer, Tabnine(.com), Code4Me(.me) and FauxPilot. The perceptives of teachers in the use of artificial intelligence by students was presented (Moura snd Carvalho, 2024). The research delves into the benefits and the demerits of using AI tools including chatGPT, chatPDF and after administering questionnaire it was discovered the majority agreed that it has benefits while adequate training is also required for the students that maximize its usefulness. It was reported that ChatGPT can provide opportunities for learning in certain subjects, including lesson planning, student support, question answering, assessment and evaluation, writing, supervision, and programming learning (Rahman & Watanobe, 2023). The consequences of ChatGPT for programming education was presented (Humble, et al., 2023). The research finds that there are several opportunities and threats of ChatGPT for programming education as the technology seems to facilitate both cheating and able to hide a lack of understanding of the programming students and enhanced learning as it can assist both teachers and students. The perception of university students concerning the use of ChatGPT was carried out (Valova, Mladenova, Kanev, 2024). Students from various fields were subjected to its use and were also administered questionnaire. The findings ChatGPT systematizes sources of information found on the Internet on a given topic and saves time and effort, despite AI's potential to enhance learning experiences, it should be viewed as a tool rather than a substitute for human educators as there is a real danger that students will learn false, malicious, or biased information if they rely entirely on ChatGPT without verifying the authenticity of what is written. As the survey shows, they do not pay enough attention and accept the answers as true; and also there is a red flag for fraud in the preparation of academic texts, cheating and plagiarism. The aim of the study is to assess the use of GenAI like chatGPT in learning computer programming, attempting classroom work, assignments and project.

Materials and Methods
This design is chosen to statistically analyze the impact of generative AI (GenAI) tools, particularly ChatGPT, on computer science student learning outcomes.

Study Area/ Sample Size
The target population for this study includes computer science students from various levels (ND1, ND2, HND1, HND2) enrolled in two tertiary institutions in New Bussa (Federal

College of Wildlife Management and Federal College of Fresh Water and Fishery Technology) which serves as our case study while the sample size is the entire computer science students enrolled in the schools with non-availability of the student and unwillingness to participate in the study as the only exclusion criteria.

Sampling Techniques
The study employed a quantitative research design with a descriptive and inferential approach.

Data collection
The primary instrument for data collection was a structured questionnaire designed to assess the impact of generative AI tools on learning outcomes of computer science students in tertiary institutions in New Bussa metropolis. The questionnaire was divided into five (5) sections, each section was designed to capture specific data points related to the research objectives and questions. The questionnaire used a 5-point Likert scale for attitudinal questions, ranging from "Strongly Disagree" to "Strongly Agree". A pilot test was conducted with a small subset of the population to validate the questionnaire. Feedback from the pilot test was used to refine and adjust the questions for clarity and relevance. Afterwards, the adjusted questionnaire was administered to each class of students in their classrooms.

Data analysis
The data analysis was conducted in two phases: descriptive statistics (Frequency distributions, percentages, means, standard deviations and cross tabulations) to summarize the data and answer the research questions, and inferential statistics (Chi-square, T-Test, Correlation and Regression) to test the research hypotheses. The Data was analyzed using SPSS (Statistical Package for the Social Sciences) statistical software.

RESULTS AND DISCUSSIONS

Demographic Characteristics of respondents
Table 1 describes the demographic characteristics of the respondents, as factors such as familiarity, usage patterns, and perceptions of ChatGPT may vary based on these characteristics. Table 1(a) shows that the majority of respondents are ND1 students (56.3%), indicating that a significant portion of the participants are early in their academic journey. There is a male-dominated sample with 78.6% male students compared to 21.4% female students. In terms of age, most students are in the 20-30 year range (50.5%), followed closely by those under 20 years (44.7%).

Table 1: Frequency distribution of respondents

Variables		Frequencies	Percentages
Level	ND1	58	56.3%
	ND2	25	24.3%
	HND1	20	19.4%
Gender	Male	81	78.6%
	Female	22	21.4%
Age	Under 20 years	46	44.7%
	20 – 30 years	52	50.5%
	31-40 years	2	1.9%
	Missing	3	2.9%

Source: Field Survey, 2024.

Tables 2(a) present descriptive statistics that provide insights into the familiarity levels of students with generative AI (GenAI) tools across various demographic groups. This interpretation addresses **Research Question 1**: *What is the level of familiarity and usage patterns of generative AI tools among computer science students, and how do these vary across different demographic groups?*

Table 2(a) shows that the average familiarity level (μ = 3.35) across all students is closest to "Somewhat Familiar." This suggests that, on average, students have a moderate understanding or use of generative AI tools, but not a high level of familiarity. The spread of the familiarity levels is moderate (s.d=0.74), indicating some variation in how familiar students are with GenAI tools, but not a wide range of extremes.

TABLE 2(a): Descriptive statistics of students' familiarity levels with GenAI tools

	N	Minimum	Maximum	Mean	Std. Deviation
Familiarity Levels	103	2.00	5.00	3.35	0.74

Source: Field Survey, 2024.

Tables 2(bi – biii) serves to test hypothesis 1 (H_01): There is a significant relationship between a student's demographic factors (such as age, gender, and academic level) and their familiarity and usage patterns of generative AI tools like ChatGPT.

In table 2(bi), males generally report higher levels of familiarity with GenAI tools compared to females. While a small number of males are "Extremely Familiar," no females reported the same level of familiarity, suggesting a potential gender gap in exposure or usage of these tools. Also, in table 2(bii), students aged under 20 and 20-30 have similar familiarity levels, with the majority being "Moderately" or "Somewhat Familiar." However, students under 20 report slightly higher "Extremely Familiar" levels (3 students) than those in the 20-30 age group, where no one is "Extremely Familiar." Familiarity with GenAI tools decreases significantly in older age groups, particularly those above 30, where familiarity is low. In 2(biii) also, as students' progress in their academic levels (from ND1 to HND1), their familiarity with GenAI tools increases slightly, though the increase is not dramatic. ND2 students have the highest level of familiarity on average.

Furthermore, the chi-square test based on gender shows **no significant** association (p = 0.666). This suggests that there is no statistically significant difference in familiarity levels between male and female students. The chi-square test based on age shows **no significant** association (p = 0.238). This indicates that there is no statistically significant difference in familiarity levels across different age groups and the chi-square test for familiarity levels based on students' level shows a **significant** association (p = 0.039). This indicates that students' familiarity with GenAI tools differs significantly across academic levels. These results suggest that academic level significantly influences familiarity with GenAI tools which is in agreement with Daher & Hussein (2024), while gender and age do not which agrees with the report of Nyaaba et al. (2024) and Daher & Hussein (2024) where there was no significant difference on how gender perceived the use of AI bots.

Table 2(b i): Chi-Square Test for Students' Gender

	Familiarity Levels					
	Not Familiar at all	Slightly Familiar	Somewhat Familiar	Moderately Familiar	Extremely Familiar	Total
Male	0	11	35	32	3	81
Female	0	2	9	11	0	22
Total	0	13	44	43	3	103

Pearson Chi-Square Value (χ^2): 1.569
Degrees of Freedom (df): 3
Asymp. Sig. (2-sided): 0.666 (Not Significant)
Likelihood Ratio: -
Linear-by-Linear Association: -
Valid Cases: 103

Table 2(b ii): Chi-Square Test for Students' Age

Familiarity Levels (Counts)	Familiarity Levels					
	Not Familiar at all	Slightly Familiar	Somewhat Familiar	Moderately Familiar	Extremely Familiar	Total
Under 20	0	8	18	17	3	46
20-30	0	5	24	23	0	52
31-40	0	0	0	2	0	2
Total	0	13	42	42	3	100

Pearson Chi-Square Value (χ^2): 8.008
Degrees of Freedom (df): 6
Asymp. Sig. (2-sided): 0.238 (Not Significant)
Likelihood Ratio: -
Linear-by-Linear Association: -
Valid Cases: 100

Table 2(b iii): Chi-Square Test for Students' class/levels

	Familiarity Levels					
	Not Familiar at all	Slightly Familiar	Somewhat Familiar	Moderately Familiar	Extremely Familiar	Total
ND1	0	12	27	17	2	58
ND2	0	0	10	14	1	25
HND1	0	1	7	12	0	20
Total	0	13	44	43	3	103

Pearson Chi-Square Value (χ^2): 13.292
Degrees of Freedom (df): 6
Asymp. Sig. (2-sided): 0.039 (Significant)
Likelihood Ratio: -
Linear-by-Linear Association: -
Valid Cases: 103

In order to answer research question 2 and hypothesis 2, table 3 was presented.

Research Question 2: How do computer science students perceive the benefits of using ChatGPT in enhancing their understanding and problem-solving skills in programming?
Each item in the table represents students' responses to section 3 (S3_1 to S3_9) regarding the benefits of using ChatGPT. The responses are broken down into **Strongly Disagree (SD)**, **Disagree (D)**, **Neutral (N)**, **Agree (A)**, and **Strongly Agree (SA)** categories, alongside a calculated **mean** and the **p-value** from a one-sample t-test.

- **Item S3_1:** 67.9% of the respondents (57% Agree, 12.6% Strongly Agree) believe that using ChatGPT improves their understanding of computer programming concepts. The mean score of 3.71 indicates a positive perception, and the t-test result (p = 0.000) confirms that this result is statistically significant.

- **Item S3_2:** 70.9% of the respondents (49.5% Agree, 21.4% Strongly Agree) think that ChatGPT provides valuable insights and explanations that enhance their learning. The mean score of 3.81, along with the significant p-value (p = 0.000), indicates strong positive perceptions.
- **Item S3_3:** 66% of the respondents (50.5% Agree, 15.5% Strongly Agree) agree that ChatGPT helps them overcome challenging programming problems. The mean score of 3.63 is positive and statistically significant (p = 0.000).
- **Item S3_4:** 52.4% of the respondents (38.8% Agree, 13.6% Strongly Agree) believe ChatGPT increases their confidence in programming. The mean score of 3.54 and the significant p-value (p = 0.000) support a positive effect.
- **Item S3_5:** 58.3% of the respondents (44.7% Agree, 13.6% Strongly Agree) agree that ChatGPT has helped them discover new programming techniques. The mean score of 3.58 indicates a positive perception, with a significant p-value (p = 0.000).
- Item S3_6: 62.2% of the respondents (40.8% Agree, 21.4% Strongly Agree) agree that ChatGPT motivates them to learn more. The mean score of 3.68 and the significant p-value (p = 0.000) show positive motivation effects.
- **Item S3_7:** 55.3% of the respondents (39.8% Agree, 15.5% Strongly Agree) believe that ChatGPT clarifies doubts and misconceptions about programming. The mean score of 3.54, with a p-value of 0.000, supports this positive perception.
- **Item S3_8:** This item assesses the overall perceived impact of ChatGPT on learning progress. With a mean score of 3.60 and a p-value of 0.000, the positive perception is statistically significant.
- **Item S3_9:** The highest mean score (3.95) among all items suggests that students feel ChatGPT expands their knowledge beyond what they could learn on their own. This is supported by the significant p-value (p = 0.000).

Overall, the findings show that students have positive perceptions of ChatGPT's benefits in enhancing their understanding of computer programming concepts and problem-solving skills. All items yielded mean scores above 3.5, indicating a generally positive response across different aspects of learning programming with ChatGPT. The statistically significant p-values for all items (p = 0.000) confirm that these perceptions are not due to chance, implying that the benefits of ChatGPT are perceived to be significant by the respondents which fully support the findings of Yilmaz and Yilmaz (2023) that the use of ChatGPT significantly increased the computational thinking skills of the students application developments.

Hypothesis (H2): The use of ChatGPT positively influences students' understanding of computer programming concepts and enhances their problem-solving abilities.
The hypothesis is supported by the data:

- The consistently high mean scores (ranging from 3.54 to 3.95) indicate that students perceive ChatGPT as beneficial for understanding programming and solving problems.
- The significant p-values (all p = 0.000) for the one-sample t-tests across all items confirm that these positive perceptions are statistically significant.

Therefore, we **accept Hypothesis H2**, as the evidence suggests that using ChatGPT positively influences students' understanding of programming concepts and enhances their problem-solving abilities.

Table 3: Frequency distribution of respondents and one Sample t-tests result

Items	SD	D	N	A	SA	Missing	Mean	p-value
S3_1	2(1.9%)	7(6.8%)	22(21.4%)	57(55.3%)	13(12.6%)	2(1.9%)	3.71	0.000
S3_2	6(5.8%)	4(3.9%)	14(13.6%)	51(49.5%)	22(21.4%)	6(5.8%)	3.81	0.000
S3_3	4(3.9%)	12(11.7%)	17(16.5%)	52(50.5%)	16(15.5%)	2(1.9%)	3.63	0.000
S3_4	3(2.9%)	8(7.8%)	35(34%)	40(38.8%)	14(13.6%)	3(2.9%)	3.54	0.000
S3_5	2(1.9%)	12(11.7%)	26(25.2%)	46(44.7%)	14(13.6%)	3(2.9%)	3.58	0.000
S3_6	2(1.9%)	13(12.6%)	22(21.4%)	42(40.8%)	22(21.4%)	2(1.9%)	3.68	0.000
S3_7	3(2.9%)	11(10.7%)	32(31.1%)	41(39.8%)	16(15.5%)	(0%)	3.54	0.000
S3_8	26(25.2%)	46(44.7%)	15(14.6%)	100(97.1%)	3(2.9%)	3(2.9%)	3.60	0.000
S3_9	22(21.4%)	43(41.7%)	31(30.1%)	102(99%)	1(1%)	1(1%)	3.95	0.000

Source: Field Survey, 2024

Research Question 3: How effective is ChatGPT in helping students comprehend and apply complex programming concepts to real-world problems?

The results in Table 4(a) reflect students' responses regarding the effectiveness of ChatGPT in aiding their understanding of complex programming concepts and applying them to real-world scenarios.

Each item (S4_1 to S4_4) assesses different aspects of this effectiveness, with responses ranging from Strongly Disagree (SD) to Strongly Agree (SA).

- **Item S4_1:** A majority of students (44.7% Agree and 18.4% Strongly Agree) believe ChatGPT effectively helps them understand complex programming concepts. With a mean score of 3.67 and a mode of 4 (Agree), the p-value of 0.000 confirms the statistical significance of this positive perception.
- **Item S4_2:** Students reported moderately positive responses, with 36.9% Agree and 15.5% Strongly Agree that ChatGPT helps them apply concepts to real-world problems. The mean score of 3.45 indicates a slightly less strong perception, but the mode of 4 and significant p-value (0.000) show that students still find it effective.
- **Item S4_3:** 62.2% of students (40.8% Agree and 21.4% Strongly Agree) agreed that ChatGPT enhances their ability to bridge complex programming concepts to practical applications. The mean score of 3.74 and mode of 4 support this, and the statistically significant p-value (0.000) suggests this result is reliable.
- **Item S4_4:** 59.3% of students (44.7% Agree and 14.6% Strongly Agree) perceive ChatGPT as effective in reinforcing their ability to work through real-world programming challenges. The mean score of 3.58 and mode of 4, along with a p-value of 0.000, further support this positive outcome.

Obviously, table 4(a) shows that students generally perceive ChatGPT as effective in helping them comprehend and apply complex programming concepts to real-world problems. All the items yielded mean scores above 3.5, showing that the majority of students have a favorable opinion of ChatGPT's effectiveness in this context. The p-values for each item are all 0.000, indicating that these results are statistically significant and unlikely to have occurred by chance which also support the findings of Yilmaz and Yilmaz (2023) which also emphasized the impact of ChatGPt in complex programming and solving real-life problem (Husain, 2024).

Table 4(a): Frequency and Mean distribution and t-tests# statistics of responses

Items	SD	D	N	A	SA	Missing	Mean	Mode	p-value
S4_1	5(4.9%)	8(7.8%)	20(19.4%)	46(44.7%)	19(18.4%)	5(4.9%)	3.67	4	0.000
S4_2	6(5.8%)	13(12.6%)	28(27.2%)	38(36.9%)	16(15.5%)	2(1.9%)	3.45	4	0.000
S4_3	1(1%)	10(9.7%)	25(24.3%)	42(40.8%)	22(21.4%)	3(2.9%)	3.74	4	0.000
S4_4	3(2.9%)	13(12.6%)	22(21.4%)	46(44.7%)	15(14.6%)	4(3.9%)	3.58	4	0.000

Source: Field Survey, 2024.

Hypothesis (H3): ChatGPT is an effective tool for helping students comprehend and apply complex programming concepts in real-world scenarios.

The results in **Table 4(b)** test **Hypothesis H3** by examining the correlations between understanding ChatGPT's responses (Section4_1) and applying them to real-world problems (Sections4_2 to Section4_4).

- Section4_1 (Understanding ChatGPT's responses) has a moderate positive correlation with Section4_2 (application of programming concepts to real-world problems) with a Pearson correlation of **0.503**. This indicates that students who understand ChatGPT's responses are more likely to apply programming concepts effectively in real-world situations. The correlation is statistically significant with a p-value of 0.000.
- There is also a moderate positive correlation (**0.441**) between Section4_1 and Section4_4 (reinforcement of programming skills through real-world challenges). This relationship is statistically significant (p = 0.000).
- The correlation between Section4_1 and Section4_3 is smaller (**0.276**) but still statistically significant (p = 0.007), indicating a weaker but still positive relationship between understanding ChatGPT's responses and applying complex concepts.

The strong interrelationships between Section4_2, Section4_3, and Section4_4 (with correlations ranging from **0.324** to **0.578**, all significant at p = 0.000 or p = 0.001) suggest that students who are able to understand ChatGPT's responses also find it easier to apply programming concepts in real-world scenarios. Therefore, **Hypothesis H3 is accepted**, as there is statistical evidence supporting that ChatGPT positively influences students' ability to understand and apply programming concepts in real-world situations.

Table 4(b): Correlation statistics showing relationship between understanding ChatGPT's responses and applying them to real-world problems

		Section4_1	Section4_2	Section4_3	Section4_4
Section4_1	Pearson Correlation	1	.503	.276	.441
	Sig. (2-tailed)		.000	.007	.000
	N	98	96	95	94
Section4_2	Pearson Correlation	.503	1	.578	.423
	Sig. (2-tailed)	.000		.000	.000
	N	96	101	100	99
Section4_3	Pearson Correlation	.276	.578	1	.324
	Sig. (2-tailed)	.007	.000		.001
	N	95	100	100	99
Section4_4	Pearson Correlation	.441	.423	.324	1
	Sig. (2-tailed)	.000	.000	.001	
	N	94	99	99	99

. Correlation is significant at the 0.01 level (2-tailed).

Source: Field Survey, 2024.

Research Question 4: What challenges and potential drawbacks do students face when using ChatGPT for learning computer programming, particularly concerning accuracy, engagement, and academic integrity?

The results in Table 5 represent students' perceptions of the challenges and drawbacks they face while using ChatGPT for learning computer programming, with a focus on issues related to the accuracy of information, engagement, and academic integrity.

Each item (S7_1 to S7_7) represents a specific aspect of these challenges, and the responses range from Strongly Disagree (SD) to Strongly Agree (SA).

- Item S7_1: The mean score is 3.02, indicating a neutral to slightly positive response regarding accuracy issues with ChatGPT. Most students fall into the Neutral (35.9%) and Disagree (24.3%) categories, with only 7.8% strongly agreeing that accuracy is a

significant challenge. The p-value of 0.846 shows that the responses are not statistically significant, indicating that accuracy may not be perceived as a strong challenge for the majority of students.

- Item S7_2: With a mean score of 3.03, students express mixed feelings about the difficulty of maintaining engagement and focus when using ChatGPT. Similar to S7_1, most students remain neutral (30.1%) or disagree (25.2%). The p-value of 0.773 suggests there is no statistically significant challenge in this regard.
- Item S7_3: This item, which addresses academic integrity concerns, also has a neutral mean of 2.97. Again, most students (25.2%) are neutral on the issue, while 21.4% disagree. The p-value of 0.785 indicates that concerns about academic integrity are not statistically significant.
- Item S7_4: This item assesses more generalized challenges, and it has the highest mean score of 3.16. Despite this, the majority of students are either neutral (28.2%) or disagree (24.3%). The p-value of 0.138 shows that, although students may experience challenges, they do not consider them overwhelmingly significant.
- Item S7_5: Students' responses to this item yielded a mean score of 3.11, which again suggests neutrality. There is no clear consensus on whether the challenges are substantial, as indicated by the p-value of 0.307.
- Item S7_6: With a mean score of 2.96, the results show that students generally remain neutral or unsure about the severity of challenges they face while using ChatGPT. The p-value of 0.705 supports this, suggesting no significant issue.
- Item S7_7: Students' responses to challenges related to engagement and focus have a mean score of 3.12, with the majority leaning towards Neutral (26.2%) or Agree (29.1%). The p-value of 0.348 indicates no statistically significant challenge.

Overall, students seem to be neutral regarding the challenges and drawbacks they face when using ChatGPT for learning computer programming. The mean scores for all items hover around 3.0, suggesting that most students do not find these challenges to be overwhelming. Additionally, none of the items' p-values are statistically significant, meaning that the challenges related to accuracy, engagement, and academic integrity are not perceived as substantial by the majority of respondents.

Hypothesis (H$_0$4): Students encounter significant challenges when using ChatGPT for learning computer programming, particularly in terms of the accuracy of information, maintaining focus, and academic integrity.

Given the generally neutral responses and the lack of statistically significant results (p-values for all items are above the significance level of 0.05) presented in table 5, **Hypothesis H$_0$4 is rejected**. There is no strong evidence to suggest that students face significant challenges when using ChatGPT for learning computer programming. While individual students may experience difficulties, these challenges are not widespread or severe enough to be considered significant by the majority of the respondents and no literature to buttress it but however perceived challenge of students using ChatGPT from tutors perspectives to hide lack of understanding during learning (Humble et.al.,2023).

Table 5: Frequency distribution of respondents and one Sample t-tests result

Items	SD	D	N	A	SA	Missing	Mean	p-value
S7_1	6(5.8%)	25(24.3%)	37(35.9%)	23(22.3%)	8(7.8%)	4(3.9%)	3.02	0.846
S7_2	7(6.8%)	26(25.2%)	31(30.1%)	33(32%)	5(4.9%)	1(1%)	3.03	0.773
S7_3	11(10.7%)	22(21.4%)	26(25.2%)	29(28.2%)	6(5.8%)	9(8.7%)	2.97	0.785
S7_4	5(4.9%)	25(24.3%)	29(28.2%)	31(30.1%)	10(9.7%)	3(2.9%)	3.16	0.138
S7_5	8(7.8%)	20(19.4%)	34(33%)	31(30.1%)	8(7.8%)	2(1.9%)	3.11	0.307
S7_6	9(8.7%)	24(23.3%)	32(31.1%)	26(25.2%)	6(5.8%)	6(5.8%)	2.96	0.705
S7_7	15(14.6%)	16(15.5%)	27(26.2%)	30(29.1%)	14(13.6%)	1(1%)	3.12	0.348

Source: Field Survey, 2024.

Key findings from the study include:

- Familiarity with GenAI Tools: The majority of students were somewhat familiar with generative AI tools, with notable differences based on gender, level of study, and age. However, familiarity levels did not show significant statistical differences by gender or age but varied by level of study.
- Perceived Benefits of ChatGPT: Students generally perceived ChatGPT as beneficial for enhancing their understanding of programming concepts and problem-solving skills. One-sample t-test results indicated that these perceptions were significantly positive, supporting the hypothesis that ChatGPT positively influences learning outcomes.
- Effectiveness of ChatGPT: ChatGPT was considered effective in helping students comprehend and apply complex programming concepts to real-world problems, with significant positive correlations between understanding ChatGPT's responses and applying them in real-world scenarios.
- Challenges and Drawbacks: While students reported facing some challenges when using ChatGPT, particularly in terms of accuracy, engagement, and academic integrity, the overall responses indicated that these challenges were not statistically significant.

CONCLUSION

The study concludes that computer science students are moderately familiar with generative AI tools like ChatGPT and find them beneficial for learning programming concepts and solving problems. The perceived effectiveness of ChatGPT in aiding comprehension and application of complex programming concepts was significant. However, students did not perceive the challenges related to accuracy, focus, or academic integrity as major obstacles, suggesting that these issues may not be as pervasive as initially expected. The overall positive reception of ChatGPT indicates its potential as a valuable educational tool in programming education.

RECOMMENDATIONS

- Incorporate ChatGPT in Curricula: Educational institutions should consider integrating ChatGPT and similar generative AI tools into their programming curricula to enhance student understanding and problem-solving abilities.
- Provide Training and Guidance: Since students are moderately familiar with generative AI tools, training programs should be implemented to improve their familiarity and effective use of these tools in educational contexts.
- Addressing Potential Drawbacks: Institutions should provide clear guidelines on the ethical use of AI tools to mitigate challenges related to academic integrity. Additionally, efforts should be made to improve students' focus and engagement when using AI tools for learning.

- Further Research: Future studies should explore long-term impacts of AI tool usage on students' academic performance and the role of such tools in different domains of computer science education.

ACKNOWLEDGEMENT

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