By the Authors:

Dela Paz, Heart Nikcole L

Estanislao, Ran-Jel I.

Villegas, Jesalle Hilary D.

Alma Fernandez, MIT

Research Adviser

Dr. Demelyn E. Monzon

Research Professor

Polytechnic University of the Philippines – Quezon City Campus

BALANCING DEPENDENCY: ASSESSING IT STUDENTS' UTILIZATION OF CHATGPT IN CODING ACTIVITIES AT PUPQC

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By

Dela Paz, Heart Nikcole L.

Estanislao, Ran-Jel I.

Villegas, Jesalle Hilary D.

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ABSTRACT

Title	: Balancing Dependency: Assessing It Students' Utilization Of ChatGPT In Coding Activities at PUPQC
Researchers	: Heart Nikcole L. Dela Paz, Ran-Jel I. Estanislao, Jesalle Hilary D. Villegas
Degre	: Bachelor of Science in Information Technology
Institution	Polytechnic University of the Philippines – Quezon City Campus
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This study explores how Bachelor of Science in Information Technology students at the Polytechnic University of the Philippines–Quezon City use ChatGPT for coding tasks such as writing code, fixing errors, and improving programs. As AI tools like ChatGPT become more common in schools, concerns have grown about their effect on student learning and possible overdependence. Using a data-based approach, the study found that ChatGPT usage increases with each academic year, with fourth-year students showing the highest use and reliance, followed by second-, third-, and first-year students. The more students use ChatGPT, the more likely they are to depend on it, especially in higher years. While students find the tool helpful, many agree that there should be clear guidelines to support responsible use. In response, the study proposes a year-level-based plan to guide students in using ChatGPT wisely, while still focusing on building strong coding skills, critical thinking, and ethical awareness. The goal is to help students become tech-savvy, independent, and career-ready.

Keywords**:** ChatGPT, AI dependency, IT education, coding proficiency, programming skills, AI-assisted learning, student autonomy, ethical AI use

Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

As technology advances, Artificial Intelligence (AI) has become an integral tool across various fields, particularly in education. AI-powered applications support students in completing academic tasks more efficiently, especially in coding. While these tools enhance productivity, excessive reliance on them may hinder students' ability to think critically and solve problems independently. Research suggests that heavy dependence on AI can turn students into passive recipients of information, reducing their engagement in the cognitive processes required for analysis and synthesis (Obiwuru, 2024).

The integration of ChatGPT and similar AI tools in educational settings presents both opportunities and challenges. On one hand, AI-powered code generators and debuggers improve learning efficiency and provide instant feedback. On the other hand, concerns arise about students becoming overly reliant on these tools, potentially diminishing their problem-solving skills and critical thinking abilities (Silva et al., 2024). In IT education, where coding proficiency is essential, understanding how students utilize AI tools whether as learning aids or as substitutes for cognitive effort is crucial.

Educators, industry professionals, and researchers have expressed concerns about AI's impact on students' cognitive development. While AI tools can streamline coding tasks, their widespread use raises questions: Do students view AI as a means to enhance their learning, or do they perceive it as a shortcut that weakens their problem-solving abilities? These concerns are particularly relevant for students in the early stages of learning how to code, where developing independent troubleshooting skills is essential for long-term success.

AI use in school should be guided by teachers. Clear instructions on when and how to use tools like ChatGPT can help students avoid overreliance. Those who were properly guided showed better memory and problem-solving skills than those who used AI without support. This means that instead of avoiding AI, schools should focus on using it in ways that help students stay involved and think for themselves (Kumar et al., 2023).

It is also important for students to reflect on their use of AI. Students who checked AI answers and understood errors before asking for help became better at analyzing problems. This shows that if students are careful and mindful when using AI, they can still improve their thinking and problem-solving skills (Nguyen & Torres, 2023).

This study examines how Information Technology (IT) students at the Polytechnic University of the Philippines, Quezon City (PUPQC), utilize ChatGPT in their coding activities, focusing on the balance between AI-assisted learning and dependency. For instance, Smith and Doe (2024) argue that while AI enhances productivity, it may also weaken critical thinking skills, which are crucial for IT careers.

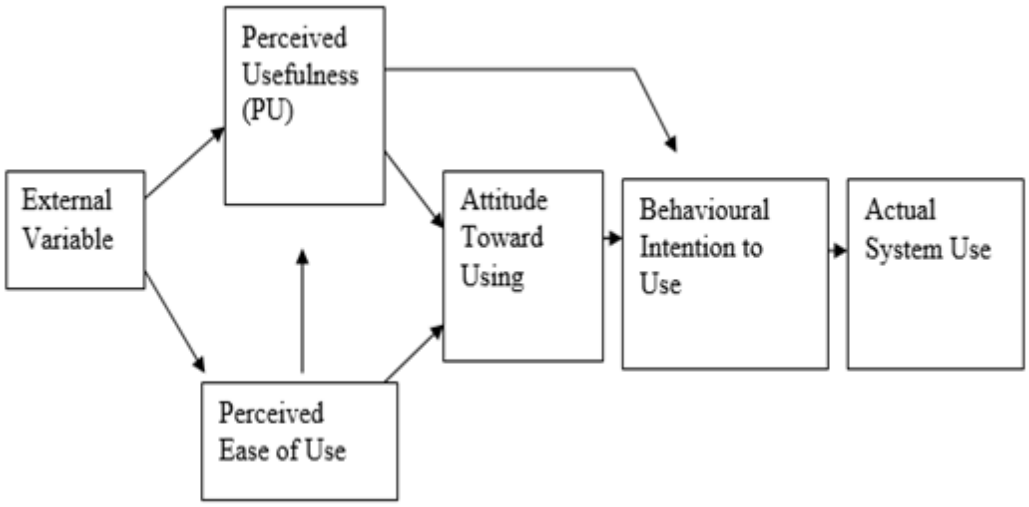
By assessing IT students' utilization of ChatGPT in coding activities, this research aims to provide framework to use ChatGPT as valuable learning aid. The findings will help educators develop strategies for integrating AI in IT education, ensuring that these tools promote independent problem-solving, critical thinking, and the development of essential programming skills for future industry professionals.

Theoretical Framework

This study aims to examine the utilization of ChatGPT in coding activities among IT students at PUP Quezon City, particularly focusing on its benefits and potential dependency. To analyze this phenomenon, the study is guided by the following theoretical constructs:

Technology Acceptance Model

Figure 1. Technology Acceptance Model



The Technology Acceptance Model (TAM), proposed by Davis (1989), provides a framework for understanding how users adopt and utilize technology based on two key factors: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). In the context of this study, TAM helps explain how IT students perceive ChatGPT as a coding assistant whether they find it useful for improving productivity and problem-solving, and whether they consider it easy to integrate into their coding activities. By assessing the utilization of ChatGPT in coding activities among IT students at PUP Quezon City, the study can investigate the extent to which TAM influences students' reliance on AI tools in coding tasks.

Self-Efficacy Theory

The Self-Efficacy Theory by Bandura (1977) emphasizes an individual's belief in their ability to succeed in specific tasks. In educational settings, self-efficacy influences students' motivation, learning behaviors, and problem-solving strategies. This theory is crucial in understanding how IT students' confidence in their coding abilities affects their dependency on ChatGPT. Students with high self-efficacy may use ChatGPT as a supplementary tool,

whereas those with low self-efficacy may develop an over-reliance on AI, potentially hindering their problem-solving growth.

Cognitive Load Theory

Sweller's Cognitive Load Theory (1988), explains how the human brain processes and retains new information by managing cognitive demands. In coding activities, ChatGPT can help reduce extraneous cognitive load by automating repetitive tasks and offering real-time assistance. However, excessive reliance on AI may diminish intrinsic cognitive engagement, preventing students from fully developing their problem-solving and debugging skills. This theory will help analyze whether students use ChatGPT in a way that enhances learning or if they become overly dependent, reducing their critical thinking and independent problem-solving abilities.

Conceptual Framework

Figure 2. Conceptual Framework

The researchers employed the Input-Process-Output (IPO) model to structure the investigation into IT students' utilization of ChatGPT in coding activities at PUP Quezon City. In the Input stage, the study is guided by the Technology Acceptance Model (TAM), Self-Efficacy Theory, and Cognitive Load Theory, which provide a strong foundation for understanding how students use ChatGPT, their confidence in coding skills, and the cognitive impact of AI assistance. These frameworks offer valuable insights into technology adoption, the relationship between ChatGPT usage and dependency, and the balance between AI-assisted learning and independent problem-solving.

The input stage identifies key factors influencing how IT students at PUP Quezon City utilize ChatGPT in their coding activities. These factors include students' year levels, which may impact their familiarity with AI tools and the extent to which they depend on them. Another crucial aspect is the specific ways ChatGPT is used in coding, particularly for code generation, debugging, and code refactoring. The level of dependency is also considered, some students may use ChatGPT as a helpful guide, while others may rely on it too much, which could affect their ability to code and solve problems on their own. Lastly, the PUPQC BSIT curriculum is included as it shows the subjects and programming lessons students take

each year. This helps explain why students at different levels may use ChatGPT in different ways.

The process stage involves gathering and analyzing data to evaluate ChatGPT usage and dependency among IT students. A survey will be conducted to assess how often students use ChatGPT and for what coding tasks. Additionally, the study will compare usage patterns across different year levels to determine whether dependency increases or decreases as students advance in their academic journey. By analyzing this data, the study will identify trends in ChatGPT reliance, helping to determine whether students view the tool as a learning aid or a replacement for independent problem-solving.

The output stage focuses on the anticipated research findings. The study aims to gain insights into how IT students engage with ChatGPT in coding, including common usage patterns and levels of dependency. Furthermore, it will examine whether students' reliance on ChatGPT is influenced by their academic level and ChatGPT usage. Based on these insights, the study will propose a framework to promote balanced AI usage, ensuring that ChatGPT supports learning without undermining students' ability to develop independent coding and problem-solving skills.

Statement of the Problem

As AI tools like ChatGPT become more integrated into education, examining their role in coding activities is crucial. This study examines how IT students at PUP Quezon City use ChatGPT for code generation, debugging, and refactoring across year levels. It explores dependency levels and the relationship between usage and reliance on AI. The findings will guide the development of a framework for balanced ChatGPT usage in coding. Specifically, this research sought to find answers to the following research questions:

1. What are the different usage of ChatGPT in coding activities across different year levels among IT students in terms of:
    1.1 Code Generation
    1.2 Debugging
    1.3 Code Refactoring
2. What is the IT students' dependency level on ChatGPT when performing coding activities?
3. What is the relationship between IT students' ChatGPT usage per year level and their level of dependency?
4. What framework can be developed to help students effectively balance the use of ChatGPT in coding activities?

Hypothesis

In this study, the researcher seeks to examine the relationship between IT students' usage of ChatGPT in coding activities and their level of dependency across different year levels. By formulating hypotheses, the study aims to determine whether a significant relationship exists between these variables. The following hypotheses are proposed:

H_0 (Null Hypothesis): There is no significant relationship between IT students' ChatGPT usage across year levels and their level of dependency.

H_1 (Alternative Hypothesis): There is a significant relationship between IT students' ChatGPT usage across year levels and their level of dependency.

These hypotheses will be tested through data collection and analysis to assess whether students' reliance on ChatGPT increases, decreases, or remains stable as they progress academically. The findings will help in developing a framework for balancing AI

usage in coding activities, ensuring that students maximize its benefits while maintaining independent problem-solving skills.

Scope and Limitations

This study focuses on IT students at PUP Quezon City and examines their usage of ChatGPT in coding activities, specifically in code generation, debugging, and code refactoring. It analyzes how ChatGPT usage varies across different year levels and explores students' dependency levels on the AI tool. Additionally, the study investigates the relationship between ChatGPT usage and dependency, aiming to develop a framework that promotes balanced AI-assisted learning in coding.

The study is limited to IT students currently enrolled at PUP Quezon City and does not include students from other campuses or academic disciplines. This study focuses only on ChatGPT and does not explore other AI-powered coding assistants. While it assesses dependency levels, it does not measure long-term effects on students' coding proficiency. Despite these limitations, the findings will provide valuable insights into AI-assisted learning and responsible AI usage in coding.

Significance of the Study

This study is essential for IT students, educators, curriculum developers, universities, and future researchers, as it provides insights into how IT students at PUP Quezon City use ChatGPT in coding activities and its impact on dependency levels across different year levels. By analyzing ChatGPT usage in code generation, debugging, and refactoring, this research

aims to develop a framework that promotes balanced AI usage, ensuring that students maximize its benefits while maintaining coding proficiency and problem-solving skills.

For IT Students, this study will help IT students understand how ChatGPT affects their coding practices, including its advantages and limitations. By assessing patterns of usage and dependency, the study encourages students to develop responsible AI usage habits, ensuring that ChatGPT serves as a learning aid rather than a replacement for their problem-solving abilities.

For Teachers and Curriculum Designers, this research provides insights into how students rely on ChatGPT for coding tasks and how dependency levels vary across year levels. These findings will help educators design curricula and teaching methods that integrate AI tools effectively, while still reinforcing fundamental coding skills and critical thinking in programming courses.

For Universities and IT Institutions, by examining the relationship between ChatGPT usage and dependency, this study provides valuable data for institutions like PUP Quezon City in setting guidelines for responsible AI usage in programming education. The findings can support the development of strategies that help students strike a balance between AI assistance and independent problem-solving.

For Future Researchers, this study serves as a reference for future research on AI-assisted learning in programming. It opens avenues for further exploration into the long-term effects of ChatGPT on students' coding proficiency, the comparison of AI-assisted learning across different institutions, and the development of strategies to minimize AI overreliance while maximizing learning benefits.

Definitions of Terms

ChatGPT. An artificial intelligence (AI) model developed by OpenAI that generates human-like text responses based on user input (OpenAI, 2023). In this study, ChatGPT refers to its application in coding activities among IT students at PUP Quezon City, specifically in code generation, debugging, and refactoring.

Code Generation. The automatic creation of programming code from user prompts, reducing the need for manual coding (Li et al., 2022). This study examines how IT students use ChatGPT to write code snippets, generate functions, or complete programming tasks.

Code Refactoring. The practice of improving existing code structure and efficiency without changing its functionality (Fowler, 2018). This study explores how students use ChatGPT to enhance code readability, maintainability, and optimize performance.

Coding. The process of writing, testing, and maintaining source code using programming languages to create software, applications, or systems (McCartney, 2024). In this study, coding specifically pertains to the activities of code generation, debugging, and code refactoring performed by IT students.

Cognitive Load. The amount of mental effort required to learn and process information effectively (Sweller, 1988). In this study, cognitive load is analyzed in relation to how ChatGPT assists students in managing complex coding tasks while also assessing whether AI reliance reduces deep learning and critical thinking.

Debugging. The process of detecting, analyzing, and correcting errors in a program to ensure its proper functionality (Zeller, 2009). In this study, debugging refers to how students use ChatGPT to identify issues in their code, understand error messages, and implement AI-suggested fixes.

Dependency Level. The extent to which students rely on AI tools for coding tasks, ranging from occasional assistance to complete reliance (Baird & Maruping, 2021). In this study, dependency level refers to whether students use ChatGPT as a learning aid or depend on it excessively, potentially impacting their coding proficiency and problem-solving skills.

IT Students. Individuals enrolled in an Information Technology program, specifically at PUP Quezon City in this study. The research focuses on how these students utilize ChatGPT in their coding activities across different year levels.

Learning Framework. A structured model designed to optimize learning processes and improve student outcomes (Merrill, 2002). In this study, the learning framework aims to help IT students balance ChatGPT usage by ensuring it supports learning rather than becoming a substitute for programming practice.

Self-Efficacy. An individual's belief in their ability to accomplish specific tasks successfully (Bandura, 1977). This study examines how ChatGPT usage affects students' confidence in their coding skills and whether AI reliance influences their ability to solve programming problems independently.

Technology Acceptance Model (TAM). A framework explaining how users adopt technology based on perceived usefulness and ease of use (Davis, 1989). This study applies TAM to analyze IT students' perceptions of ChatGPT, their willingness to use it in coding, and how these perceptions influence their dependency levels.

Year Level. The academic standing of students based on their progression in an educational program (Schunk & DiBenedetto, 2020). This study examines whether ChatGPT usage and dependency levels vary across different year levels and how experience influences AI reliance.

Chapter 2

REVIEW OF RELATED LITERATURE & STUDIES

ChatGPT in General Higher Education

Recent studies have documented the widespread adoption of artificial intelligence (AI) tools among students, with ChatGPT emerging as the most commonly used AI assistant in academic contexts. According to the Digital Education Council (2024), their Global AI Student Survey revealed that 86% of students worldwide incorporate AI tools into their studies, and 66% specifically use ChatGPT. This prevalence underscores ChatGPT's growing importance as a versatile tool for learning support, including coding, writing, and problem-solving activities. The findings highlight the increasing reliance on AI-driven platforms by students to enhance their educational experiences, reflecting a significant shift in how academic tasks are approached in the digital age.

Song et al. (2024) consider the incorporation of ChatGPT into college education in the context of improving educational practices, exposing a landscape of both positive and mixed student experiences. The authors discovered that although most students valued the instant feedback and help that AI offered, there were serious worries about the possibility of dependency, which would impede the growth of critical thinking and problem-solving abilities. This difference emphasizes how important it is that educational establishments set precise rules that support autonomous learning and the efficient application of AI. The report urges a balanced approach to their adoption and offers crucial insights into the implications of AI tools in higher education.

The article "The Impact of Artificial Intelligence on the Development of Critical Thinking Skills in Students" published in the European Research Studies Journal highlights that while

AI can support learning, "this technology may also lead to overdependence and a limitation in the capacity for independent thinking and problem-solving" (Szmyd & Mitera, 2024). This directly supports concerns about AI's impact on critical thinking.

The learning effects of college students who used ChatGPT for a writing project are examined by Wang et al. (2024), providing insight into how AI tools might support conventional teaching techniques. According to the study, although students valued ChatGPT's ease of use and assistance in structuring their ideas and thoughts, they also voiced worries about an excessive dependence on AI that could impair their writing abilities. The authors contend that if teachers stress critical thinking and creativity in writing assignments, integrating AI tools like ChatGPT into the classroom can promote collaborative learning and increase student engagement. This study emphasizes how AI can help students become more proficient writers while also posing a challenge

The impact of AI chatbots, particularly OpenAI's ChatGPT, on higher education institutions (HEIs) is examined by Dempere et al. (2023). Their study explores how ChatGPT has changed education by offering real-time information and helping students finish assignments, which has increased student involvement and productivity. The authors do point out certain difficulties, though, such as worries about academic integrity and the possibility of an excessive dependence on AI, which could affect students' capacity for critical thought and problem-solving. According to this study, even if ChatGPT has a lot to teach us, its use needs to be controlled to maintain the integrity and values of education.

Yu (2023) uses the entropy weight integrated scoring model to evaluate the effects of artificial intelligence (AI) on college students. This study demonstrates the many ways AI affects student learning, such as improved academic achievement, more effective information retrieval, and assistance with individualized learning paths. The study offers a thorough examination of how AI technologies can both help and hinder students' educational journeys

by using the entropy weight approach to quantify the differing degrees of effect across several aspects. According to the findings, even if artificial intelligence (AI) has many benefits, integrating technology into educational settings needs careful thought to maximize the benefits for students' growth.

Khan et al.(2023) explored the frequency and impact of ChatGPT usage among higher education students. Through surveys, they found a strong correlation between increased academic performance and frequent ChatGPT usage. The study emphasized how ChatGPT contributes to enhanced learning and improved efficiency in completing academic assignments. However, it also raised concerns about over-reliance on AI tools, which may negatively affect creativity and critical thinking. These findings highlight the dual-edged nature of AI in education, providing both opportunities and challenges for its integration.

In their comprehensive review, Almarzooq et al. (2023) delve into the current landscape of artificial intelligence (AI) applications in higher education, emphasizing its transformative potential and challenges. The authors classify several AI technologies, including adaptive learning systems and intelligent tutoring, emphasizing their efficacy in personalizing educational experiences and increasing student outcomes. However, the report also addresses crucial issues, such as ethical considerations and the possibility of worsening gaps in education. This paper, by integrating current studies, is a great resource for educators and policymakers seeking to leverage AI's potential while considering its consequences for teaching and learning in higher education.

The potential and difficulties posed by machine learning (ML) and artificial intelligence (AI) in higher education institutions are examined by Kuleto et al. (2021). Through data-driven insights and individualized training, their research demonstrates how AI and ML may improve learning experiences and potentially revolutionize educational approaches. The authors do, however, also point out issues that could affect students' critical thinking abilities, such as

resource allocation, data privacy concerns, and the danger of growing reliance on technology. The study highlights the value of a well-rounded strategy and recommends that in order to optimize the advantages of AI and ML in education, institutions must address these issues.

Similarly, Hooda et al. (2022) look into how AI-powered assessment and feedback systems can improve academic achievements in higher education. Their findings suggest that AI tools, through real-time feedback and data-driven insights, might help students better understand their performance and discover areas for development. AI-powered systems use algorithms such as ANN, SVM, and Random Forest to give reliable assessments that help students learn, engage, and motivate. The study emphasizes that such technology-driven assessment systems can make feedback less stressful and more constructive, allowing educators to play a more supportive role in supporting student success.

Wonkhe (2025) states that AI's diverse applications in higher education, including enhancing learning experiences and content creation, which implicitly suggests increasing student interaction with these tools as they evolve. This helps set the context for widespread AI adoption.

According to research conducted by the University of St. Augustine for Health Sciences (USAHS) (2025), "artificial intelligence (AI) is playing a growing role in society, which has ultimately led to its incorporation into higher education," underscoring its widespread adoption and the transformation of the educational landscape.

ChatGPT in Higher Education Programming

ChatGPT has emerged as a powerful conversational AI tool, demonstrating extensive capabilities across various tasks, such as summarization, content generation, and even code

writing. These capabilities highlight its potential to support students in tasks like academic research and assignments. OpenAI's development has aimed at improving its usability by offering customizable models and tools for diverse applications (IEEE, 2024).

Wollowski (2023) evaluates ChatGPT's potential as a learning tool by examining how well it works for producing code for college-level programming projects. The study shows that ChatGPT is capable of generating working code for common assignments, helping students comprehend coding ideas and fix mistakes. Wollowski, however, expresses worries about an over-dependence on AI, which could impede students' capacity for problem-solving and increase their reliance on automated answers. According to this study, ChatGPT can be a useful adjunct, but it should be utilized carefully in classrooms to make sure it supports active learning rather than taking its place.

Padilla, et al. (2023) studied the integration of ChatGPT as a linguistic AI tool in higher education, specifically in programming contexts, is examined in this conference paper. In this case study, the authors show how ChatGPT's natural language processing capabilities might improve programming instruction by shedding light on student interactions and the possible advantages and difficulties of AI-assisted learning in programming classes. The results highlight how crucial it is to contextualize AI technologies in order to properly assist learning objectives in programming fields.

Sun et al. (2024) investigate the impact of ChatGPT-facilitated programming (CFP) on college students' programming practices, performance, and perceptions. The study, which employed a quasi-experimental methodology, discovered that CFP led to increased debugging and code modification behaviors. Although CFP enhanced students' overall performance, there was no statistically significant difference from self-directed programming (SDP). However, CFP had a significant impact on students' opinions of ChatGPT's usability

and utility in programming education, with implications for incorporating AI tools into instructional design.

According to Lee (2024) a GPT-4-based code review system intended to improve students' learning experiences in programming classes. The system is designed to deliver quick, individualized feedback on student code contributions, with the goal of improving code quality and reducing AI-assisted cheating. The GPT-4 approach assists students in understanding and correcting their faults by providing focused suggestions rather than immediately solving their difficulties. The system efficiently balances support and active learning, making it a viable tool for programming instruction (Lee, 2024).

A study by Zeng et al. (2024) explores how ChatGPT is used in education, focusing on its ability to assist with homework, programming, and tutoring, demonstrating its versatility in supporting both students and professionals. This paper discusses the limitations of the tool in understanding complex emotional cues and real-time events.

Savelka et al. (2023) explore how large language models—in particular, GPT-4—have advanced to do well on tests in programming courses for higher education. The scientists point out that, in contrast to its predecessors, GPT-4 now has a great ability to solve challenging programming challenges, earning passing scores on a range of coding tests. This development is both exciting and concerning because, whereas GPT-4 helps students with coding and debugging, it has consequences for student learning and academic integrity. The report urges instructors to discover responsible ways to include AI into their teaching in order to enhance student learning rather than replace it.

Abdulla et al. (2024) in their study Using ChatGPT in Teaching Computer Programming and Studying its Impact on Students' Performance highlight that "ChatGPT can provide instructor-like guidance and feedback through conversational interactions, assisting students

in real-time problem-solving." However, they also acknowledge concerns about "inconsistencies and inaccuracies in their submitted code," which directly informs ongoing discussions regarding the utility and challenges of using ChatGPT in programming education.

ChatGPT Impact on Student Learning and Programming Skill

The impact of AI on student learning and programming skills is significant, as demonstrated by the integration of generative AI tools like ChatGPT in programming education. Research by Yilmaz R. and Yilmaz F. (2023) highlights that AI-powered tools provide students with quick and mostly accurate responses, aiding in debugging, improving problem-solving abilities, and boosting self-confidence. Additionally, AI enhances accessibility to programming concepts, allowing students to learn at their own pace through interactive learning environments. However, concerns arise regarding over-reliance on AI, potential inaccuracies, and the risk of diminishing critical thinking skills. While AI serves as a valuable learning aid, proper implementation and guidance are necessary to maximize its benefits while mitigating its limitations.

According to Silva et al. (2023), AI-powered tools like ChatGPT play a significant role in enhancing student learning and programming skills by providing real-time assistance, personalized feedback, and automated debugging, helping students grasp complex concepts more efficiently. Similarly, their study highlights that AI-driven platforms facilitate self-paced learning and improve coding proficiency by offering adaptive guidance tailored to individual needs. However, they also emphasize potential drawbacks, such as over-reliance on AI tools, reduced problem-solving skills, and concerns regarding academic integrity. To mitigate these challenges, Silva et al. (2023) suggest integrating AI with traditional teaching strategies to ensure balanced skill development and critical thinking in programming education.

Ghimire and Edwards (2024) examined the impact of generative AI tools like ChatGPT on student engagement in introductory programming courses. Their study, conducted in CS1 classes, investigated students' patterns of AI usage, revealing a preference for using ChatGPT to address debugging issues and conceptual questions rather than generating code directly. The research highlights that AI tools can boost student engagement and foster greater interest in programming, indicating their potential to enhance learning outcomes. However, the study also raises concerns about students' over-reliance on AI, as many were found to copy and paste AI-generated responses directly into their code.

According to Al-Zahrani (2024), excessive reliance on artificial intelligence can negatively impact human cognitive processes, highlighting the "crucial need to safeguard human judgment and intuition." This emphasizes the importance of carefully managing AI integration to prevent the displacement of vital human skills.

ChatGPT and Its Applications in Coding

The study "Exploring the Key Factors Influencing College Students' Willingness to Use AI Coding Assistant Tools: An Expanded Technology Acceptance Model" by Pan, Xie, Liu, and Xia (2024) investigates how college students perceive AI Coding Assistant Tools (AICATs) and the factors influencing their adoption of these tools. Using an enhanced Technology Acceptance Model (TAM), the study examines key drivers such as perceived trust, perceived danger, dependent anxiety, and self-efficacy to determine students' behavioral intentions toward AICATs. According to survey responses from 303 participants, trust and ease of use greatly increase readiness to adopt AICATs, whereas perceived risk and reliance worry reduce this intention. The study emphasizes that students' concerns about

over-reliance on AICATs may discourage use, and self-efficacy is crucial in resolving dependency concerns and generating positive evaluations of usability (Pan et al., 2024).

Bringula (2024) examined the potential use and limitations of ChatGPT in a Data Analytics course. The study revealed that ChatGPT offers valuable assistance to educators in creating class materials, facilitating teaching-learning activities, and designing assessments. Students benefited from the technology by generating R programming codes and using it as a learning companion. However, the study also highlighted limitations, such as the potential for over-reliance on AI tools, which may impede the development of independent coding skills.

Ma et al. (2024) explored ChatGPT's impact on learning in a Python programming course tailored for first-year students over eight weeks. By analyzing responses from surveys, open-ended questions, and student-ChatGPT dialog data, the study provided a comprehensive view of ChatGPT's utility and identified both its advantages and limitations as perceived by students. Findings indicated a generally positive reception toward ChatGPT, offering insights into its role in enhancing the programming education experience.

Scholl and Kiesler (2024) investigated how novice programmers utilize ChatGPT when solving programming exercises in an introductory course. The study found that students employed ChatGPT for code generation and debugging assistance. While ChatGPT provided immediate solutions, there were concerns about students' over-reliance on the tool, potentially hindering the development of problem-solving skills. The research emphasized the need for balanced AI-assisted learning approaches to foster independent coding abilities.

Husain, A. (2024) investigated the perceptions of programming instructors regarding the effectiveness of ChatGPT in supporting the instructional process. The study revealed that instructors recognized the potential benefits of ChatGPT in providing immediate feedback

and assisting with code generation. However, concerns were raised about the potential negative impact on students' critical thinking and problem-solving skills if overused. The study suggested that while ChatGPT can be a valuable educational tool, it should complement traditional teaching methods to ensure the development of essential programming competencies.

ChatGPT's Role in Enhancing Engagement and Efficiency

Hatmanto et al. (2024) analyzes the role of ChatGPT in Philippine education, particularly in improving student engagement. The study's interviews with senior educators show a variety of excitement and apprehension over AI, particularly its effects on critical thinking, engagement, and dependency. While some educators worried about possible over-reliance and cultural disconnects, others commended ChatGPT's value in promoting participatory learning and adapting curriculum for pupils. To fully utilize AI's educational potential, the authors stress the necessity of professional development, curricular alignment, and balanced AI application.

In order to reduce the burden and free up more time for interactive teaching, this study investigates how ChatGPT improves instructor efficiency by helping with lesson preparation, grading, and lesson creation. ChatGPT is a useful tool in the classroom that helps with administrative work as well as individualized student support. De Jesus does, however, emphasize the significance of ethical issues that could impact teachers' duties as mentors, such as data privacy and the danger of an over-reliance on AI. His results show the necessity of integrating AI in a balanced way to enhance conventional teaching techniques rather than replace them (De Jesus, 2023).

In light of the changing educational landscape, Jia and Tu (2024) offer an innovative conceptual model for AI-enhanced learning that emphasizes the functions of college students'

general self-efficacy, learning motivation, critical thinking awareness, and artificial intelligence capabilities. According to the authors, using AI technologies might greatly improve students' learning experiences by boosting their enthusiasm and self-confidence, two factors that are crucial for academic achievement. The study also emphasizes how crucial it is to develop critical thinking abilities so that students can successfully use AI while continuing their own education. By highlighting the necessity of a comprehensive strategy to improve student learning outcomes, this study offers insightful information about the incorporation of AI in educational settings.

Artificial Intelligence in Usage Across Different Year Levels

Research by Dickey et al. (2023) highlights concerns about the impact of Generative AI (GenAI) on core skill development in computer science students. Preliminary surveys indicated that at least 48.5% of students use GenAI for homework. The study emphasizes the need for guiding students' interactions with GenAI, especially during foundational academic years, to prevent over-dependence that could hinder the development of essential problem-solving skills.

Wang et al. (2023) evaluated the performance of ChatGPT across 187 problems from six undergraduate computer science courses, covering different topics and academic levels. The study explored methods to adapt course materials to AI capabilities and gathered instructor perspectives on AI's impact on education. Findings suggest that AI assistants influence course design and highlight the importance of adapting teaching strategies to leverage AI effectively across various academic levels.

The use of generative artificial intelligence (AI) tools into programming instruction has sparked widespread interest due to its potential impact on students' learning outcomes. Ododo, Essien, and Bassey (2023) investigate how the use of generative AI tools affects

programming self-efficacy and computational thinking skills among Nigerian university students taking Java programming courses. Their research found that students who actively use generative AI tools had higher self-efficacy in programming, which is important for their academic and professional development. Furthermore, the scientists discovered a favorable relationship between the use of AI tools and improved computational thinking capabilities, implying that these technologies help develop important problem-solving talents required for successful programming. The findings underscore the importance of incorporating generative AI into educational practices to support and enhance student learning in programming disciplines.

According to Royce and Bennett (2025), *To Think or Not to Think: The Impact of AI on Critical-Thinking Skills* (NSTA), teachers can leverage AI effectively by framing it as a resource rather than a shortcut and encouraging active engagement with AI-generated data. This approach implicitly supports a progressive integration of AI, aligning with strategies that foster critical thinking and student development at various year levels. In addition, according to Mahmoud (2024), *Generative AI in Engineering Capstone Projects* (ECEDHA) outlines guidelines for the ethical use of AI in capstone projects, emphasizing transparency, enhancing creativity, and fostering critical thinking. These strategies align with the "Professional Readiness Stage" for fourth-year students, aiming to integrate AI while promoting essential skills for future engineering professionals.

Artificial Intelligence in Beginner Programming Classes

Generative AI technologies have emerged as major developments in educational environments, notably in beginner programming classes. Becker et al. (2023) investigate the use of generative AI in programming education, emphasizing its ability to meet varied learning demands and increase student engagement. The authors highlight that generative AI may deliver immediate feedback, unique learning experiences, and customizable resources,

which can significantly shorten the learning curve for students new to programming. However, they warn about the obstacles of incorporating AI into educational processes, such as maintaining academic integrity and ensuring that students gain crucial programming skills rather than relying entirely on AI aid. The study emphasizes the significance of carefully integrating generative AI into curriculum to maximize its benefits while mitigating potential negatives.

Notably, Prather et al. (2024) analyze the dual nature of generative AI's impact on new programmers, emphasizing both its benefits and potential drawbacks. The paper explores how generative AI tools might improve learning by delivering instant feedback, promoting problem solving, and lowering entry barriers for beginners in programming. However, the authors warn that reliance on these technologies may result in a growing skills gap, since new programmers may fail to master essential coding skills and critical thinking abilities. By examining user experiences and performance statistics, the authors urge for a balanced incorporation of generative AI in programming education, highlighting the importance of educators guiding students in efficiently using these tools while developing core programming competencies.

The study "The Effect of Generative Artificial Intelligence (AI)-Based Tool Use on Students' Computational Thinking Skills, Programming Self-Efficacy, and Motivation" looks into how the use of generative AI tools affects key educational outcomes for students. The study found that using AI-based tools resulted in significant gains in computational thinking skills and programming self-efficacy. Furthermore, the findings indicate that the usage of generative AI improves students' motivation to learn programming, resulting in a more interesting and effective learning environment. This suggests that incorporating generative AI tools into programming instruction may improve not only skill development but also students' overall interest in coding (Sharma et al., 2023).

AI's Impact on Student Learning and Programming Skills

In Students' Perspectives on AI Code Completion: Benefits and Challenges, Takerngsaksiri et al. (2023) investigate how AI code completion tools affect student learning. They discovered that while these tools can improve coding speed and reduce cognitive strain, they may inadvertently promote dependency, inhibiting deeper skill development. This study focuses on a critical challenge in AI-assisted coding education: balancing the benefits of assistance with the risk of overreliance, which can damage competence gains.

According to Zhang et al. (2024), the evolution of college students' computational thinking skills during programming learning is examined using a thorough data analysis approach. The study identifies major changes in computational thinking across learning stages, indicating that students' abilities to decompose problems, spot patterns, and build algorithms grow dramatically with time. The authors emphasize the relevance of individualized instructional strategies in improving these important abilities by examining performance data and learning patterns. Their findings indicate that encouraging computational thinking in programming education is critical for preparing students to solve complex challenges in engineering and technology sectors. This study advances our understanding of how students acquire computational thinking and underlines the importance of adaptive teaching techniques to support their learning journey

Finnie-Ansley et al. (2023) examine how OpenAI's Codex affects beginning programming classes, stressing both the difficulties and the revolutionary possibilities of this cutting-edge AI tool. The study highlights how Codex can improve learning results by helping students grasp programming concepts by offering real-time code suggestions and corrections. The authors do warn, though, about the dangers of being overly dependent on this kind of technology, which may result in a loss of fundamental programming and problem-solving skills. This study promotes a balanced approach to incorporating AI in education by

examining how students engage with Codex, making sure that it complements conventional teaching techniques rather than replaces them.

Prather, et al. (2024) explore the revolutionary impact of generative AI, particularly large language models (LLMs), on computing education. Their work addresses how these new tools enhance coding training while presenting significant challenges for evaluation methods. The authors conducted a comprehensive literature review of 71 papers, highlighting the complexity of incorporating AI into educational systems. Additionally, survey data collected from educators and students across over 20 nations reveals diverse perspectives on the utility and implications of AI in learning environments. The study emphasizes the importance of educational stakeholders navigating AI integration thoughtfully to enhance learning outcomes while mitigating potential over-reliance on AI tools.

Using an intersectional analysis method, Maher et al. (2023) investigate how AI tools affect the learning experience of students in programming courses. The study demonstrates how a number of variables, such as students' backgrounds and past knowledge, affect their success and level of involvement while utilizing AI technologies in educational settings. The authors discovered that whereas AI technologies can improve comprehension and offer tailored assistance, there are differences in the ways that various groups profit from these resources. The study emphasizes how important it is for teachers to take these differences into account when incorporating AI tools into their curricula in order to guarantee fair access to educational opportunities and promote an inclusive learning environment.

AI as a Tool for Enhancing Education

Aini et al. (2023) studies ChatGPT's innovative potential as an educational technology tool, specifically in connection with improving teaching and learning experiences. The authors emphasize that ChatGPT may significantly increase student motivation and engagement by

offering rapid feedback, enabling interactive learning, and offering personal help. For Filipino students in particular, this is important since the implementation of AI technology may help in closing educational gaps by giving them access to focused learning experiences and excellent resources that may not always be available in traditional classrooms. By utilizing its potential, teachers may establish a more dynamic classroom that motivates students to think critically and creatively.

The study by Mananay (2024) evaluates the integration of artificial intelligence (AI) in language teaching, emphasizing its effectiveness, challenges, and potential strategies for maximizing its application in educational settings. The study uses a combination of methods to show how AI-powered tools like machine learning, natural language processing, and adaptive learning platforms improve engagement and personalized education. Recommendations for technological assistance, training, and educator collaboration have been proposed in order to solve issues such as resource access, technology limits, and data privacy. The results support the idea of AI as a revolutionary educational tool by highlighting its contribution to increasing student competency and self-directed learning.

The role of artificial intelligence (AI) in improving educational outcomes and instructional approaches has been extensively studied in academic research. Xia and Li (2022) first gave insights into how AI may potentially alter higher education by assisting with the development of teaching skills and boosting overall educational delivery. Although the article was ultimately retracted, the initial premise influenced conversations about the use of AI tools in educational contexts. It emphasized how artificial intelligence may help educators create personalized learning experiences, increase instructional quality, and develop digital competences. The retraction emphasizes the necessity of careful scrutiny in AI research, especially when assertions affect instructional methods and educational policies.

Farzanggi et al. (2023) emphasize the beneficial effects of artificial intelligence (AI) technologies on students' learning experiences in their case study on integrating AI in English instruction at the University of Mindanao. By offering resources and feedback that are specific to each learner's needs, the authors show how AI technologies facilitate individualized learning, which improves language competency and engagement. They believe that the application of AI creates a dynamic and interactive learning environment that gives students the ability to take control of their education and more successfully acquire essential abilities. This optimistic view of AI is significant to comprehending how comparable technologies might help IT students become proficient coders, improving their learning outcomes through individualized guidance and resource accessibility.

Chen et al. (2023) introduced GPTutor, a programming tool designed to enhance code comprehension by leveraging ChatGPT. The authors highlighted GPTutor's ability to explain code snippets in various programming languages, making it a valuable asset for educational settings. They examined its potential benefits, particularly in improving students' learning experiences by simplifying complex programming concepts. Despite its advantages, the study also addressed challenges, such as accuracy and contextual understanding in AI-generated code explanations. This underscores the importance of balancing AI's utility with its limitations in educational contexts

Challenges and Benefits of ChatGPT

Introduction of ChatGPT, an advanced AI language model, into educational settings has revealed both benefits and obstacles, particularly in programming education. According to Silva et al. (2024), ChatGPT improves efficiency, provides fast responses, and promotes sustainable learning habits by enabling self-paced and tailored learning experiences. The

study found that ChatGPT can help students with coding exercises, enhance critical thinking, and promote long-term coding skills by reducing redundant chores. However, one big disadvantage is the danger that students would become heavily dependent on AI-generated information, which may impede the development of core programming skills and diminish critical engagement with educational materials. This concern highlights the importance of using ChatGPT in a balanced manner, supplementing rather than replacing traditional learning approaches (Silva et al., 2024).

A working group report from the ITiCSE conference, presented by Prather et al. (2023), focuses on how AI is revolutionizing computing education, especially through transformer models. The authors highlight how AI coding assistants can improve learning experiences, accommodate a variety of learning styles, and advance coding abilities while discussing the benefits and difficulties associated with incorporating these technologies into the curriculum. But they also warn of possible dangers, like an over-reliance on AI technologies and the possibility that pupils' critical thinking and problem-solving skills would deteriorate. The paper highlights the significance of careful application and ongoing evaluation of AI's role in education in order to promote a well-rounded strategy that optimizes advantages while reducing disadvantages.

In addition, Finnie-Ansley et al. (2023) examine OpenAI's Codex's potential to help students with computer science programming tasks, paying particular attention to how well it works in a supervised learning environment. The study evaluates Codex's performance on a range of CS2 programming tasks and finds that although the AI provides remarkable coding support, students' opinions on its value are not entirely consistent. While some participants value the assistance with debugging and producing code snippets, others voice worries about an excessive dependence on AI and the possible loss of basic programming abilities. This

study highlights how crucial it is to carefully include AI technologies into computer science courses. such that they improve learning without sacrificing students' ability to code.

In their study of generative AI's function in hackathons, Sajja et al. (2023) address both the technology's advantages and disadvantages in an educational setting. According to the study, generative AI is a potent instrument that fosters creativity and speeds up problem-solving, giving participants fresh approaches to quickly generate and improve ideas. But the authors also point possible drawbacks, such as issues with creativity, moral application, and the potential for AI to erode experiential learning. This study emphasizes the necessity of carefully incorporating AI into hackathons, arguing that clear rules could guarantee that these technologies promote rather than impede skill development.

According to *Strategies for the Responsible Use of AI in Higher Education Learning* (Explorance, 2025), inconsistent AI policies have led to confusion among stakeholders, highlighting the urgent need for clear and consistent guidelines from institutional administration. This underscores the importance of establishing balanced strategies to ensure the ethical and effective use of AI in higher education.

According to Wynants et al. (2025), the ethical and responsible use of artificial intelligence in higher education necessitates clear communication of AI policies and guidelines to all campus stakeholders. Their framework emphasizes the development and adherence to explicit protocols for responsible AI use in academic work to maintain integrity and accountability. Moreover, they highlight the importance of educating the campus community on proper citation, attribution, and ethical practices concerning AI-generated content and tools. These principles are essential for fostering a strategic approach to integrating AI technologies while upholding academic standards across institutions.

According to MacCabe (2024), responsible and ethical use of artificial intelligence in higher education requires transparent guidelines, strict data privacy measures, accountability, and fairness in AI integration. These factors are essential for fostering structured guidance and ethical considerations, which support the effective and equitable adoption of AI technologies within academic environments.

Oyetade and Zuva (2025) discuss the integration of AI ethics and bias mitigation in education as critical components for advancing equitable education. Their study highlights how inclusive AI can help reduce bias and enhance teacher literacy, directly supporting the curriculum integration aspect of the "Professional Readiness Stage" in strategic educational frameworks. This emphasizes the importance of addressing ethical considerations and bias to ensure AI tools contribute positively to educational outcomes.

Impact of ChatGPT Dependency

The growing use of AI tools like ChatGPT in education raises concerns about their impact on students' critical thinking, creativity, and independent learning. Critics argue that AI-generated text may discourage original thought and thorough research, especially in fields requiring deep analysis. This also raises issues of academic integrity and cheating, prompting calls for educational institutions to create ethical AI usage guidelines and promote critical engagement with technology (Tech Business News, 2024).

Obiwuru (2024) explored the impact of AI chatbots on knowledge construction and critical reasoning among university students. While chatbots provide diverse perspectives and learning efficiency, they risk promoting passive learning and undermining critical reasoning. The study recommends educating students on ethical AI usage and integrating strategies that strengthen critical thinking.

Similarly, Zunaidah et al. (2023) emphasize the cognitive risks of excessive reliance on AI, particularly in language education. The study advocates for a balanced approach, integrating AI tools to enhance productivity while encouraging critical engagement and independent problem-solving skills.

Baron (2024) studies how students' increasing reliance on artificial intelligence (AI) tools affects their psychosocial development, emphasizing essential skills including self-reliance, social responsibility, and emotional control. This study emphasizes that while AI tools provide significant academic advantages, such as individualized learning, access to a wealth of knowledge, and real-time feedback, they can also present problems for students' growth in critical thinking and social skills. Baron advocates for being careful in its adoption to enable comprehensive student development and suggests a balanced integration of AI in educational settings to promote academic advancement without compromising essential social and emotional capacities.

Doctor of Education students' opinions of AI's role in academic writing are examined by Bueno and Minimo (2024), who found a mixed feeling of anxiety about dependency and appreciation for efficiency. Since students identify both potential threats to their personal skill development and benefit in productivity, they emphasized the need for rules that establish a balance between academic standards and AI assistance. According to this research, competent AI integration is necessary to enhance rather than replace conventional academic competencies.

A Scale to Measure AI Dependency

The study conducted by Morales-García et al. (2024) addresses the increasing use of artificial intelligence tools by university students, focusing on the need to measure dependence on such technologies. Recognizing a gap in existing literature, the authors developed and validated a scale specifically designed to assess university students' dependence on AI tools. Through a rigorous methodological process involving exploratory and confirmatory factor analysis, they identified multiple dimensions of AI dependence, including cognitive, emotional, and behavioral components. The findings suggest that high levels of dependence on AI tools can negatively impact students' academic behavior, such as reducing critical thinking and increasing procrastination. This study contributes significantly to educational research by offering a reliable instrument to assess AI tool dependence, paving the way for future studies and interventions aimed at promoting balanced and responsible AI usage among students.

Balancing AI Dependency

Baek et al. (2024) explore college students' perspectives and use of generative AI tools such as ChatGPT, demonstrating complex attitudes toward these technologies in learning environments. Many students see the potential benefits of generative AI for improving learning, such as idea generation and essay drafting, but many are skeptical of its reliability and ethical consequences, notably about academic integrity and the authenticity of AI-generated work. The authors underline the need of educational institutions to provide clear standards and support for safe AI use, while also encouraging open discussion between educators and students. This method can help students effectively use generative AI while

maintaining academic standards, emphasizing educators' dual roles in supporting integration and managing the ethical challenges connected with these developing technologies

While caution is needed to avoid dependence, AI tools in education, such as coding and academic writing, have shown amazing potential in helping students with grammar, structure, and idea processing. According to studies, while AI improves writing and coding efficiency by supporting grammar and code structure, when used excessively, it can also create dependency and delay students' ability to develop independent skills. The significance of balanced AI use is pointed out by researchers such as Fabro et al. (2024) and Adams and Chuah (2022), who recommend putting AI literacy programs into place to encourage students to use these tools as enhancements to their own talents rather than as a replacement for them. Because reliance on AI may delay skill mastery, this need for balance is especially applicable to coding skill, emphasizing the necessity for responsible use of AI in education.

Umali's (2024) study addresses how AI technology is incorporated and managed in private schools, with a specific focus on how it affects instructional strategies and student motivation. This study shows the advantages and difficulties of using AI in the classroom by emphasizing how it may help with assessments, personalized learning, and support administrative duties. Results show that AI can improve teacher effectiveness and student engagement, but it also generates concerns about data privacy and dependency, stressing the need for cautious management and a balanced approach to AI in education. This study emphasizes the necessity of laws that support moral AI use in order to maintain a fruitful educational setting and promote critical thinking.

The KAP-CQ39 survey instrument was created by Robledo et al. (2023) to evaluate new teachers' understanding, views, and actions regarding utilizing ChatGPT in Philippine education, emphasizing both its advantages and disadvantages. This study supports ChatGPT as an AI tool that can improve learning, but it also emphasizes the necessity for

cautions against risks including academic dishonesty and reliance. Their results show how important it is to apply AI in education in a balanced way to prevent negative impacts on students' intellectual growth and creativity, which will guide practice and policy (Robledo et al., 2023).

This study discusses the possibilities and challenges of ChatGPT as an additional educational tool. There are potential risks associated with using AI technology, such as possible dependency, ethical concerns, and decreased student interest, even if it can enhance accessibility, offer immediate support, and enable individual education. ChatGPT is useful for improving educational experiences, but it must be used carefully to prevent overuse and preserve critical thinking abilities. To promote meaningful educational outcomes, educators have to establish a balance between the use of AI and ethical considerations as well as direct instruction (Genelza, 2024).

The effects of artificial intelligence (AI) on students' writing abilities are investigated by Solis and Idul (2024), who pay close attention to the possible compromise between making tasks easier to complete and encouraging reliance on AI for writing processes. While AI tools like ChatGPT, QuillBot, and Google Bard quicken tasks and increase efficiency, they also run the risk of reducing students' critical thinking and originality, according to this experiential study, which was carried out with senior high school students. The results show that a large number of pupils value the ease and assistance AI offers for vocabulary, grammar, and structural enhancements. Meanwhile, concerns were expressed, about an excessive dependence on AI, with students citing possible effects on their capacity to independently come up with ideas and construct arguments.

Lastly, the impact of Artificial Intelligence on educational quality has become a major topic of concern in education. AI applications in education enable individualized learning, adaptive exams, and data-driven insights to help students succeed and participate. Studies

show that AI tools improve inclusion by addressing varied student needs and minimizing gaps in accessibility to educational resources. However, ethical problems and the possibility of dependency pose barriers to AI integration in education, mandating a balanced approach to technology use in learning contexts (IntechOpen, 2024).

The article written by Cacho (2024) addresses the need for operational, educational, and ethical requirements while offering a complete structure for incorporating generative AI into university instruction. While the study recognizes AI's potential to improve learning, it also stresses the need for colleges to build a systematic strategy to handle the benefits and difficulties AI presents, especially when it comes to promoting students' academic honesty and skill development. This study supports our "The Impact of AI on Coding Proficiency" research by exploring the limit between AI support and reliance. In order to ensure responsible and efficient AI use and create an academic setting where AI enhances learning without damaging critical thinking abilities, Cacho's study suggests that teachers and students work together.

Comparison with Traditional Learning Methods

The rise of artificial intelligence in education has led to ongoing debates about its effectiveness compared to traditional teaching methods. AI-driven learning systems provide personalized instruction by adjusting content based on a student’s progress. These systems allow students to learn at their own pace and receive immediate feedback, which can improve their engagement and overall learning outcomes. A systematic review by Hardaker and Glenn (2024) highlights that AI technologies enable personalized instruction by adapting to individual learners' needs, thereby enhancing the teaching and learning process.

Despite the benefits of AI in education, traditional learning methods offer distinct advantages that artificial intelligence cannot fully replicate. In-person interactions between

students and teachers are instrumental in developing critical thinking, communication skills, and emotional intelligence. These competencies are essential for academic and professional success and are more effectively nurtured through human interaction rather than AI-generated content. According to Dumulescu and Mușoiu (2021), the emotional and social dimensions of learning — such as empathy, motivation, and personalized mentoring — are areas where traditional teachers outperform AI systems. Furthermore, teachers provide real-world context, nuanced explanations, and mentorship that go beyond what algorithms can currently deliver.

A study by Dendritic Health (2023) compares AI assisted learning with traditional classroom methods and finds that while AI can streamline learning by automating explanations and grading, it may also reduce opportunities for discussion and collaborative problem solving. The study suggests that a combination of AI and traditional teaching strategies would be the most effective approach. By integrating AI in moderation, students can benefit from both the efficiency of technology and the critical thinking skills that come from teacher led instruction.

Frameworks for Balanced AI-Assisted Learning

Holmes et al. (2020) explore best practices for AI-assisted education, proposing a Balanced AI Pedagogy Framework. Their model encourages active learning strategies, where students use AI to complement, rather than substitute, problem-solving efforts. They highlight teacher-guided AI integration, ensuring students are taught when and how to use AI responsibly

Selwyn (2021) investigates how AI influences student autonomy in learning and warns against automation bias where students over trust AI-generated solutions without critical analysis. The study introduces a Personalized AI Learning Framework (PALF), advocating for AI-driven feedback loops that encourage active engagement rather than passive acceptance of AI-generated answers.

Gulson and Sellar (2022) analyze the effects of AI on student learning behavior, emphasizing the need for a structured framework that maintains student engagement while preventing over-reliance on AI tools. They propose an AI Literacy Framework, which incorporates AI as a learning guide rather than a replacement for cognitive effort.

Ethical Considerations in AI Assisted Learning

The integration of artificial intelligence in education has raised significant ethical concerns, particularly in areas such as fairness, privacy, and academic integrity. Dwivedi et al. (2023) emphasize the importance of responsible AI use in classrooms, highlighting the need for educators to recognize potential biases in AI systems and ensure equal access for all students. They argue that while AI can enhance learning, it must be implemented in a way that does not put certain groups of students at a disadvantage. Similarly, Cheong (2024) discusses the ethical dimensions of AI in education, stressing that AI applications should uphold transparency, accountability, and student autonomy. He advocates for AI to serve as

a support tool that complements human reasoning and decision-making, ensuring that learners remain active participants in the educational process.

Similarly, Williamson and Eynon (2020) highlight the need for educational institutions to implement governance frameworks that ensure ethical AI use. Their research underlines the risk of students becoming overly reliant on algorithmic systems, potentially undermining their critical thinking and problem-solving skills. They advocate for clear policies and digital literacy programs to help students and educators understand how AI systems operate and to foster a healthy skepticism of automated feedback.

Another major concern is data privacy. AI-powered learning platforms collect and analyze vast amounts of student data, which raises the need for stronger policies to protect user information. Researchers emphasize the importance of transparency in how AI systems operate and stress the necessity of obtaining informed consent from students before using AI-driven learning tools (Zhou et al., 2023). Addressing these ethical concerns is essential to ensuring that AI remains a tool for academic growth rather than a source of unfair advantages and risks.

According to Hua's research (2023), students may not be properly ethically informed, which could lead to a difference between their moral views and behavior, even though they typically have good opinions toward AI in the classroom. Significantly, the study revealed that neither AI dependence nor social background had a direct effect on the tendency of learners to act dishonestly, emphasizing the necessity of programs such as the AI Dependence Inclusive Course for Transparency Program (AIDICT).

Synthesis of the Review of Related Literature

As technology continues to shape education, many college students use ChatGPT to assist with coding activities, including code generation, debugging, and code refactoring.

Research highlights that while AI-powered tools help students write and refine code more efficiently, they also raise concerns about over-reliance, which can hinder the development of essential problem-solving and critical-thinking skills (Song et al., 2024; Becker et al., 2023).

The way students across different year levels use ChatGPT varies. First-year and second-year students tend to rely more on AI for code generation and debugging, often using it to solve problems without fully understanding the logic behind the solutions (Scholl & Kiesler, 2024; Becker et al., 2023). Meanwhile, third-year and fourth-year students use ChatGPT more for code refactoring, leveraging its capabilities to optimize their code while still applying their knowledge of programming concepts (Sun et al., 2024; Lee, 2024). These patterns suggest that as students progress through their IT courses, their reliance on AI shifts from basic problem-solving to more advanced code improvements.

However, dependency on ChatGPT remains a key concern. Studies reveal that students who frequently use AI tools may struggle with coding confidence and self-sufficiency, making it harder for them to complete projects without assistance (Ododo et al., 2023; Pan et al., 2024). This raises questions about how dependency levels vary between students of different year levels and whether excessive AI use negatively impacts their ability to think independently and troubleshoot errors on their own.

To address these challenges, researchers propose structured AI integration frameworks that guide students on how to use ChatGPT effectively. The Balanced AI Pedagogy Framework (Holmes et al., 2020) and AI Literacy Framework (Selwyn, 2021) emphasize that AI should be a learning aid, not a replacement for problem-solving skills. These frameworks suggest gradual AI exposure, where students develop programming fundamentals first before incorporating AI tools into their workflow (Fabro et al., 2024).

In connection with this study, developing a framework to balance ChatGPT use in coding activities is crucial. Such a framework should focus on teaching students when and how to use AI tools responsibly while ensuring that they develop independent problem-solving abilities as they progress through their IT coursework.

Chapter 3

METHODOLOGY

Research Design

This study employed a quantitative research approach to analyze how IT students at PUP Quezon City utilize ChatGPT in coding activities, including code generation, debugging, and code refactoring. Using a descriptive research design, the study examined first-year to fourth-year BSIT students to assess their usage patterns and dependency levels on ChatGPT. The primary data collection method involved distributing survey questionnaires through google forms designed to capture students' frequency of use and reliance on ChatGPT for coding tasks. The collected data was analyzed to determine the relationship between usage patterns and dependency levels, guiding the development of a framework for balanced ChatGPT utilization in coding activities.

Sources of Data

The study purposively selected respondents from the Bachelor of Science in Information Technology (BSIT) program at the Polytechnic University of the Philippines, Quezon City (PUPQC). With an estimated student population of 389, respondents were stratified by year level to ensure a comprehensive analysis of ChatGPT utilization in coding activities and the balance between assistance and dependency. To determine an appropriate sample size, Yamane’s formula was applied with a 5% margin of error, yielding a sample of approximately 198 students. Stratified sampling was employed to enhance the reliability and validity of the findings by ensuring diverse representation across year levels, providing deeper insights into students' usage patterns of ChatGPT in coding.

Table 1.

Sample Size (BSIT Students per year level)

YEAR	NO. OF STUDENTS	PERCENT	SAMPLE SIZE
First Year	113	28.79%	57
Second Year	104	26.77%	53
Third Year	90	23.23%	46
Fourth Year	82	21.21%	42
TOTAL	**389**	**100%**	**198**

This study employed a stratified random sampling technique, grouping participants by year level within the Bachelor of Science in Information Technology (BSIT) program at Polytechnic University of the Philippines, Quezon City (PUPQC). This method ensures equal representation across year levels, allowing for a comprehensive analysis of ChatGPT utilization in coding activities and its impact on students' dependency levels. By including students from first to fourth year, the study captures a broad spectrum of perspectives on ChatGPT's

The selection criteria for respondents include:

(a) Respondents must be currently enrolled at the Polytechnic University of the Philippines, Quezon City (PUPQC) and currently taking Bachelor of Science in Information Technology Program;

(b) Experience using ChatGPT for coding activities, such as code generation, debugging, or refactoring.

Data will be collected exclusively from students, excluding faculty and staff, to ensure that the study focuses on student experiences, and awareness of ChatGPT's influence on coding and dependency.

The sample size will be proportionally distributed across all year levels, following calculations based on Yamane's formula with a 5% margin of error, resulting in a sample of approximately 198 students. This approach ensures that the study presents a representative analysis of BSIT students' engagement with ChatGPT and provides insights into developing a framework for balanced AI usage in coding activities.

Research Instrument

The research instrument used in this study is a structured survey questionnaire designed to assess IT students' utilization of ChatGPT in coding activities and examine the dependency or the respondents. The questionnaire is structured into sections that evaluate various aspects, including students' use of ChatGPT for code generation, debugging, and refactoring. It also measures their dependency levels when performing coding activities, and the relationship between usage patterns and dependency levels across different year levels.

To ensure broad accessibility and efficient data collection, the survey was distributed online via Google Forms, allowing participation from students across all year levels in the Bachelor of Science in Information Technology (BSIT) program at the Polytechnic University of the Philippines, Quezon City (PUPQC). This approach ensures that the collected data is

both reliable and representative of the student population, facilitating a comprehensive analysis of ChatGPT's role in coding activities.

Ethical Considerations

In alignment with the ethical standards of research and the principles of confidentiality and informed consent, this study prioritizes the protection of participants' rights and welfare. The research follows the guidelines set by the Polytechnic University of the Philippines' University Research Ethics Committee (PUP-UREC), ensuring adherence to ethical norms, legal frameworks, and privacy laws, including Republic Act No. 10173, the Data Privacy Act.

The study emphasizes obtaining free and informed consent from all participants, ensuring they fully understand the research's objectives, procedures, potential risks, and their right to voluntarily participate or withdraw at any time without consequence. This commitment to transparency creates an environment where participants can make well-informed decisions regarding their involvement in the study. Moreover, robust confidentiality measures are implemented to safeguard the privacy and integrity of the data collected from participants, ensuring their information remains secure throughout the research process.

Data Gathering Procedure

The data gathering procedure for the will involve a systematic approach to ensure comprehensive and reliable data collection from the participants. The following steps outline the procedure:

1. **Participant Recruitment**:

(a) Participants will be recruited from the Bachelor of Science in Information Technology (BSIT) program at the Polytechnic University of the Philippines, Quezon City (PUP QC).

(b) Announcements will be made in classes and through social media platforms to invite students who use ChatGPT in their coding activities to participate in the study.

2. **Informed Consent**:

(a) Prior to data collection, informed consent will be obtained from all participants. They will be provided with detailed information about the study's purpose, procedures, potential risks, and benefits.

(b) Participants will have the opportunity to ask questions and will be required to agree on a consent form indicating their willingness to participate.

3. **Distribution of Research Instruments**:

Structured Questionnaire: The online questionnaire will be distributed through email, messenger or an educational platform, such as Google Forms, to assess IT students' utilization of ChatGPT in coding activities. The questionnaire will explore students' usage patterns, the benefits and challenges of using ChatGPT for code generation, debugging, and refactoring, as well as their self-reported levels of dependency on the tool. It will also gather insights into their coding proficiency and how ChatGPT influences their coding practices. This method ensures easy accessibility for participants and enables a comprehensive analysis of the students' experiences regarding ChatGPT's role in coding tasks.

4. **Data Management**:

(a) All collected data will be securely stored and only accessible to authorized research team members.

(b) Personal identifiers will be removed from the data to maintain confidentiality and anonymity of the participants.

5. **Data Analysis**:

Once data collection is complete, quantitative data from questionnaires will be analyzed using statistical methods to examine relationships between ChatGPT usage and dependency level of each year level.

6. **Ethical Considerations**:

Throughout the data gathering process, ethical standards will be upheld by ensuring participant confidentiality, voluntary participation, and the right to withdraw from the study at any time without penalty

Data Case Analysis

The researchers utilized various statistical tools and formulas to analyze the data collected in this study, which explores the utilization of ChatGPT in coding activities among IT students at PUPQC. The following methods were employed:

A. Descriptive Statistics

Percentage and Frequency Distribution

Used to analyze the demographic profile of respondents, including year level, and frequency of ChatGPT usage.

$$P = \left(\frac{f}{n}\right) \times 100$$

Where:

P=percentage,

f = frequency,

n = total number of respondents.

Weighted Mean

The weighted mean was used to measure IT students' overall utilization and dependency on ChatGPT in coding activities, including code generation, debugging, and refactoring.

$$M = \frac{\sum fx}{n}$$

Where:

M = weighted mean,

f = frequency of each response,

x= corresponding value of the response,

n= total number of respondents.

Standard Deviation

Used to measure how responses are spread out from the mean, indicating the level of agreement or variation.

$$SD = \sqrt{\frac{\sum(x - \bar{X})^2}{n - 1}}$$

Where:

x = individual score

X= weighted mean

n = number of respondents

B. Inferential Statistics

Spearman Rank Correlation Coefficient (Spearman's Rho)

Used to measure the strength and direction of the relationship between ranked variables (non-parametric test).

$$\rho = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Where:

ρ = Spearman's rho

d = difference between the ranks of paired scores

n = number of observations

C. Likert Scale

Table 2.

Level of Dependency on AI Tools for Coding Tasks

INTERVALS	DESCRIPTIVE RATING
4.20 - 5.00	Strongly Agree (Highly Dependent)
3.40 - 4.19	Agree (Moderately Dependent)
2.60 - 3.39	Neutral
1.80 - 2.59	Disagree (Slightly Independent)
1.00 - 1.79	Strongly Disagree (Highly Independent)

This scale measures students' perceived dependency on ChatGPT across coding tasks such as code generation, debugging, and refactoring, using a five-point Likert scale modeled after the Dependence on AI (DAI) framework. Respondents rate their level of agreement from 1 (Strongly Disagree) to 5 (Strongly Agree), reflecting how reliant they feel on ChatGPT for completing coding activities. The overall dependency score is calculated using the weighted mean formula. A higher weighted mean indicates a stronger perceived dependency on ChatGPT, while a lower score suggests greater independence from AI assistance. This scale thus captures the balance between helpful AI support and potential overreliance, providing valuable insight into how ChatGPT influences students' coding proficiency002E

Chapter 4

RESULT AND DISCUSSION

Demographic Profile

Table 3

Frequency and Percentage of the Respondents per Year Level

Year-Level	Frequency	Percent
First Year	57	28.79
Second Year	53	26.77
Third Year	46	23.23
Fourth Year	42	21.21
Total	**198**	**100.00**

This table presents the demographic composition of the respondents in terms of their academic year level. The distribution reveals that first-year students comprise the largest group (28.79%), followed by second-year (26.77%), third-year (23.23%), and fourth-year students (21.21%). This stratification is critical as it provides insight into the maturity of coding skills and exposure to programming challenges across different stages of academic training. The slightly higher proportion of lower-year students indicates that early adopters of ChatGPT may be those with limited prior coding experience who turn to AI for foundational support.

From a pedagogical perspective, this suggests that educational institutions may need to emphasize the development of critical thinking and coding literacy at the earliest stages of instruction, especially as students become increasingly exposed to intelligent technologies. Moreover, the data reinforces the importance of tailoring educational interventions to different year levels, as the motivations for and reliance on AI may evolve over time. The findings

underline the necessity of longitudinal studies to observe how patterns of AI tool dependency develop across the student lifecycle.

RQ1: What is the different usage of ChatGPT in coding activities across different year levels among IT students?

Figure 3. Research Question 1.1 Graph

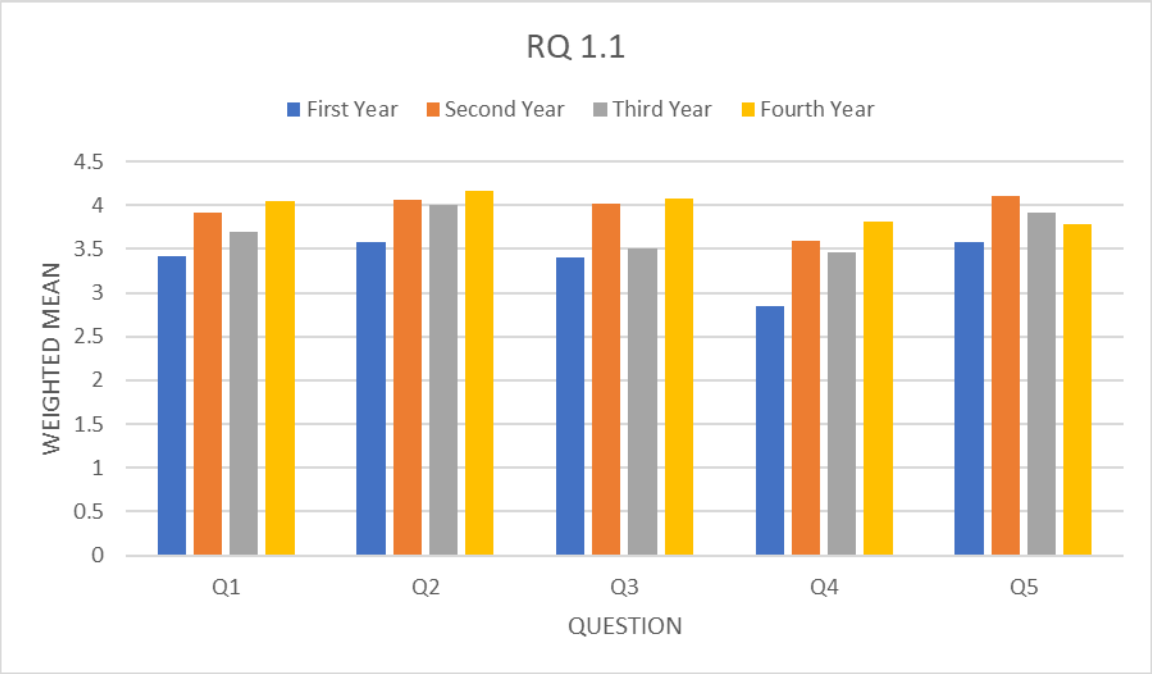


Table 4.1

Descriptive Statistics on the Different Usage of ChatGPT in Coding Activities across Different Year Levels among IT Students in terms of Code Generation.

STATEMENTS	LEVEL	N	WM	SD	VI
1.1 Code Generation [I use ChatGPT to generate code from	First Year	57	3.42	0.93	Agree

scratch for assignments or projects.]					
1.1 Code Generation [I rely on ChatGPT to provide syntax examples for unfamiliar programming concepts.]	First Year	57	3.58	0.98	Agree
1.1 Code Generation [I use ChatGPT to generate code templates for repetitive activities.]	First Year	57	3.40	0.98	Agree
1.1 Code Generation [I depend on ChatGPT to create full functions or classes based on a given problem.]	First Year	57	2.84	0.98	Neutral
1.1 Code Generation [I rely on ChatGPT for guidance in solving programming exercises or coding challenges.]	First Year	57	3.58	0.91	Agree
Overall Mean	**First Year**	**57**	**3.37**	**0.62**	**Agree**
1.1 Code Generation [I use ChatGPT to generate code from scratch for assignments or projects.]	Second Year	53	3.91	0.97	Agree
1.1 Code Generation [I rely on ChatGPT to provide syntax examples for unfamiliar programming concepts.]	Second Year	53	4.06	0.86	Agree
1.1 Code Generation [I use ChatGPT to generate code templates for repetitive activities.]	Second Year	53	4.02	0.95	Agree
1.1 Code Generation [I depend on ChatGPT to create full functions or classes based on a given problem.]	Second Year	53	3.60	1.12	Agree

1.1 Code Generation [I rely on ChatGPT for guidance in solving programming exercises or coding challenges.]	Second Year	53	4.11	0.99	Agree
Overall Mean	**Second Year**	**53**	**3.94**	**0.82**	**Agree**
1.1 Code Generation [I use ChatGPT to generate code from scratch for assignments or projects.]	Third Year	46	3.70	1.23	Agree
1.1 Code Generation [I rely on ChatGPT to provide syntax examples for unfamiliar programming concepts.]	Third Year	46	4.00	0.97	Agree
1.1 Code Generation [I use ChatGPT to generate code templates for repetitive activities.]	Third Year	46	3.50	1.15	Agree
1.1 Code Generation [I depend on ChatGPT to create full functions or classes based on a given problem.]	Third Year	46	3.46	1.15	Agree
1.1 Code Generation [I rely on ChatGPT for guidance in solving programming exercises or coding challenges.]	Third Year	46	3.91	1.09	Agree
Overall Mean	**Third Year**	**46**	**3.71**	**0.92**	**Agree**
1.1 Code Generation [I use ChatGPT to generate code from scratch for assignments or projects.]	Fourth Year	42	4.05	0.85	Agree
1.1 Code Generation [I rely on ChatGPT to provide syntax	Fourth Year	42	4.17	0.66	Agree

examples for unfamiliar programming concepts.]					
1.1 Code Generation [I use ChatGPT to generate code templates for repetitive activities.]	Fourth Year	42	4.07	0.81	Agree
1.1 Code Generation [I depend on ChatGPT to create full functions or classes based on a given problem.]	Fourth Year	42	3.81	0.86	Agree
1.1 Code Generation [I rely on ChatGPT for guidance in solving programming exercises or coding challenges.]	Fourth Year	42	3.79	1.12	Agree
Overall Mean	**Fourth Year**	**42**	**3.98**	**0.73**	**Agree**

Legends

1.0 – 1.80 Strongly Disagreeing

1.81 – 2.60 Disagreeing

2.61 – 3.40 Neutral

3.41 – 4.20 Agreeing

4.21 – 5.00 Strongly Agreeing

Table 2 offers a detailed quantitative analysis of how IT students across different year levels utilize ChatGPT specifically for code generation. This analysis is presented through descriptive statistics, including the mean, standard deviation, and verbal interpretation (VI) for each statement related to code generation.

The mean scores provide a measure of the central tendency of students' agreement levels with each statement, offering insights into the extent to which students in each year level engage with ChatGPT for various code generation tasks. The standard deviation, on

the other hand, quantifies the degree of variability or dispersion in students' responses, indicating the level of consensus or disagreement within each group.

Across all year levels, the overall means indicate that students generally "Agree" with using ChatGPT for code generation. However, there are notable differences in the extent of agreement among the year levels. First-year students exhibit the lowest overall mean (3.37), suggesting a relatively moderate level of agreement in using ChatGPT for code generation. In contrast, fourth-year students demonstrate the highest overall mean (3.98), indicating a stronger inclination towards leveraging ChatGPT for code generation activities. This observed trend suggests that as students progress through their academic careers and encounter more complex coding tasks, their reliance on ChatGPT for code generation tends to increase.

Specifically, the table delves into different facets of code generation, such as generating code from scratch, obtaining syntax examples, creating code templates, generating functions or classes, and seeking guidance for solving programming exercises. Analyzing the means for these individual statements reveals variations in how students utilize ChatGPT for different code generation purposes. For instance, students across all year levels generally express strong agreement with using ChatGPT for syntax examples

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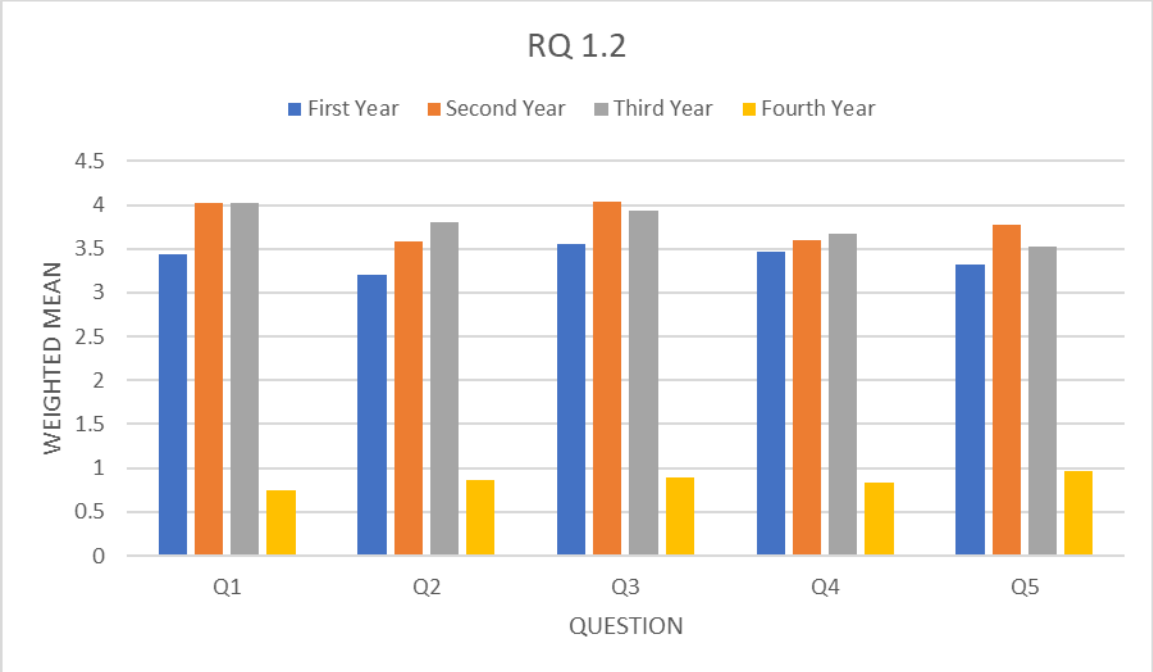
Figure 4. Research Question 1.2 Graph



These nuances in ChatGPT usage for code generation highlight the multifaceted role of AI tools in supporting students' coding activities. It also underscores the importance of understanding how students strategically employ ChatGPT for different code generation needs.

Table 4.2

Descriptive Statistics on the Different Usage of ChatGPT in Coding Activities across Different Year Levels among IT Students in terms of Debugging.

Statements	Level	N	W	SD	VI
1.2 Debugging [I rely on ChatGPT to identify errors in my code during debugging.]	First Year	57	3.44	0.96	Agree

1.2 Debugging [I trust ChatGPT to provide accurate solutions when debugging my code.]	First Year	57	3.21	0.98	Agree
1.2 Debugging [ChatGPT helps me resolve debugging issues more efficiently than traditional methods.]	First Year	57	3.56	0.89	Agree
1.2 Debugging [I feel confident in ChatGPTâ€™s ability to assist with debugging activities.]	First Year	57	3.46	0.89	Agree
1.2 Debugging [I regularly use ChatGPT as a primary tool for debugging my code.]	First Year	57	3.32	0.99	Agree
Overall Mean	**First Year**	**57**	**3.40**	**0.60**	**Agree**
1.2 Debugging [I rely on ChatGPT to identify errors in my code during debugging.]	Second Year	53	4.02	1.05	Agree
1.2 Debugging [I trust ChatGPT to provide accurate solutions when debugging my code.]	Second Year	53	3.59	1.25	Agree
1.2 Debugging [ChatGPT helps me resolve debugging issues more efficiently than traditional methods.]	Second Year	53	4.04	0.96	Agree
1.2 Debugging [I feel confident in ChatGPT's ability to assist with debugging activities.]	Second Year	53	3.60	1.08	Agree
1.2 Debugging [I regularly use ChatGPT as a primary tool for debugging my code.]	Second Year	53	3.77	0.93	Agree

Overall Mean	**Second Year**	**53**	**3.80**	**0.87**	**Agree**
1.2 Debugging [I rely on ChatGPT to identify errors in my code during debugging.]	Third Year	46	4.02	1.13	Agree
1.2 Debugging [I trust ChatGPT to provide accurate solutions when debugging my code.]	Third Year	46	3.80	1.03	Agree
1.2 Debugging [ChatGPT helps me resolve debugging issues more efficiently than traditional methods.]	Third Year	46	3.94	1.00	Agree
1.2 Debugging [I feel confident in ChatGPTâ€™s ability to assist with debugging activities.]	Third Year	46	3.67	1.08	Agree
1.2 Debugging [I regularly use ChatGPT as a primary tool for debugging my code.]	Third Year	46	3.52	1.07	Agree
Overall Mean	**Third Year**	**46**	**3.79**	**0.86**	**Agree**
1.2 Debugging [I rely on ChatGPT to identify errors in my code during debugging.]	Fourth Year	42	4.12	0.74	Agree
1.2 Debugging [I trust ChatGPT to provide accurate solutions when debugging my code.]	Fourth Year	42	3.88	0.86	Agree
1.2 Debugging [ChatGPT helps me resolve debugging issues more efficiently than traditional methods.]	Fourth Year	42	3.93	0.89	Agree

1.2 Debugging [I feel confident in ChatGPTâ€™s ability to assist with debugging activities.]	Fourth Year	42	4.02	0.84	Agree
1.2 Debugging [I regularly use ChatGPT as a primary tool for debugging my code.]	Fourth Year	42	3.91	0.96	Agree
Overall Mean	**Fourth Year**	**42**	**3.97**	**0.73**	**Agree**

Legends

1.0 – 1.80 Strongly Disagreeing

1.81 – 2.60 Disagreeing

2.61 – 3.40 Neutral

3.41 – 4.20 Agreeing

4.21 – 5.00 Strongly Agreeing

Table 3 mirrors the structure of Table 2 but shifts the focus to the utilization of ChatGPT for debugging activities. It presents descriptive statistics, including means, standard deviations, and verbal interpretations, to analyze how students in different year levels employ ChatGPT to aid in the debugging process.

The mean scores in this table reflect the degree to which students agree with statements about using ChatGPT for tasks such as identifying errors, obtaining accurate solutions, improving debugging efficiency, expressing confidence in ChatGPT's debugging capabilities, and using ChatGPT as a primary debugging tool. The standard deviations provide a measure of the variability in students' responses to these statements.

Similar to the findings in Table 2, the overall means in Table 3 indicate that students across all year levels generally "Agree" that they utilize ChatGPT for debugging. This suggests that students perceive ChatGPT as a valuable resource for identifying and resolving errors in their code.

Furthermore, the data reveals a trend of increasing reliance on ChatGPT for debugging as students advance through their academic years. The overall mean scores progress from 3.40 for first-year students to 3.97 for fourth-year students, suggesting that more senior students tend to depend more heavily on ChatGPT to assist them in debugging tasks. This progression could be attributed to the increasing complexity of coding projects and the heightened pressure to resolve errors efficiently as students move through the IT curriculum.

By examining the means for individual statements, it is possible to discern specific ways in which students leverage ChatGPT for debugging. For example, students generally express agreement with using ChatGPT to identify errors and improve debugging efficiency.

Overall, Table 3 highlights the significant role that ChatGPT plays in supporting students' debugging practices. It also underscores the need to consider the evolving nature of debugging challenges and the increasing reliance on AI tools as students gain more coding experience.

Figure 5. Research Question 1.3 Graph

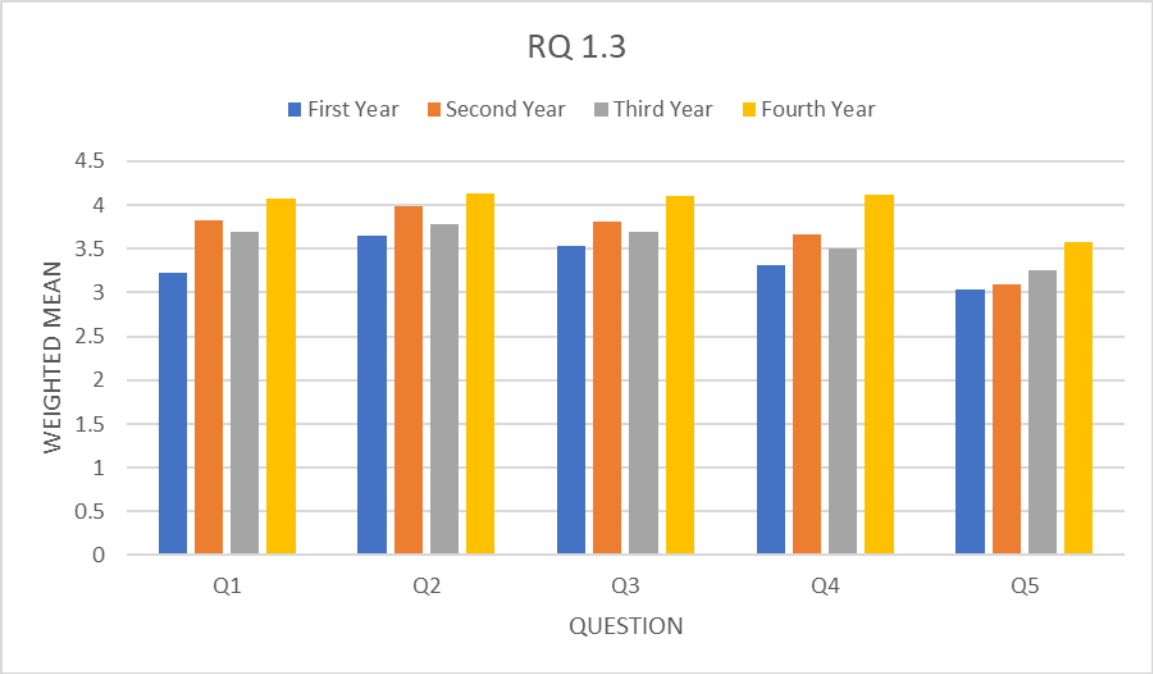


Table 4.3

Descriptive Statistics on the Different Usage of ChatGPT in Coding Activities across Different Year Levels among IT Students in terms of Code Refactoring.

Statements	Level	N	WM	SD	VI
1.3 Coding Refactoring [I use ChatGPT to refactor my code to improve readability and structure.]	First Year	57	3.23	1.10	Neutral
1.3 Coding Refactoring [ChatGPT provides valuable suggestions that help optimize my codes performance during refactoring.]	First Year	57	3.65	0.81	Agree
1.3 Coding Refactoring [I believe ChatGPT significantly improves the quality of my code when I use it for refactoring.]	First Year	57	3.54	0.93	Agree
1.3 Coding Refactoring [I depend on ChatGPT to refactor my code for better organization and efficiency.]	First Year	57	3.32	1.02	Neutral
1.3 Coding Refactoring [I use ChatGPTs code refactoring suggestions without modifying them.]	First Year	57	3.04	1.21	Neutral
Overall Mean	**First Year**	**57**	**3.35**	**0.79**	**Neutral**
1.3 Coding Refactoring [I use ChatGPT to refactor my code to improve readability and structure.]	Second Year	53	3.83	1.03	Agree
1.3 Coding Refactoring [ChatGPT provides valuable suggestions that	Second Year	53	3.98	0.93	Agree

help optimize my codes performance during refactoring.]					
1.3 Coding Refactoring [I believe ChatGPT significantly improves the quality of my code when I use it for refactoring.]	Second Year	53	3.81	0.98	Agree
1.3 Coding Refactoring [I depend on ChatGPT to refactor my code for better organization and efficiency.]	Second Year	53	3.66	1.11	Agree
1.3 Coding Refactoring [I use ChatGPTâ€™s code refactoring suggestions without modifying them.]	Second Year	53	3.09	1.17	Neutral
Overall Mean	**Second Year**	**53**	**3.68**	**0.89**	**Agree**
1.3 Coding Refactoring [I use ChatGPT to refactor my code to improve readability and structure.]	Third Year	46	3.70	1.09	Agree
1.3 Coding Refactoring [ChatGPT provides valuable suggestions that help optimize my codeâ€™s performance during refactoring.]	Third Year	46	3.78	1.03	Agree
1.3 Coding Refactoring [I believe ChatGPT significantly improves the quality of my code when I use it for refactoring.]	Third Year	46	3.70	1.03	Agree
1.3 Coding Refactoring [I depend on ChatGPT to refactor my code for better organization and efficiency.]	Third Year	46	3.50	1.05	Agree

1.3 Coding Refactoring [I use ChatGPTâ€™s code refactoring suggestions without modifying them.]	Third Year	46	3.26	1.20	Neutral
Overall Mean	**Third Year**	**46**	**3.59**	**0.93**	**Agree**
1.3 Coding Refactoring [I use ChatGPT to refactor my code to improve readability and structure.]	Fourth Year	42	4.07	0.84	Agree
1.3 Coding Refactoring [ChatGPT provides valuable suggestions that help optimize my codeâ€™s performance during refactoring.]	Fourth Year	42	4.14	0.65	Agree
1.3 Coding Refactoring [I believe ChatGPT significantly improves the quality of my code when I use it for refactoring.]	Fourth Year	42	4.10	0.66	Agree
1.3 Coding Refactoring [I depend on ChatGPT to refactor my code for better organization and efficiency.]	Fourth Year	42	4.12	0.59	Agree
1.3 Coding Refactoring [I use ChatGPTâ€™s code refactoring suggestions without modifying them.]	Fourth Year	42	3.57	0.97	Agree
Overall Mean	**Fourth Year**	**42**	**4.00**	**0.56**	**Agree**

Legends

1.0 – 1.80 Strongly Disagreeing

1.81 – 2.60 Disagreeing

2.61 – 3.40 Neutral

3.41 – 4.20 Agreeing

4.21 – 5.00 Strongly Agreeing

Table 4 presents the descriptive statistics pertaining to the use of ChatGPT for code refactoring, another critical aspect of software development. The table follows the same format as Tables 2 and 3, providing means, standard deviations, and verbal interpretations for statements related to refactoring code with the help of ChatGPT.

The statements in this table explore students' agreement levels regarding using ChatGPT to improve code readability and structure, optimize code performance, enhance code quality, refactor code for better organization and efficiency, and using ChatGPT's refactoring suggestions without modifications.

Interestingly, the overall mean for first-year students (3.35) falls within the "Neutral" range, indicating that, on average, they neither agree nor disagree with using ChatGPT for code refactoring. In contrast, students in the second, third, and fourth year levels exhibit overall means that fall within the "Agree" range, suggesting a greater inclination to utilize ChatGPT for code refactoring as they progress in their studies.

Similar to the previous tables, fourth-year students demonstrate the highest overall mean (4.00), signifying the strongest agreement with using ChatGPT for code refactoring. This trend might reflect the increasing emphasis on code quality, maintainability, and efficiency as students undertake more complex software development projects in their senior years.

Examining the means for individual statements reveals that students generally agree that ChatGPT provides valuable suggestions to optimize code performance and improves code quality during refactoring. However, there is more variability in students' agreement with statements about using ChatGPT's refactoring suggestions without modifications, as indicated by the standard deviations.

In summary, Table 4 sheds light on the role of ChatGPT in code refactoring, highlighting the increasing adoption of this AI tool for refactoring as students advance through their IT education. It also underscores the importance of considering students' perspectives on the extent to which they rely on ChatGPT's refactoring suggestions.

These results support what Farooq et al. (2022) found. They said that senior students often use AI tools for more advanced tasks like improving and organizing code, while beginners use them for easier tasks such as fixing syntax or creating code from examples. This is clear in the way students at different year levels use AI tools. Seniors tend to use them in a more thoughtful and skilled way.

In the same way, Aljanabi (2023) found that students mostly use AI coding tools during the part of the project where they build and complete their work. This part of the project is usually done by students in higher year levels. This explains why seniors use AI tools more often and for more serious tasks during their schoolwork.

Vaithilingam et al. (2022) also said that AI tools help students become more productive when fixing errors in their code. This matches the strong agreement from students in all year levels, especially from seniors. It shows that as students move up in their studies, they find more value in using AI tools to fix and improve their code.

OpenAI (2023) shared that students who are more familiar with AI tools like ChatGPT use them in smarter and more creative ways. This is true in college settings where students have more chances to explore and use technology. Senior students, who have had more time to use AI tools, tend to use them in many different ways depending on what they need to do in their coding activities.

Another reason why students frequently use ChatGPT is the pressure from their academic workload. With a curriculum that includes many coding subjects and major projects, students often turn to AI tools for help. ChatGPT becomes a go-to resource, especially when they need quick support in writing, fixing, or improving their code. The demand to meet

deadlines, complete system requirements, and understand new programming concepts encourages regular use of AI tools throughout their college years.

Overall, these findings show that the use of AI tools in coding becomes more advanced and meaningful as students gain more experience. Senior students are more likely to use AI tools not just for simple tasks but also for planning, improving, and fixing their code. This shows the growing role of AI in helping students learn and complete their work more effectively, especially in the higher years of study.

RQ2: What is the IT students' dependency level on ChatGPT when performing coding activities?

Figure 6. Research Question 2 Graph

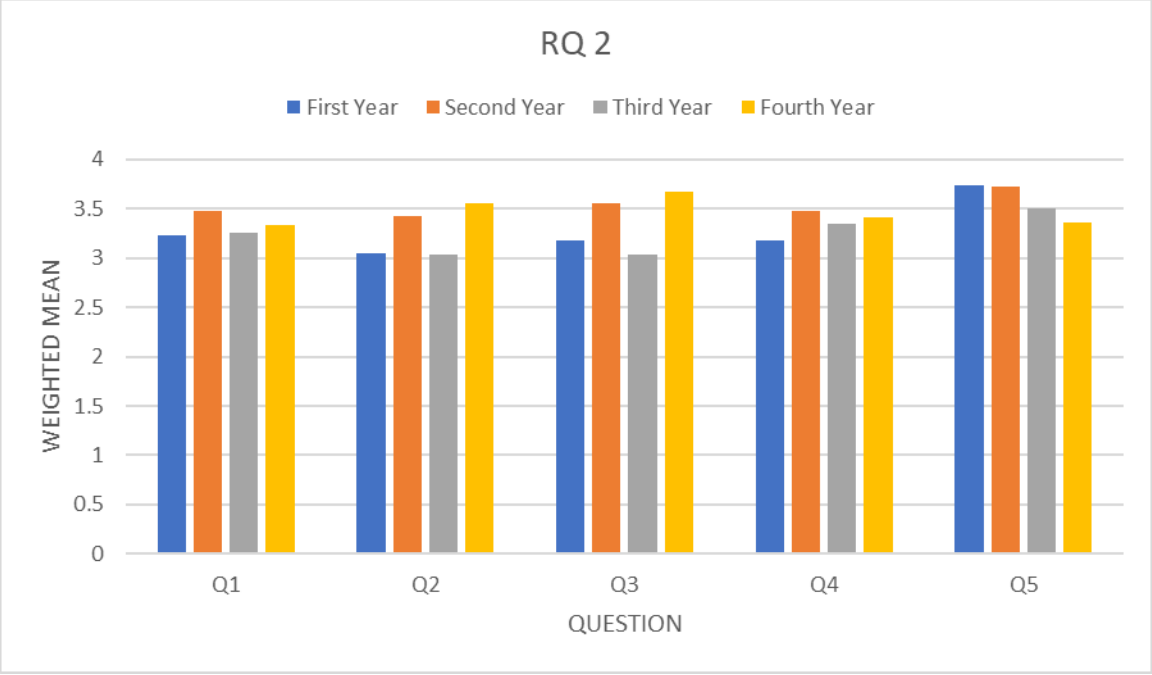


Table 5

Descriptive Statistics on IT Students' Dependency on ChatGPT in Performing Coding Activities.

Statements	Level	N	WM	SD	VI
2. Level of Dependency [I feel vulnerable when I do not have access to ChatGPT.]	First Year	57	3.23	0.96	Neutral
2. Level of Dependency [I am concerned about the idea of being left behind in my tasks or projects if I do not use ChatGPT.]	First Year	57	3.05	1.01	Neutral
2. Level of Dependency [I do everything possible to stay updated with ChatGPT to impress or remain relevant in my field.]	First Year	57	3.18	1.04	Neutral
2. Level of Dependency [I constantly need validation or feedback from ChatGPT to feel confident in my decisions.]	First Year	57	3.18	1.00	Neutral
2. Level of Dependency [I fear that ChatGPT might replace my current skills or abilities.]	First Year	57	3.74	1.25	Agree
Overall Mean	**First Year**	**57**	**3.27**	**0.72**	**Neutral**
2. Level of Dependency [I feel vulnerable when I do not have access to ChatGPT.]	Second Year	53	3.47	1.14	Agree
2. Level of Dependency [I am concerned about the idea of being	Second Year	53	3.42	1.34	Agree

left behind in my tasks or projects if I do not use ChatGPT.]					
2. Level of Dependency [I do everything possible to stay updated with ChatGPT to impress or remain relevant in my field.]	Second Year	53	3.55	1.23	Agree
2. Level of Dependency [I constantly need validation or feedback from ChatGPT to feel confident in my decisions.]	Second Year	53	3.47	1.34	Agree
2. Level of Dependency [I fear that ChatGPT might replace my current skills or abilities.]	Second Year	53	3.72	1.32	Agree
Overall Mean	**Second Year**	**53**	**3.53**	**1.13**	**Agree**
2. Level of Dependency [I feel vulnerable when I do not have access to ChatGPT.]	Third Year	46	3.26	1.22	Neutral
2. Level of Dependency [I am concerned about the idea of being left behind in my tasks or projects if I do not use ChatGPT.]	Third Year	46	3.04	1.07	Neutral
2. Level of Dependency [I do everything possible to stay updated with ChatGPT to impress or remain relevant in my field.]	Third Year	46	3.04	1.12	Neutral
2. Level of Dependency [I constantly need validation or feedback from ChatGPT to feel confident in my decisions.]	Third Year	46	3.35	1.16	Neutral
2. Level of Dependency [I fear that ChatGPT might replace my current skills or abilities.]	Third Year	46	3.50	1.36	Agree

Overall Mean	Third Year	46	3.24	0.90	**Neutral**
2. Level of Dependency [I feel vulnerable when I do not have access to ChatGPT.]	Fourth Year	42	3.33	1.05	Neutral
2. Level of Dependency [I am concerned about the idea of being left behind in my tasks or projects if I do not use ChatGPT.]	Fourth Year	42	3.55	1.11	Agree
2. Level of Dependency [I do everything possible to stay updated with ChatGPT to impress or remain relevant in my field.]	Fourth Year	42	3.67	0.90	Agree
2. Level of Dependency [I constantly need validation or feedback from ChatGPT to feel confident in my decisions.]	Fourth Year	42	3.41	1.08	Agree
2. Level of Dependency [I fear that ChatGPT might replace my current skills or abilities.]	Fourth Year	42	3.36	1.17	Neutral
Overall Mean	**Fourth Year**	**42**	**3.46**	**0.96**	**Agree**

Legends

1.0 – 1.80 Strongly Disagreeing

1.81 – 2.60 Disagreeing

2.61 – 3.40 Neutral

3.41 – 4.20 Agreeing

4.21 – 5.00 Strongly Agreeing

Table 5 shifts the focus from ChatGPT usage to ChatGPT dependency. It presents descriptive statistics that analyze the extent to which IT students from different year levels perceive themselves as being dependent on ChatGPT for their coding activities.

The statements in this table explore students' feelings of vulnerability without access to ChatGPT, concerns about being left behind if they don't use ChatGPT, the need to stay updated with ChatGPT, the reliance on ChatGPT for validation and feedback, and the fear that ChatGPT might replace their skills.

The overall means for first-year and third-year students (3.27 and 3.24, respectively) fall within the "Neutral" range, suggesting that, on average, they neither agree nor disagree with being dependent on ChatGPT. In contrast, the overall means for second-year and fourth-year students (3.53 and 3.46, respectively) fall within the "Agree" range, indicating a greater tendency to perceive themselves as dependent on ChatGPT.

It is noteworthy that the statement "I fear that ChatGPT might replace my current skills or abilities" elicits relatively high means across all year levels, ranging from 3.36 to 3.74. This suggests that students, regardless of their year level, express a degree of concern about the potential for AI tools like ChatGPT to render their coding skills obsolete.

The findings in Table 5 provide valuable insights into the psychological and emotional dimensions of students' interactions with ChatGPT. They highlight the importance of addressing students' concerns about dependency and skill displacement as AI tools become increasingly integrated into coding education.

These findings can be supported by the study of Kasneci et al. (2023), which discussed how relying too much on AI tools can have psychological effects on students, including feelings of vulnerability and uncertainty when AI is not available. This directly relates to the statement "I feel vulnerable without ChatGPT," which received notable agreement across year levels. This suggests that students may feel anxious or unsure about their ability to complete coding tasks on their own without the support of ChatGPT. Such dependence can

affect their confidence and increase stress, especially when they face challenges that require independent problem-solving.

Weidinger et al. (2022) noted that increased use of large language models may reduce users' confidence in their own thinking and learning abilities, which can eventually lead to dependency. This helps explain why many students agreed with the statement "I fear that ChatGPT might replace my current skills or abilities." The more students depend on AI to solve problems or validate their work, the less confident they may feel in their own capacity to code or make decisions without AI support. Over time, this could limit their growth and independence as future professionals.

Bubeck et al. (2023) warned about passive overreliance among learners, especially those in transitional learning stages, such as second-year students who are starting to face more complex programming tasks. This matches the findings in Table 5, where second-year students showed the highest overall dependency mean (3.53) among all year levels. This may indicate that students at this stage are still adjusting to the demands of coding and are more likely to lean on ChatGPT as a safety net, rather than building problem-solving skills through practice and struggle.

Lastly, Zawacki-Richter et al. (2023) found that dependency on AI in academic settings is strongly linked to how often students use it and for what purpose. This trend is clearly reflected in the current data, where students who reported frequent use of ChatGPT — especially for completing project tasks and checking their work — also expressed higher levels of emotional and academic reliance. The stronger dependency seen in second- and fourth-year students may be influenced by the more demanding nature of their subjects, which leads to more frequent and purposeful use of ChatGPT.

Overall, these related studies help explain the patterns seen in Table 5, emphasizing the emotional, cognitive, and academic effects of AI tool dependency. They highlight the

importance of helping students find a healthy balance in using tools like ChatGPT so they can gain support without losing confidence in their own abilities.

RQ3: What is the relationship between IT students' ChatGPT usage per year level and their level of dependency?

Table 6

Spearman Rho Correlational Testing Results between IT Students' ChatGPT Usage per Year Level and their Level of Dependency.

Variables	rho	p-value	Decision	Interpretation
ChatGPT Usage and Level of Dependency for First Year Level Students	0.354	0.007	Significant	Weak Positive Relationship
ChatGPT Usage and Level of Dependency for Second Year Level Students	0.803	< .001	Significant	Strong Positive Relationship
ChatGPT Usage and Level of Dependency for Third Year Level Students	0.437	0.002	Significant	Moderate Positive Relationship
ChatGPT Usage and Level of Dependency for Fourth Year Level Students	0.868	< .001	Significant	Very Strong Positive Relationship

p-value < 0.05, statistically significant

Table 6 presents the results of Spearman Rho correlational testing, a statistical technique used to assess the relationship between two variables. In this context, the table

examines the correlation between the extent of ChatGPT usage and the level of dependency on ChatGPT among IT students, with the analysis conducted separately for each year level.

The results in Table 6 reveal statistically significant positive correlations between ChatGPT usage and dependency for all year levels. However, the strength of the correlation varies across the year levels. First-year students exhibit a weak positive relationship (rho = 0.354), while fourth-year students demonstrate a very strong positive relationship (rho = 0.868). Second-year and third-year students show a strong (rho = 0.803) and moderate (rho = 0.437) positive relationship, respectively.

These findings suggest that as students progress through their academic years, the relationship between ChatGPT usage and dependency becomes stronger. This implies that while ChatGPT usage is associated with increased dependency across all year levels, this association is particularly pronounced among more senior students.

Figure 7. Spearman Rho Correlational Testing Results between IT Students' ChatGPT Usage and their Level of Dependency for First Year Level.

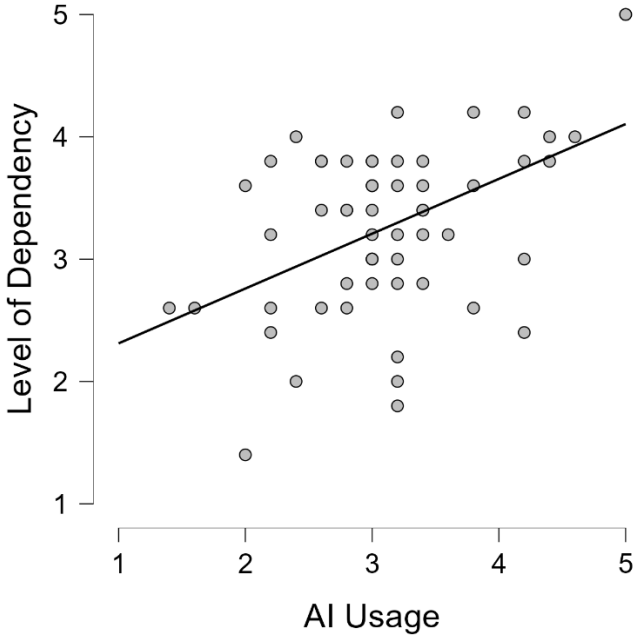


Figure 1 visually represents the relationship between ChatGPT usage and dependency levels specifically for first-year IT students. The scatter plot displays individual data points, each representing a first-year student's reported level of ChatGPT usage and their corresponding level of dependency. The upward-sloping trend line superimposed on the scatter plot illustrates the positive correlation between these two variables, indicating that among first-year students, higher reported usage of ChatGPT tends to be associated with a higher reported level of dependency on the tool. However, the dispersion of the data points around the trend line suggests that this relationship is relatively weak, which aligns with the Spearman Rho correlation coefficient (rho = 0.354) reported in Table 6. This visual representation implies that while there is a tendency for increased usage to coincide with increased dependency in first-year students, other factors likely play a more significant role in determining their level of reliance on ChatGPT at this early stage of their academic journey.

Figure 8. Spearman Rho Correlational Testing Results between IT Students' ChatGPT Usage and their Level of Dependency for Second Year Level.

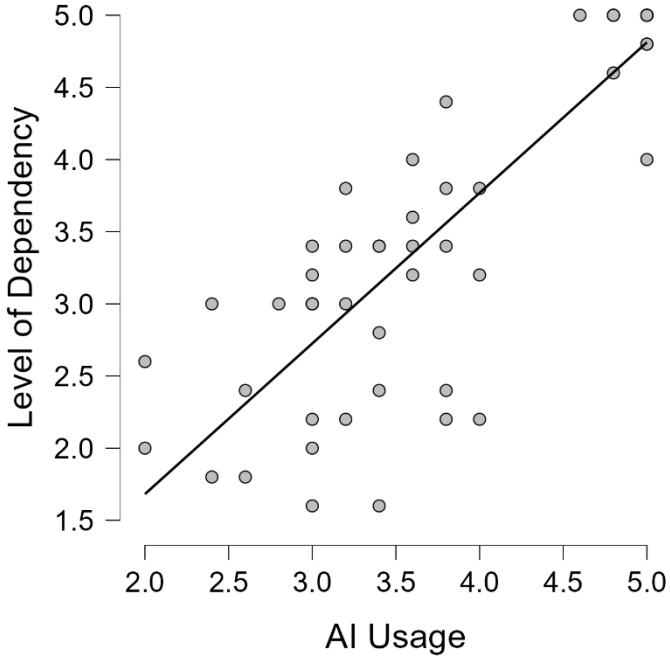


Figure 2 presents the correlation between ChatGPT usage and dependency for second-year IT students. Similar to Figure 1, the scatter plot shows individual student data points, and the upward-sloping trend line indicates a positive relationship between the two variables. However, in this figure, the data points appear to be more closely clustered around the trend line compared to Figure 1. This visual observation suggests a stronger positive correlation between ChatGPT usage and dependency among second-year students, which is consistent with the Spearman Rho coefficient of 0.803 reported in Table 6. This implies that as second-year students increase their use of ChatGPT, their level of dependency on the tool tends to increase more predictably compared to first-year students. The tighter clustering of data points suggests that ChatGPT usage might be becoming a more influential factor in shaping the dependency levels of students as they progress in their IT education.

Figure 9. Spearman Rho Correlational Testing Results between IT Students' ChatGPT Usage and their Level of Dependency for Third Year Level.

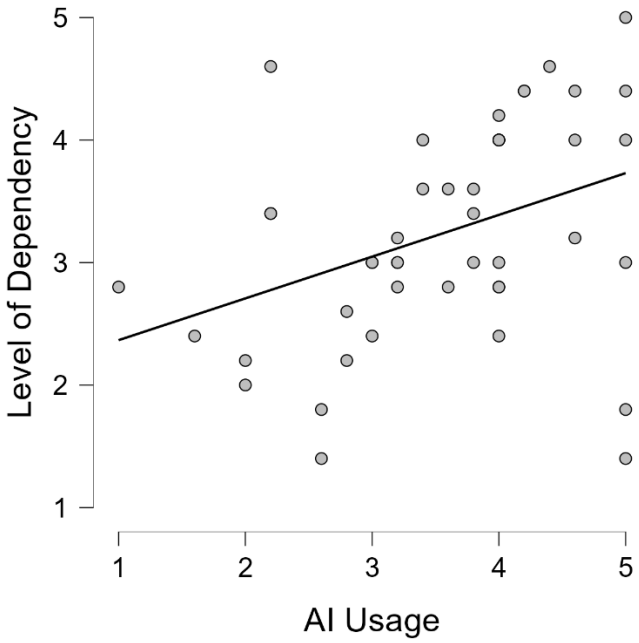


Figure 3 illustrates the relationship between ChatGPT usage and dependency for third-year IT students. The scatter plot and the upward-sloping trend line again indicate a positive correlation between the two variables. The degree to which the data points are clustered around the trend line appears to be moderate, suggesting a stronger relationship than observed for first-year students but perhaps slightly weaker than that of second-year students. This visual assessment aligns with the Spearman Rho coefficient of 0.437 reported in Table 6, indicating a moderate positive correlation. This suggests that for third-year students, there is a noticeable tendency for higher ChatGPT usage to be associated with higher dependency, but the relationship might be influenced by a wider range of other factors compared to the second-year cohort.

Figure 10. Spearman Rho Correlational Testing Results between IT Students' ChatGPT Usage and their Level of Dependency for Fourth Year Level.

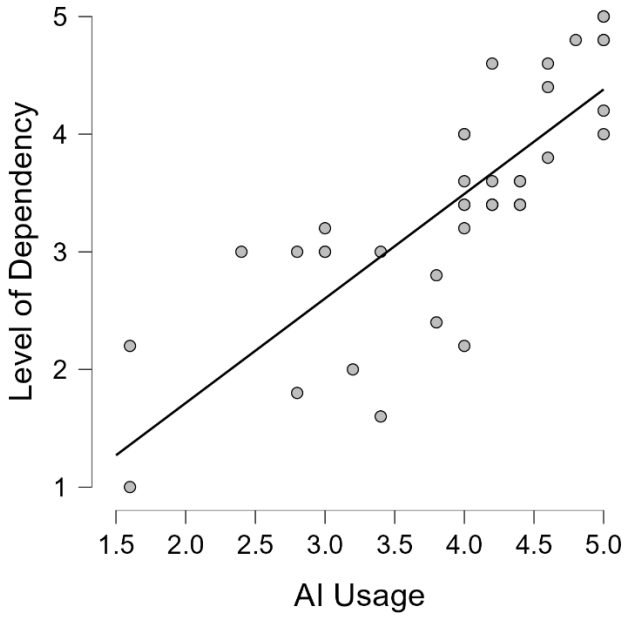


Figure 4 depicts the correlation between ChatGPT usage and dependency for fourth-year IT students. The scatter plot in this figure shows a very tight clustering of data points around the steep upward-sloping trend line. This strong visual representation strongly suggests a very strong positive correlation between ChatGPT usage and dependency among fourth-year students, which is consistent with the Spearman Rho coefficient of 0.868 reported in Table 6. This implies that for senior IT students, the extent to which they use ChatGPT is a very strong predictor of their level of dependency on the tool. The close proximity of the data points to the trend line indicates that as fourth-year students increase their utilization of ChatGPT in their coding activities, their reliance on it becomes significantly more pronounced compared to students in the earlier year levels. This observation may reflect the increasing complexity of their coursework and projects, leading them to depend more heavily on AI assistance.

The results of the Spearman Rho correlation analysis revealed a statistically significant positive relationship between ChatGPT usage and the level of dependency across all year levels, with the strength of correlation progressively increasing from first year (weak) to fourth

year (very strong). This pattern indicates that as students advance in their academic journey, their reliance on ChatGPT becomes more pronounced in proportion to their usage of the tool.

These findings are supported by Kasneci et al. (2023), who emphasized that frequent interaction with AI tools leads to cognitive offloading, especially among higher-level students who encounter more complex academic tasks. This aligns with the observed trend that fourth-year students, who are often engaged in capstone projects or advanced programming coursework, demonstrate the highest dependency scores. Similarly, OpenAI (2023) reported that habitual use of AI in complex problem-solving scenarios contributes to dependency development over time, reinforcing the strong correlations seen among senior students. Furthermore, Farooq et al. (2022) found that consistent use of AI tools among upper-level software engineering students led to feelings of indispensability toward such technologies, reflecting the very strong relationship between usage and dependency documented in the data.

Together, these studies validate the increasing strength of the correlation across year levels and support the conclusion that sustained ChatGPT usage, especially in higher academic contexts, significantly contributes to students' perceived dependence on the tool.

RQ4: What framework can be developed to help students effectively balance the use of ChatGPT in coding activities?

Figure 11. Research Question 4 Graph

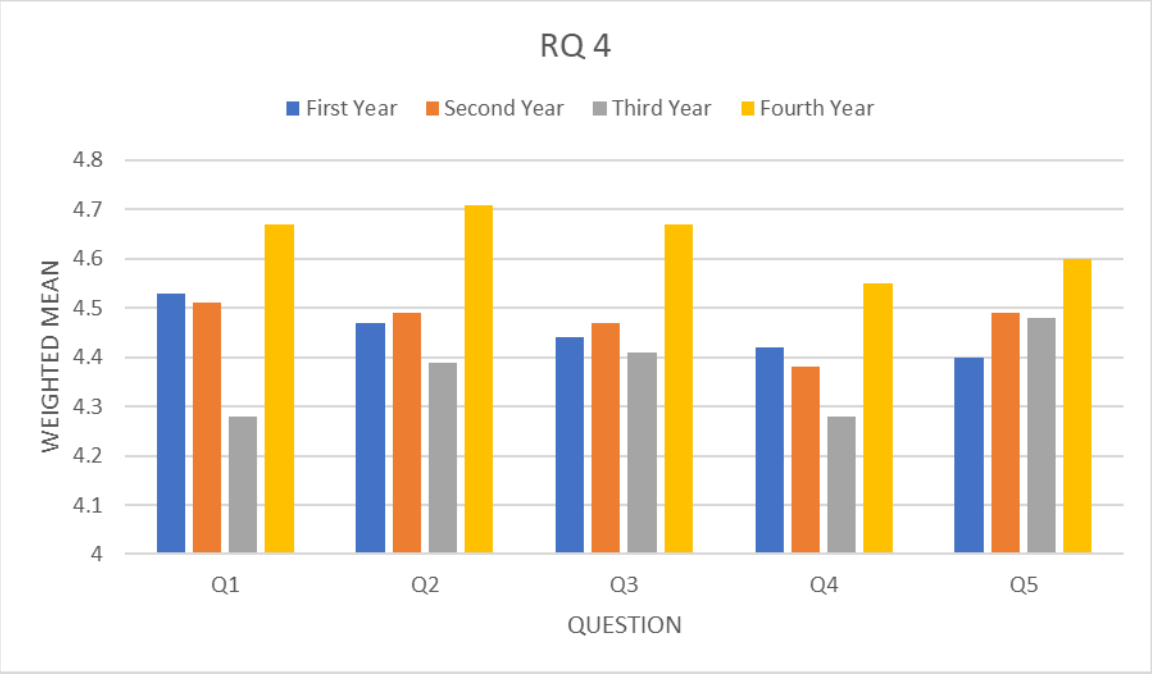


Table 7

Descriptive Statistics on The Proposed Strategies to Develop in Helping Students Effectively Balance the Usage of ChatGPT in Coding Activities.

Statements	Level	N	WM	SD	VI
4. Strategies [I believe it's important to develop core coding skills independently, even with ChatGPT available.]	First Year	57	4.53	0.68	Strongly Agree
4. Strategies [I feel that ChatGPT should only be used to assist in coding activities, not to replace	First Year	57	4.47	0.68	Strongly Agree

basic programming understanding.]					
4. Strategies [I think more guidance on how to use ChatGPT effectively and responsibly in coding tasks would be beneficial.]	First Year	57	4.44	0.66	Strongly Agree
4. Strategies [ChatGPT should be integrated into coding education in a way that encourages independent problem-solving and creativity.]	First Year	57	4.42	0.71	Strongly Agree
4. Strategies [I believe that the college should provide guidelines for ChatGPT usage in coding activities to prevent students from becoming overly dependent on the tool.]	First Year	57	4.40	0.73	Strongly Agree
Overall Mean	**First Year**	**57**	**4.45**	**0.56**	**Strongly Agree**
4. Strategies [I believe it's important to develop core coding skills independently, even with ChatGPT available.]	Second Year	53	4.51	0.80	Strongly Agree
4. Strategies [I feel that ChatGPT should only be used to assist in coding activities, not to replace basic programming understanding.]	Second Year	53	4.49	0.85	Strongly Agree
4. Strategies [I think more guidance on how to use ChatGPT effectively and responsibly in coding tasks would be beneficial.]	Second Year	53	4.47	0.89	Strongly Agree
4. Strategies [ChatGPT should be integrated into coding education in a way that encourages	Second Year	53	4.38	0.90	Strongly Agree

independent problem-solving and creativity.]					
4. Strategies [I believe that the college should provide guidelines for ChatGPT usage in coding activities to prevent students from becoming overly dependent on the tool.]	Second Year	53	4.49	0.85	Strongly Agree
Overall Mean	**Second Year**	**53**	**4.47**	**0.81**	**Strongly Agree**
4. Strategies [I believe it's important to develop core coding skills independently, even with ChatGPT available.]	Third Year	46	4.28	1.07	Strongly Agree
4. Strategies [I feel that ChatGPT should only be used to assist in coding activities, not to replace basic programming understanding.]	Third Year	46	4.39	1.00	Strongly Agree
4. Strategies [I think more guidance on how to use ChatGPT effectively and responsibly in coding tasks would be beneficial.]	Third Year	46	4.41	0.88	Strongly Agree
4. Strategies [ChatGPT should be integrated into coding education in a way that encourages independent problem-solving and creativity.]	Third Year	46	4.28	1.00	Strongly Agree
4. Strategies [I believe that the college should provide guidelines for ChatGPT usage in coding activities to prevent students from becoming overly dependent on the tool.]	Third Year	46	4.48	0.84	Strongly Agree

Overall Mean	**Third Year**	**46**	**4.37**	**0.86**	**Strongly Agree**
4. Strategies [I believe it's important to develop core coding skills independently, even with ChatGPT available.]	Fourth Year	42	4.67	0.65	Strongly Agree
4. Strategies [I feel that ChatGPT should only be used to assist in coding activities, not to replace basic programming understanding.]	Fourth Year	42	4.71	0.55	Strongly Agree
4. Strategies [I think more guidance on how to use ChatGPT effectively and responsibly in coding tasks would be beneficial.]	Fourth Year	42	4.67	0.61	Strongly Agree
4. Strategies [ChatGPT should be integrated into coding education in a way that encourages independent problem-solving and creativity.]	Fourth Year	42	4.55	0.71	Strongly Agree
4. Strategies [I believe that the college should provide guidelines for ChatGPT usage in coding activities to prevent students from becoming overly dependent on the tool.]	Fourth Year	42	4.60	0.63	Strongly Agree
Overall Mean	**Fourth Year**	**42**	**4.64**	**0.57**	**Strongly Agree**

Legends

1.0 – 1.80 Strongly Disagreeing

1.81 – 2.60 Disagreeing

2.61 – 3.40 Neutral

3.41 – 4.20 Agreeing

4.21 – 5.00 Strongly Agreeing

Table 7 focuses on identifying and evaluating potential strategies to help students achieve a balanced approach to using ChatGPT in their coding activities. The table presents descriptive statistics, including means, standard deviations, and verbal interpretations, for students' agreement levels with various proposed strategies.

The strategies explored in this table include emphasizing the importance of developing core coding skills independently, promoting the use of ChatGPT as an assistive tool rather than a replacement for basic understanding, advocating for more guidance on effective and responsible ChatGPT usage, encouraging the integration of ChatGPT in a way that fosters independent problem-solving and creativity, and recommending the establishment of college guidelines to prevent over-dependency on the tool.

The overall means in Table 7 are consistently high across all year levels, ranging from 4.37 to 4.64, and all fall within the "Strongly Agree" range. This strong agreement indicates that students, regardless of their year level, overwhelmingly recognize the importance and value of these strategies in promoting a balanced and healthy relationship with ChatGPT in their coding practices.

Specifically, students strongly agree with the idea that developing fundamental coding skills independently is crucial, even with the availability of ChatGPT. They also strongly support the notion that ChatGPT should be used as a tool to assist and augment their learning, rather than as a substitute for developing a solid understanding of programming concepts. Furthermore, students express a strong desire for more guidance and education on how to utilize ChatGPT effectively and responsibly, highlighting the need for clear guidelines and best practices.

The findings in Table 7 provide valuable insights for educators and institutions seeking to integrate AI tools like ChatGPT into coding curricula in a way that maximizes their benefits

while mitigating potential risks. The strong consensus among students regarding the proposed strategies underscores the importance of fostering a balanced approach that prioritizes both AI assistance and the development of core coding competencies

The results from Table 7 show that students from all year levels strongly agree on the importance of using ChatGPT in a balanced way. Most students believe they should continue to build their own coding skills, even if ChatGPT is available. They also agree that ChatGPT should only be used to help with coding, not to replace their understanding of programming. In addition, many students think that schools should provide clear rules and training on how to use ChatGPT properly to avoid becoming too dependent on it.

These results are supported by Zawacki-Richter et al. (2023), who said that schools should have clear rules when using AI tools in learning to stop students from relying too much on them. This matches the students' request for school guidelines. Kasneci et al. (2023) also shared that students should be taught how to use AI tools in a smart and responsible way while still thinking for themselves. This supports the idea of teaching students how to use ChatGPT properly. Bubeck et al. (2023) explained that AI should help students learn, not take their place in the learning process. This agrees with the student responses that show they want to keep improving their own coding skills.

In short, the data and these studies show that students want support and clear guidance to use ChatGPT in a way that helps their learning without taking away their chance to grow as independent coders.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

This research examined the utilization of ChatGPT in coding-related academic tasks among Bachelor of Science in Information Technology (BSIT) students at the Polytechnic University of the Philippines, Quezon City (PUPQC). The analysis spanned across four academic year levels and employed both descriptive and inferential statistical techniques to draw insights from student responses. The following key findings emerged from the data presented in Chapter IV:

1. **Usage Patterns Across Academic Levels**: There was a progressive increase in ChatGPT usage as students advanced through their academic years. First-year students exhibited moderate use, while fourth-year students demonstrated the highest levels of engagement with the tool, particularly for code generation, debugging, and refactoring activities.

2. **Levels of Dependency**: Analysis of student responses revealed that dependency on ChatGPT varied by academic year. First- and third-year students generally reported neutral dependency levels (M = 3.27 and M = 3.24, respectively). In contrast, second- and fourth-year students showed elevated dependency, with mean scores of 3.53 and 3.46, respectively. A consistent concern was the potential of ChatGPT to displace students' core coding skills, regardless of year level.

3. **Correlation Between Usage and Dependency**: Spearman Rho correlation testing indicated statistically significant positive relationships between ChatGPT usage and dependency at all year levels. Notably, the strength of this correlation increased by academic level, ranging from weak (r = 0.354) among first-year students to very strong (r = 0.868) among fourth-year students.

4. **Perceived Need for Balanced Use Strategies**: Across all year levels, students overwhelmingly supported the need for structured guidance in using ChatGPT responsibly. Weighted mean scores for proposed strategies to foster independent skill development and mitigate over-reliance on AI tools ranged from 4.37 to 4.64, with all responses falling under the "Strongly Agree" category.

Conclusions

Based on the synthesized findings, the following conclusions can be drawn:

1. The use of ChatGPT is both widespread and increasingly sophisticated among PUPQC IT students, particularly in higher academic years. The tool is perceived as helpful in supporting coding activities, although its use must be carefully guided.

2. A measurable and escalating correlation between usage and dependency underscores the critical need to manage the manner and extent to which ChatGPT is integrated into student workflows.

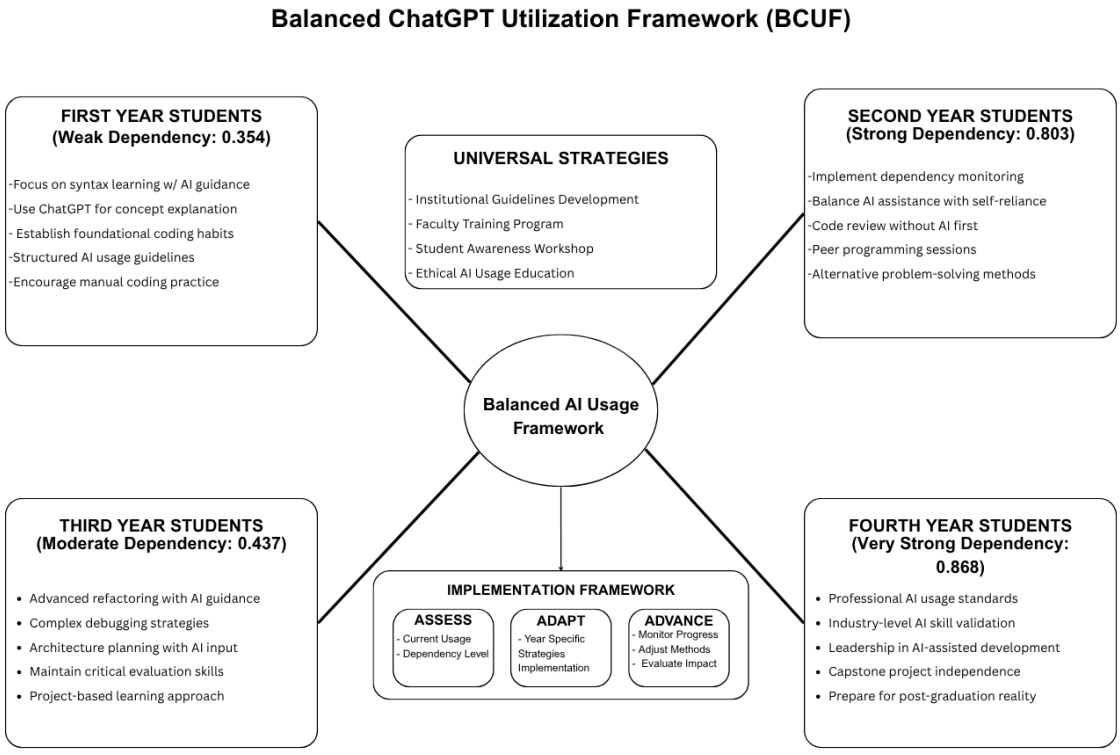
3. Students are conscious of the potential drawbacks of excessive reliance on AI tools and advocate for a balanced, informed approach to integrating these technologies within the academic environment.

4. There is strong justification for a structured, progressive framework that addresses year-specific needs and ensures that AI tools like ChatGPT serve as enhancers, not replacements of human competencies in software development.

Strategic Framework for Balancing ChatGPT Dependency

To address the nuanced progression of AI usage and dependency across academic levels, this study proposes a tiered framework aligned with students' developmental stages. This model, conceptualized as the Balanced AI Usage Framework for IT Students, incorporates both universal and year-specific strategies to ensure effective, ethical, and pedagogically sound AI integration.

Figure 12. Balanced ChatGPT Utilization Framework (BCUF



A. Universal Strategies (Applicable Across All Academic Levels)

- Development and dissemination of institutional policies governing AI usage
- Routine monitoring and evaluation of AI-assisted learning practices
- Faculty training on AI integration and its pedagogical implications
- Student seminars and workshops on digital ethics and AI literacy
- Curricular integration of modules on responsible AI use

B. Year-Level Specific Strategies

1. First Year: Foundation Stage

Dependency Level: Weak (r = 0.354)

Objective: Establish foundational programming competencies and introduce students to responsible AI engagement.

- Use ChatGPT selectively for syntax clarification and concept exploration
- Implement structured assignments with limited AI assistance
- Prioritize manual problem-solving activities
- Encourage collaborative coding and peer reviews to foster independent learning

2. Second Year: Skill Development Stage

Dependency Level: Strong (r = 0.803)

Objective: Enhance problem-solving efficiency while preventing over-reliance on AI tools.

- Regularly assess individual AI usage and dependency levels
- Integrate phases of coding assignments requiring manual debugging and peer feedback
- Emphasize diverse problem-solving approaches beyond AI assistance
- Promote self-reflection on AI-generated outputs

3. Third Year: Application and Critical Thinking Stage

Dependency Level: Moderate (r = 0.437)

Objective: Support strategic and evaluative use of ChatGPT in more complex coding tasks.

- Integrate ChatGPT use in project-based learning, especially in code refactoring
- Develop tasks requiring critical assessment and improvement of AI-generated code
- Introduce architectural planning exercises with limited AI input

4. Fourth Year: Professional Readiness Stage

Dependency Level: Very Strong (r = 0.868)

Objective: Prepare students for real-world software development environments with ethical AI use at the forefront.

- Establish strict AI usage guidelines for capstone projects and thesis work
- Incorporate AI ethics, bias mitigation, and intellectual property discussions into the curriculum
- Promote continuous learning to keep pace with evolving AI tools and practices

Conclusion

This study reinforces the necessity of balancing technological assistance with the cultivation of essential human problem-solving capabilities. The proposed strategic framework grounded in empirical evidence and supported by student consensus addresses both the opportunities and challenges posed by AI tools like ChatGPT in higher education. By adopting this structured, year-level-informed approach, institutions can foster responsible AI use and cultivate graduates who are not only technologically adept but also critically aware, ethically grounded, and professionally prepared.

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