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Impact of AI-ChatGPT Intervention on Coding: NPL Supportive Approach to Teaching and Learning Effectiveness

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A B S T R A C T

AI-ChatGPT is increasingly popular among all individuals, particularly researchers, educators, and students. This fantastic tool was created to generate human-like text in response to user inputs, making it ideal for chatbots and other conversational systems. Because of its capacity to solve various problems such as choice difficulties, prediction problems, and coding problems, it may be readily linked with programming learning to increase and interest students in coding challenges that typically encountered during traditional programming language learning. This study combines a programming language for teaching and learning, such as Python, with ChatGPT to determine whether it will be a valuable tool for students' programming expertise. The assignment was carried out using a basic randomised controlled approach to ensure that no students from either group had previous information about what to accomplish before being assigned to the groups; also, the gender of the students was balanced. Results showed that the experimental group performed better in the Pre-Test and Post-Test after exposure to diverse teaching methods. The study emphasises the importance of ChatGPT implementation in Python programming and the importance of a randomised controlled approach.

1. Introduction

Artificial intelligence has made a tremendous contribution to human learning, comprehension, and creative problem-solving. Every aspect of life is being transformed by this technology, which is a multifaceted tool that allows individuals to reevaluate how to combine information, analyze data, and use the results to enhance and improve decision-making. One technology that is thought to have affected all industries, including education, is artificial intelligence.

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Problem-solving courses are available at Lagos State University of Education for both computer science (BSc) and education (BSc.Ed) majors. Years ago, it was noticed that using realistic methods to teach programming principles was effective. Not because the method was bad, but because AI-ChatGPT was combined with it and used to speed up students' thinking, a better outcome was obtained. Students spent a lot of time considering how to answer some of the mathematical issues presented to them because this was the first course that introduced new students to coding in their chosen programming language. Because it directs and offers suggestions for what to do as well as displaying the algorithm for solving the difficulties, the use of AI-ChatGPT improves their understanding to find the ideal solution to a particular situation.

The article from this section goes on to examine pertinent literature, present hypotheses, and outline the study methodology. The data analysis and a summary of the results came next. The reports were then analyzed in light of the conclusions drawn from the research findings.

Literature Review

For years, technological advancements have been occurring quickly. A more engaging learning environment, preparing students for the future, connecting teachers and students, and fostering collaborations between teachers and students are just a few of the advantages of technology in the classroom that Lumen (2023) highlighted. Teachers now have a new means of communication and interaction with their students thanks to artificial intelligence (AI). According to IndustryTrends (2023), AI might increase the personalization of students' learning programs and courses, encourage tutoring by helping students hone their skills and improve their weak areas, assure quick answers between teachers, and improve accessibility to everyday learning for all people.

AI-powered Assistants via chatbots could be a useful resource for students studying programming languages to help them become better code writers. In order to aid students with their current challenges, chatbot assistants can now communicate with AI to create solutions. According to IndustryTrends (2023), chatbots can be useful for responding to queries or requests from pupils, frequently even more quickly than the teacher. In Vocational High Schools in the field of tourism expertise, chemistry subjects are not studied directly as subjects, but are integrated into applied science subjects (Afinda, 2023).

In the modern day, ChatGPT can quicken the learning curve for learning to code (Zhai, 2022). In programming language classes, this effective tool helps students and instructors overcome coding problems and provide a thorough justification of what they accomplished (Cheguri, 2023). Students can save a ton of time and effort and reduce the likelihood of error by using ChaGPT. It enables programmers to create code more quickly and efficiently, which improves the quality of their work and makes it easier to spot problems. Additionally, ChatGPT is a fantastic tool for a variety of jobs, from text completion and code generation to natural language processing and bug discovery.

According to Xu (2021), teaching artificial intelligence talent has become a key goal of education in recent years. AI has become a highly hot topic in education. With the advancement of AI and the deep integration of AI and education that has emerged as the development trend of the future educational world, educational methodologies have altered. Education and artificial intelligence have finally met in the future, and we are now witnessing numerous advances and rapid advancements in productive pedagogical methods. Learning support, teacher assistance, and institution support are all included in AI. According to Seldon (2018), Miao (2021), and Avijeet (2023), AI will eventually render teachers de facto redundant, or at the very least, their role will be repurposed as classroom orchestrators/technology facilitators, responsible for managing learner behavior and ensuring that the technology is turned on.

This has helped learners learn independently of teachers or they have their own artificial personal tutor. Additionally, Zawacki-Richter et al. (2019) recent systematic literature analysis of AI applications in higher education found that nearly half (48%) of the included research looked at AI support for administrative and institutional activities. Automating procedures linked to student admissions, improving contact with students, and allocating resources are the three key areas of institution-supporting AI. Additionally, it was noted that a large number of institutions of higher learning, primarily in the USA, use AI-supported software to support their admissions procedures (Holmes et al., 2022 and Woolf, 2021). Since the education industry is linked to extremely dynamic business settings that are managed and maintained by information systems, Mieczyslaw et al. (2021) recognized the advantages and difficulties of applying AI in the education sector.

The study's findings demonstrated that AI helped to improve knowledge of the particulars of AI systems, services, and tools, which later cleared the path for a successful implementation. Personalizing instruction and acquiring 21st-century abilities are two of AI in education's biggest downsides, according to Woolf's research from 2021. He noted that there were no computational tools in education that could personalize learning, improve student experiences, and provide data for the development of novel educational theories. He also noted that there were no intelligent tutors that could give researchers new opportunities to examine enormous amounts of instructional behaviour data and understand how students behave. Language is an important tool to express and communicate with the others (Sari, 2023).

The expert system is one of the key fields where AI has given rise to quickly developing technology. As an expert system is frequently used nowadays to handle complicated problems in numerous domains such as education, engineering, business, medical, weather forecasting, etc., application areas of artificial intelligence are having a significant impact on a variety of fields of life (Verma, 2018). Artificial intelligence applications in education have witnessed improvements in both quality and effectiveness. In their study of teachers' attitudes regarding the employment of AI in EFL classes, Sumakul (2022) discovered that all teachers had favourable opinions of the technology. The educators concurred that AI may aid in both teaching and student learning. Additionally, the interview

results suggested that when incorporating AI into EFL classrooms, teachers' technological and pedagogical abilities should also be taken into account. According to Ahmad (2021), the educational sector should also adopt contemporary teaching techniques and the required technology. Looking at the flow, firms in the education industry need to use AI technology as a result of modern necessity and education. Jia et al. (2022) described the methodology and developmental process utilized to create, develop, test, and verify the AIELL system for AI-enabled English language learning and to identify essential design elements for English learning in real-world situations.

The testing involved 20 people, with three interviewees. The validity and usefulness of the design were confirmed through mixed research methodologies, which also helped pinpoint places where the intended features might be further improved. The study provided guidance for the mobile learning principle-based AI integration that facilitated language teaching and learning. In their paper, Vorst (2019), the authors evaluated the potential socio-technical effects of AI on individualized learning. As a result, they looked into technology possibilities as well as any potential adoption-related factors, such as legal, sociological, and ethical issues. The findings demonstrated that alternatives for formulating policy might most effectively encourage the adoption of AI-driven personalized learning systems.

Based on the aforementioned data and academic viewpoints, it is crucial to connect AI's significance to education by examining how ChatGPT can help create a positive learning environment for both teachers and students. Zhai (2022) believes that ChatGPT, a general-purpose conversation chatbot that OpenAI will release on November 30, 2022, will have an impact on every sphere of society, particularly education. The prospective effects of this NLP tool on education, however, are still unclear and complex. Due of ChatGPT's ability to quickly change educational learning goals, learning activities, and assessment and evaluation procedures, this influence might be substantial. The findings suggested that ChatGPT can assist researchers in producing a publication that is methodical, (partially) accurate, cohesive, and instructive. The essay was completed in 2 to 3 hours with very little assistance from the author's professional experience. According to the study, learning objectives should be changed; students should be able to use AI tools to complete activities related to their specific fields of study, and the emphasis in the classroom should be on developing students' creativity and critical thinking rather than generic academic abilities. Researchers should create AI-based learning projects that involve students in solving real-world problems in order to meet the learning objectives. The study came to the conclusion that new evaluation forms are required to emphasize creativity and critical thinking, which AI cannot replace.

2. Methodology

Following the literature review, the following hypotheses were established:
Ho1: Using ChatGPT to teach programming has no significant effect on overall students’ performance in a course.

Ho2: Using ChatGPT to teach programming has no significant effect on students' time to complete the task.
Ho3: Using ChatGPT to teach programming has no significant effect on student's accuracy to solve a problem.
Ho4: Using ChatGPT to teach programming has no significant effect on student's interest to learn more in a course.

The first group [Control Group] of 10 students received hands-on training using personal computers after being randomly assigned to one of two groups. In addition to having their own computers, the second set of 10 students (the "Experimental Group") also had access to the ChatGPT website online. Students from the two departments of computer science and computer science education were divided into groups using a straightforward randomized method. An equal number of male and female students were chosen for the study in order to avoid gender bias. The experimental group received instruction using the practical approach with ChatGPT, whereas the control group received instruction using simply the practical technique. Assignments, tests, classwork, and exams were used to determine the overall course grade. Students' time was measured using time limits of 5 minutes, 10 minutes, 15 minutes, and 20 minutes, respectively, as Fastest, Very Fast, Faster, and Fast. Students' accuracy was determined using 100%, 80%, 60%, and 40%, respectively, as Fastest, Very Accurate, More Accurate, and Accurate. Students' interest was calculated using 100%, 80%, 60%, and 40%, respectively, as Fast

3. Results and Discussion

Results

Statistical significance was examined for each hypothesis separately using IBM SPSS 23.0. The students' time to complete the tests or exams, their accuracy in answering questions truthfully, and their enthusiasm in using ChatGPT to help practical programming learning were all factors that were tested, in addition to the groups' overall course marks (scores).

Ho1: Using ChatGPT to teach programming has no significant effect on overall students' performance in a course.

To compare Group One (Control Group) and Group Two (Experimental Group), an independent-sample t-test was used. The ratings for Group One (M=56.7, SD=6.48) and Group Two (M=85.2, SD=8.99; t (18) = -8.131, p=.0001) differed significantly. Eta squared =.79 indicates how much the means of Groups One and Two [Control and Experimental] differed from one another. It demonstrates that there was a significant difference between the Experimental Group and the Control Group (79%) and that there was a major effect (Table 1 and 2).

Table 1. Descriptive Statistics for Hypothesis One

	Group Identification	N	Mean	Std. Deviation
Scores	Control Group	10	56.7000	6.48160
	Experimental Group	10	85.2000	8.99135

Table 2. Independent T-Test for hypothesis one

Scores	Equal variances assumed	Levene's Test for Equality of Variances	t-test value	Df	Sig.
	Yes	.075	-8.131	18	.0001

$$Eta\ Square = \frac{t^2}{t^2+(N1+N2-2)} = (66.113161 / 84.11316) = 0.7860025733666103$$

Ho2: Using ChatGPT to teach programming has no significant effect on students' time to complete the task.

To compare Group One (Control Group) and Group Two (Experimental Group), an independent-samples t-test was used. There was a statistically significant difference in scores between Group One (M=17.4, SD=1.27) and Group Two (M=4.7, SD=1.16; t(18)= 23.405, p=.0001). The size of the changes in averages between Groups One and Two [Control and Experimental] was significant (eta squared=.97). It demonstrates that there was a significant difference (97%) between the Control Group and the Experimental Group (Table 3 and 4).

Table 3. Descriptive Statistics for Hypothesis Two

	Group Identification	N	Mean	Std. Deviation
Student's Time to Solve a Problem	Control Group	10	17.4000	1.26491
	Experimental Group	10	4.7000	1.15950

Table 4. Independent T-Test for Hypothesis One

Scores	Equal variances assumed	Levene's Test for Equality of Variances	t-test value	Df	Sig.
	Yes	.890	23.405	18	.0001

$$Eta\ Square = \frac{t^2}{t^2+(N1+N2-2)} = (547.794025 / 565.794025) = 0.96818630242693$$

Ho3: Using ChatGPT to teach programming has no significant effect on student's accuracy in solving a problem.

To compare Group One (Control Group) and Group Two (Experimental Group), an independent-samples t-test was used. The ratings for Group One (M=47.7, SD=3.89) and Group Two (M=91.2, SD=3.71; t (18) = -17.731, p=.0001) were significantly different. Eta squared=.95 indicates how much the means of Groups

One and Two [Control and Experimental] differed from one another. It demonstrates that there was a significant difference between the Experimental Group and the Control Group (95%) and that there was a strong effect (Table 5 and 6).

Table 5. Descriptive Statistics for Hypothesis Three

	Group Identification	**N**	**Mean**	**Std. Deviation**
Student's Accuracy to solve a problem	Control Group	10	47.7000	3.88873
	Experimental Group	10	91.2000	6.71317

Table 6. Independent T-Test for hypothesis three

Scores	**Equal variances assumed**	**Levene's Test for Equality of Variances**	**t-test value**	**Df**	**Sig.**
	Yes	.142	-17.731	18	.0001

$$Eta\ Square = \frac{t^2}{t^2+(N1+N2-2)} = (314.388361 / 332.388361) = 0.9458464792634541$$

Ho4: Using ChatGPT to teach programming has no significant effect on student's interest to learn more in a course.

To compare Group One (Control Group) and Group Two (Experimental Group), an independent-samples t-test was used. There was a significant difference in scores between Groups One and Two (M=83.9, SD=6.98; t (18) =.159, p=.876). This means that there are no significant variations in the means of Groups One and Two [Control and Experimental] in their interest in using ChatGPT. It demonstrates that both groups are eager to combine ChatGPT with learning programming (Table 7 and 8).

Table 7. Descriptive Statistics for Hypothesis Four

	Group Identification	**N**	**Mean**	**Std. Deviation**
Student's Interest towards programming with the use of ChatGPT	Control Group	10	83.9000	6.98331
	Experimental Group	10	83.4000	7.08990

Table 8. Independent T-Test for Hypothesis Four

Scores	**Equal variances assumed**	**Levene's Test for Equality of Variances**	**t-test value**	**Df**	**Sig.**
	Yes	.866	.159	18	.876

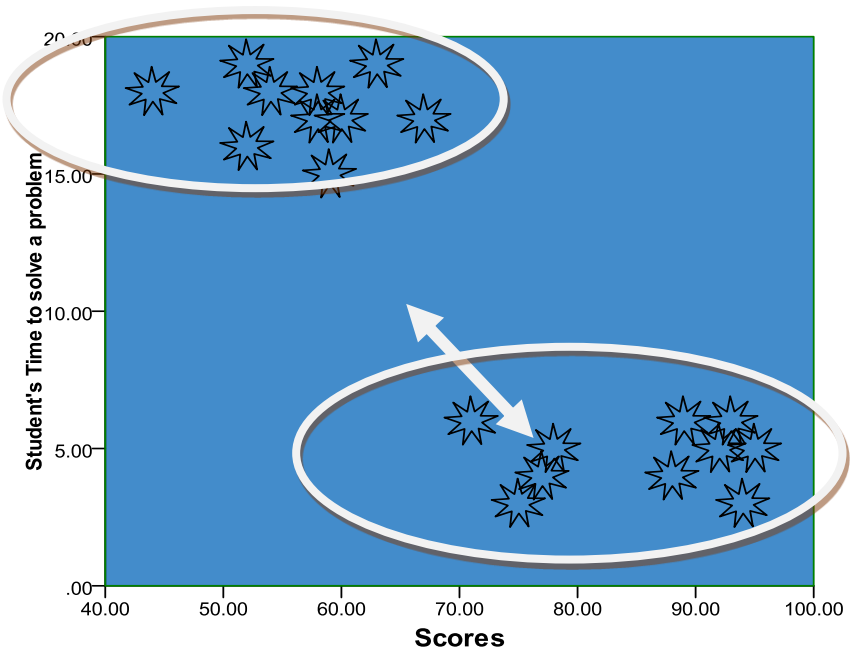

Figure 1. The Difference in the Scores of Students' Time to Solve a Problem

The scatter plot in Figure one depicts the distinct time spent by the groups (Control and Experimental). This suggests that students in the Experimental group took less time to complete their tests than students in the Control group.

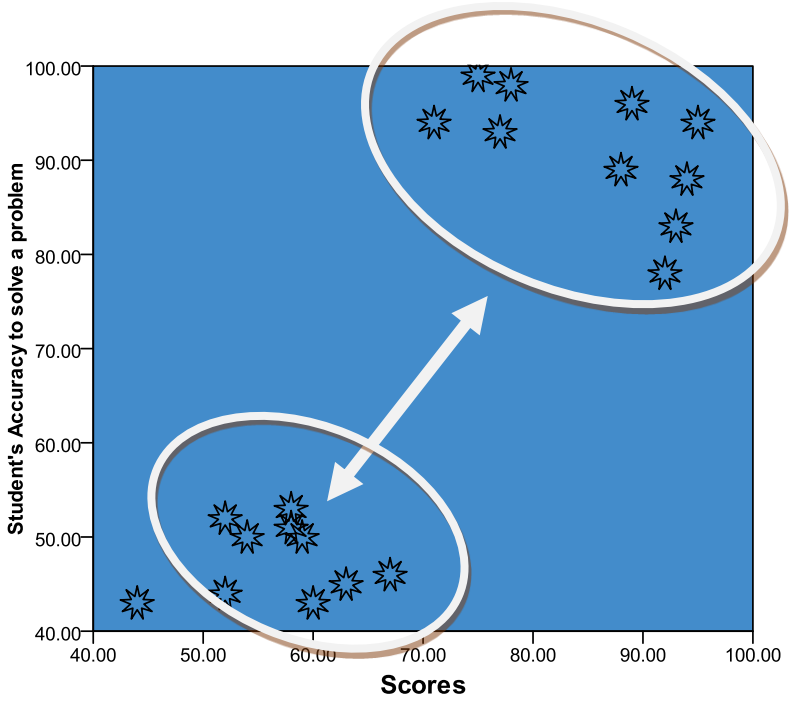

Figure 2. The Difference in the Scores of Students' Accuracy in Solving a Problem

Similarly, in Figure 2, the scatter plot reveals differences in the groups' accuracy to solve and acquire right responses (Control and Experimental). This explains why

students in the Experimental group solved tasks more accurately than their colleagues in the Control group.

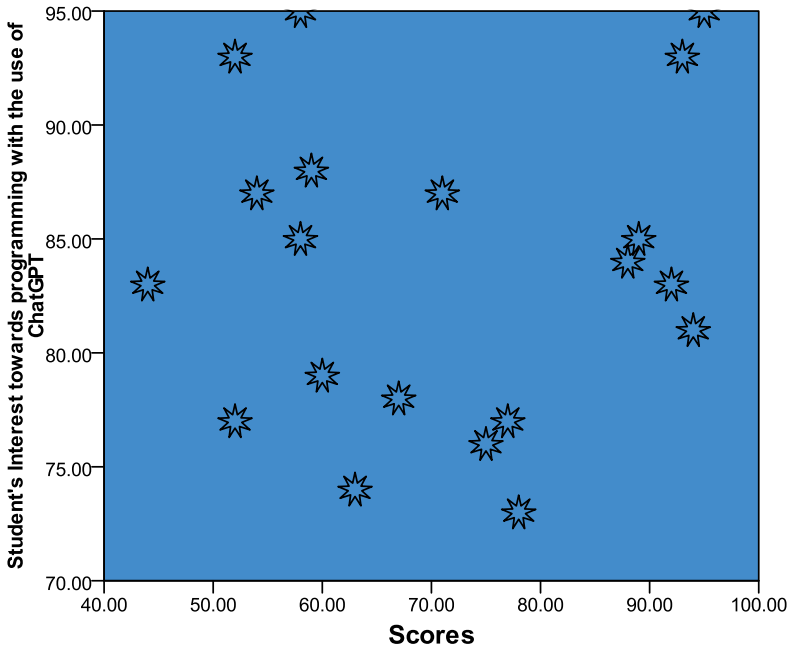

Figure 3. The Difference in the Scores of Students' Interest Towards Programming with the Use of ChatGPT

On the contrary, the scatter plot in Figure 3 demonstrates no significant difference in the students' interest in using ChatGPT to help them solve programming difficulties. It implies that not only the students in the Experimental group enjoyed and were interested in using ChatGPT, but also those in the Control group. This suggests that if they had also been able to use the ChatGPT, they would have performed admirably.

By comparing the scores of students in the Experimental and Control groups with students' time to solve a problem, students' accuracy to solve the problem correctly, and students' interest in using ChatGPT to help solve the programming codes, the scatter plot matrix (Fig. 4) displays a combined pictorial representation of the three formulated hypothesis results.

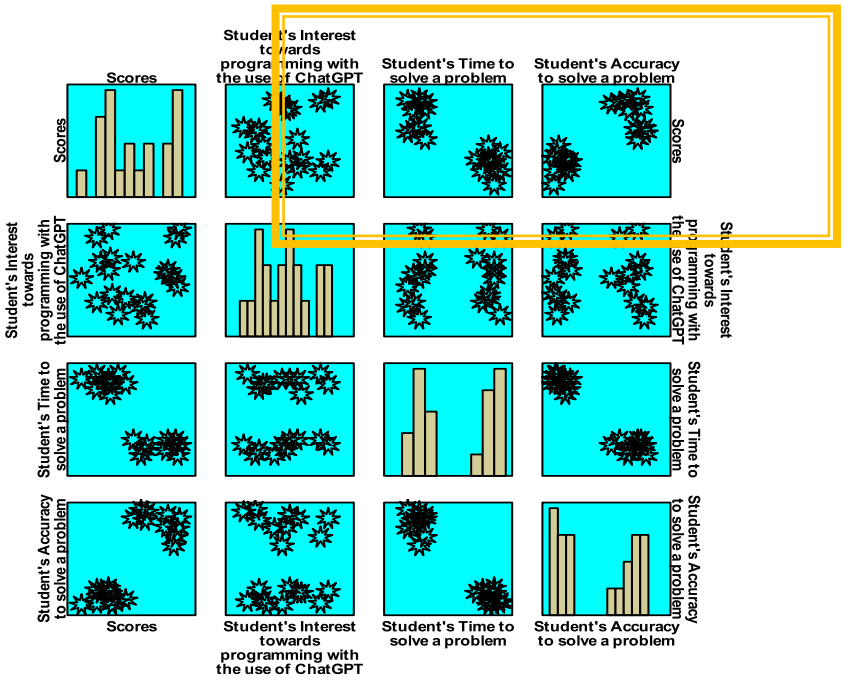

Figure 4. Scatter Plot Matrix (SPLOM) for Students' Time, Accuracy and Interest in the Use of ChatGPT

Discussion

It was noticeable that two different tables were supplied for a particular postulated analysis in Tables 1 and 2, 3 and 4, 5 and 6, & 7 and 8. The first set of tables included descriptive group statistics that primarily displayed the means and standard deviations of the two groups, Group One and Group Two. A close examination of Tables 1, 3, and 5 showed that the mean scores varied greatly: Table 1 compares (X = 56.7) to (X = 85.2), Table 3 compares (X = 17.4) to (X = 4.7), and Table 5 compares (X = 49.7) to (X = 91.2); Table 1 also compares standard deviations (SD) to (SD = 6.48, (SD = 1.27 to (SD = 1.16), and Table 5 to (SD = 3.89 to (SD = 6.71); Table 7 shows little difference (X = 83.9) as compared with ($SD = 7.09$). The standard deviations provided a more precise figure to explain the difference in their means based on these findings. The standard deviations in Tables 1, 3, and 5 together demonstrated that Group Two's [Experimental Group] mean scores were significantly higher than those of Group One [Control Group], both in terms of the time taken to complete the tests and the accuracy with which the tests were administered. Contrarily, Table 7 demonstrates that there was no significant difference between the two groups in terms of the students' interest in using ChatGPT to help them better understand how to solve coding challenges.

Similar to this, it was noted that tables 2, 4, and 6 from the independent Samples T-test had the same finding that there were significant variations in the mean scores, students' response times, and students' accuracy in completing the given task correctly. As long as the significant Levene's test for equality of variance in the T-test tables 2, 4, 6, and 8 were greater than.05 [.075, 0.890, 0.142, and 0.866], the

equality of variance condition was satisfied. As a result, equal variance assumed values were used, and the results on the first three posed hypotheses were significant, with the exception of the fourth, which had no significant result: Table 2: t(18) = -8.131, Table 4: t(18) = 23.405, Table 6: t(18) = -17.731, and Table 8: t(18) = 0.159, P >.05 respectively. In a similar vein, scatter plots in Fig. 1 to 4 were used to visually portray extra data in addition to the results in the tables. The scatter plots clearly show that there were significant differences in the mean scores, the time it took students to complete the problem, and the accuracy with which they solved it (see Figs. 1 and 2), but no significant difference was seen in Fig. 3. The scatter plot matrix displayed the plots' executive summary.

The first three hypotheses were all rejected based on the results of the T-test tables, which also revealed a very great magnitude of the differences between the mean scores of the two groups. Using the mean scores and standard deviations of each group, eta squared was performed for the first three hypotheses to determine this. In conclusion, the data showed that there were significant differences in their means, indicating that Group Two outperformed Group One to a very substantial degree. At the same time, it is feasible to deduce that the usage of ChatGPT in addition to actual practice may have contributed to the differences between these groups in terms of scores, time, and accuracy. Not just this, but Group Two pupils may have received special treatment (using ChatGPT) that allowed them to communicate with the AI-enabled assistance before completing the assignments. The method is also seen by the students as a chance to introduce them to new technology while also introducing them to some basic ideas in computer programming languages.

The study's outcome was controlled for the potential intervening variable of one group mixing with another. It was prohibited for students in one group to observe what was happening in the other group. However, when randomizing students into samples, the study's findings disregarded the students' age, religion, ethnicity, and maturity (Muraina et al., 2011).

4. Conclusion

The relevance of the first three proposed hypotheses established that it is possible to combine ChatGPT with teaching and learning programming concepts such as Python, Java, etc. because the findings established that this would greatly improve students' coding abilities and performance. As a result, it is thought that integrating ChatGPT into practical science lessons and pressuring teachers to use it are effective strategies to boost educational value, foster learning, and provide students with positive technological experiences.

This study was conducted to tell educators at all levels of learning how to use ChatGPT in lessons to introduce fresh ideas to students in subjects other than programming. However, when using this strategy patiently, pupils should receive the correct coaching. With the use of AI-ChatGPT students’ understanding to find the ideal solution to a particular situation will be improved. A more engaging

learning environment, preparing students for the future, connecting teachers and students, and fostering collaborations between teachers and students are just a few of the advantages of technology in the classroom that AI-ChatGPT can enhance. With the advancement of AI and the deep integration of AI and education that has emerged as the development trend of the future educational world, educational methodologies have altered. The study's findings demonstrated that AI helped to improve knowledge of the particulars of AI systems, services, and tools, which later cleared the path for a successful implementation. Looking at the flow, firms in the education industry need to use AI technology as a result of modern necessity and education.

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