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Generative Artificial Intelligence Integrated Pedagogy and Quality of Student Output in Web Design Courses Among Information Technology Students

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Abstract

This study examined the relationship between Generative Artificial Intelligence (GenAI)-integrated pedagogy and the quality of student outputs in web design courses among Information Technology students at Gingoog City Colleges, Inc. Specifically, it determined students' GenAI usage profile, level of GenAI-integrated pedagogy, differences in pedagogy according to GenAI usage, quality of web design outputs, and the relationship between pedagogy and student output quality. The study employed a descriptive-correlational research design involving 80 second-year Bachelor of Science in Information Technology (BSIT) students selected through purposive sampling and total enumeration, alongside three expert evaluators who assessed student outputs using a standardized web design rubric. Data were gathered using a researcher-developed questionnaire with a Cronbach's alpha of 0.971, indicating excellent internal consistency. Statistical tools included frequency and percentage, weighted mean, standard deviation, Kruskal-Wallis H-test, and Pearson r. Findings revealed that 61 students used GenAI for coding, 45 for research, and 39 used it several times weekly, with ChatGPT (57 users) and Canva AI (51 users) as the most-used tools. The overall level of GenAI-integrated pedagogy yielded a grand mean of 2.68 (Neutral/Average), while students' web design outputs obtained a grand mean of 1.79 (Developing). Furthermore, the findings showed no significant relationship between GenAI-integrated pedagogy and output quality ($p > 0.05$), indicating that the use of GenAI alone does not necessarily improve student performance.

Keywords: Generative Artificial Intelligence, Genai-Integrated Pedagogy, Web Design, Student Output Quality, Information Technology Students

Introduction

The rapid integration of Generative Artificial Intelligence (GenAI) in education has enabled the automatic production of text, code, and graphics. In the IT field, especially in web design classes, GenAI was used extensively by students for programming and layout design. The ease and effectiveness of these technologies rendered them a regular part of students' learning processes.

The use of GenAI marked a paradigm shift from regular ICT trends, changing the way students received, interpreted, and used knowledge. It revolutionized the acquisition, interpretation, and application of knowledge among students, thereby affecting teaching and learning processes and the quality of student performance in performance-based classes. In one study, Lively et al. (2023) found that implementing GenAI in web design classes improved the quality of student output. While text-based generators improved productivity and coding processes, the use of visual generators enabled concept generation and interface creation, resulting in an improved learning process for students in web design classes.

The quality of students' outputs, especially in skill-oriented subjects like web design, remained an important factor in assessing the efficacy of the learning process. The quality was based not only on the technical skills demonstrated by the learners but also on their cognitive abilities, including analysis, evaluation, and innovation. Quality outputs were indicative not just of technical expertise but also of creativity, usability, and adherence to design standards. However, as technologies like GenAI gained prominence in teaching and learning, an important concern emerged – whether their incorporation into the learning process would actually enhance the quality of outputs or merely automate performance.

The present research was associated with the UN Sustainable Development Goal 4 (SDG 4), which sought to provide inclusive, equitable, quality education and promote lifelong learning opportunities for all people. As educational institutions increasingly use emerging technologies in education, the ethical integration of GenAI would help improve the instructional process, enhance digital literacy, and increase students' motivation. In the field of IT, specifically in web design course development, the use of GenAI offered unique opportunities to adopt learner-centered, innovative approaches to teaching that improved students' creativity, critical thinking, and technological skills. The focus on the influence of GenAI-integrated pedagogy on student performance was essential to promoting quality education grounded in technology-based and ethical instructional strategies in accordance with SDG 4 goals.

This shift was consistent with the provisions of Article XIV, Section 1 of the Philippine Constitution, which states that the state must protect and promote quality education, and likewise with Memorandum Order No. 46, s. In 2012, the Commission on Higher Education (CHED) emphasized the importance of ensuring the quality and relevance of higher education programs. As a result, the development of GenAI necessitated an evaluation of existing teaching approaches so that the technology could contribute positively to the learning process.

At Gingoog City Colleges, Inc. (GCCI), this trend was apparent. The faculty recognized the need to adapt their instructional techniques and assessment approaches due to students' increasingly prevalent use of GenAI, which could increase efficiency but may also raise concerns about academic integrity. On the other hand, there were no clear guidelines within the institution regarding the appropriate use of these technologies in instructional processes. This dilemma became more pronounced in the context of web design classes, wherein students were tasked with creating efficient digital products.

Moreover, there was no localized empirical study in the Philippines, specifically in Northern Mindanao, on how the application of GenAI-integrated pedagogy affected the quality of output produced by IT students enrolled in web design courses. The previous studies conducted were more inclined towards the use of general AI, students' attitudes towards its use, and overall academic uses of AI, thus creating an important gap in the specific discipline and performance-based assessment aspects. Specifically, very few studies have examined the effect of GenAI-integrated pedagogy on the quality of students' web design products across creativity, usability, code structure, design coherence, and conformance with web design principles.

Thus, this study investigated the correlation between the pedagogical use of GenAI and the effectiveness of web design projects created by Information Technology students at Gingoog City Colleges, Inc. By employing a descriptive-correlational research design, the study aimed to provide insights to guide educators and policymakers in responsible GenAI integration.

Related Studies

This section highlights the literature and research on the quality of students' output in Web Design courses, particularly in performance activities. The literature on GenAI and education is extensive.

The application of GenAI, specifically large language models (LLMs) like ChatGPT, has quickly reshaped the educational world by generating new content in text, image, and programming forms through pattern recognition on large datasets. With the availability of open-source GenAI applications starting late 2022, researchers have begun analyzing the impacts of these systems in education.

According to Rueda et al. (2023), consistent and responsible use of GenAI technology leads to increased student engagement, motivation, and performance outcomes; however, ethical use guidelines and training play key roles, as evidenced by their research on the use of ChatGPT in education at the University of Sevilla.

The potential and risks of LLMs in education are also detailed by Kasneci et al. (2023), who refer to the latter as both potent tools for personalized learning and threats involving privacy, bias, and regulatory issues. In a broader educational context, GenAI tools in the UK are widely used by students for tasks such as generating ideas and summaries. However, there are ongoing problems concerning the accuracy of results and citing them properly (Weale, 2025). Using ChatGPT for science education has strengths and weaknesses. Namely, it can generate accurate answers based on conceptual knowledge while presenting unsupported claims as facts.

To successfully integrate artificial intelligence into learning, one should adapt their pedagogical approaches. Adaptation is an essential process of changing one's teaching strategies, methods, and approaches in light of the emerging need to use innovative technologies or to teach different types of learners. This need for pedagogical adaptation has been emphasized in all studies concerning technology integration in education. For example, Koehler and Mishra (2009) state that meaningful use of technology occurs when it emerges from the convergence of content knowledge, pedagogy, and technology. Complementing this perspective, Puentedura 2006) suggests the SAMR Model, according to which technology integration is viewed as a progression from substitution through augmentation and modification towards redefinition.

The above theories are supported by empirical evidence from Agustina et al. (2025), who investigated the impact of adopting adaptive technology in the Indonesian education system. It was discovered that adopting adaptive technologies could increase student engagement, enable data-informed learning, and help teachers identify students' learning challenges. Nevertheless, the research identified critical barriers to implementing adaptive technologies, including insufficient digital infrastructure, inadequate digital literacy among teachers, and cultural resistance to technology use. Therefore, the researchers advocated for investing in digital infrastructures, teacher training based on the TPACK model, and community digital literacy programs.

Conversely, excessive reliance on artificial intelligence conversational agents can hinder students' cognitive development, especially in decision-making and critical thinking (Zhai et al., 2024). On a similar note, Opre (2021) examined teachers' beliefs regarding pedagogy and the integration of technology in the European Proceedings of Educational Sciences. The findings showed that teachers' pedagogical beliefs significantly influence the integration of technology into teaching and learning, as well as the outcomes of these practices. As explained by Opre, technology integration should align with the philosophy of instruction that is focused on students and learning.

Also, Kumbo et al. (2023) examined novel pedagogies for effective technology integration in teaching at the Department of Computing and Communication Technology, National Institute of Transport, Tanzania. Based on their findings, technology integration should be flexible and learner-centered to equip learners with the skills needed in the 21st century.

Output quality in performance-based courses, such as web design, is a clear indication of how well a student learns, as it requires cognitive skills. Buendía-García & Piris-Ruano (2025) investigated the use of GenAI to assist students in user experience in web development courses. They realized that an example of a GenAI-supported web development course for UX-focused students involved scaffolded prompting and benchmarks using GitHub Copilot. With this approach, students with low technical skills were able to accomplish both front-end and back-end tasks. It also made it possible to provide standard guidelines for evaluation by lecturers.

Furthermore, the findings from Lively et al. (2023), based on their experiment incorporating GenAI tools into the web design course, indicate that the inclusion of such tools helps minimize challenges for students and leads to better outputs. In addition, they pointed out that text-based generators are useful for improving productivity and creating code, while visual generators are used to develop concepts related to themes. By utilizing AI-driven tools for complementing traditional modes of education, the process becomes more dynamic and interactive (Elycheikh et al., 2024). Specifically, when applied to web design courses, Generative AI can enhance students' aesthetic and creative skills by generating multiple design concepts.

Moving away from web courses, another study by Yang et al. (2025) examined instructional design and the application of GenAI-based information technology courses in China. According to them, using an instructional model for information technology courses based on Generative AI has led to greater student interest and satisfaction with their learning activities.

On a larger scale, Bai & Wang (2025) conducted a longitudinal study in China examining the effects of GenAI interaction and output quality on learning outcomes. According to their research, the quality of interactions and outputs from generative AI tools positively impacted learning motivation and creative self-efficacy, leading to improved learning outcomes. This means there are psychological mechanisms that can improve students' output by leveraging the benefits of generative AI tools in education.

In addition to the previously mentioned research, Ma & Zhong (2025) conducted a meta-analysis of the impact of GenAI on learning outcomes, with particular attention to competencies demonstrated through performance-based outputs. The researchers concluded that the influence of generative AI tools was relatively strong and led to positive learning outcomes, particularly in cognitive performance and competency development, which are closely aligned with students' academic and design outputs. To make the most of the potential advantages of AI tools in education, researchers recommend aligning them with the requirements of each class, tailoring them to the needs of diverse students, and integrating them with traditional educational techniques.

There has been growing research on the role of GenAI in promoting high-level cognitive skills among learners in educational settings. For instance, Chan et al. (2023) examined students' experiences with generative AI at the University of Hong Kong, including its use, benefits, and challenges. This research found that most students have positive attitudes towards the use of GenAI in learning, particularly for personalized learning, essay writing assistance, brainstorming, and research. Nonetheless, there are challenges related to accuracy, privacy, ethics, personal development, and employability.

Condoy (2025) conducted a study on the impact of GenAI on critical thinking in professional medical learning at Universidad de Las Américas, Quito, Ecuador. Findings from this study indicated that GenAI was being used to train doctors and concluded that AI could promote critical thinking rather than merely automating tasks.

On the other hand, the effect of a GenAI assessment tool on the development of higher-order thinking skills among undergraduate computing students in the USA was examined by Lee et al. (2025). Their results revealed improvements in quiz scores and perceptions of problem-solving abilities and critical thinking skills. Moreover, the effectiveness of GenAI in education relies heavily on human-AI cooperation, as active collaboration yields more productive cognitive outcomes than passive use (Nasr et al., 2025).

Further, Shahzad et al. (2025) focused their research on the effects of GenAI on the performance of learning tasks, considering self-efficacy, fairness and ethics, creativity, and trust in higher education. As a result, the use of this technology in higher education was shown to affect learning outcomes and motivation positively.

Additionally, Fan et al. (2025) investigated the educational impacts of GenAI on the performance of engineering students in China. According to them, using GenAI as a learning assistant improved engineering students' efficiency, creativity, initiative, and self-efficacy.

In line with this, Wu and Zhang (2025) examined the use of GenAI in secondary education, focusing on its benefits and implications for students' innovation abilities and digital literacy at Handan University. The finding showed that innovative learning environments supported by GenAI significantly improve students' innovation abilities, digital literacy, and critical thinking, which reinforce one another.

However, the use of scalable, personalized feedback from GenAI is essential for boosting students' engagement in learning and facilitating self-regulated learning (Wang et al., 2024). Besides, the effect of using generative AI agents and scaffolding in enhancing students' understanding of visual learning analytics was studied by Yan et al. (2024). The finding indicated some problems, including model limitations, ethical issues, and interference with conventional assessment procedures.

Further, Asad and Ajaz (2024) researched the influence of generative AI on lifelong learning and learners' development in higher education institutions worldwide. The finding emphasized that generative AI is likely to widen existing educational gaps, especially if unequal access is present or biased training data is employed.

As a result, Francis (2025) investigated the impact of Generative AI on higher education in the United Kingdom. The scholar offered three recommendations: to introduce GenAI literacy programs, to revise assessment procedures to emphasize outputs and creativity, and to formulate institutional policies to ensure accountability and fairness. In addition, the influence of Generative AI on learning performance in science courses of Hacettepe University was analyzed by Gunsaldi et al. (2025). The scholars pointed out that integrating AI requires evidence-based policies and rigorous scientific research to monitor its effectiveness.

Regarding the Philippine context, policy-related and institutional research indicates increased acceptance of artificial intelligence in higher education. According to Untalan (2025), the CHED issues appeals to implement artificial intelligence in higher education institutions, as posted on GMA Integrated News in the Philippines. The articles prove that the CHED encourages universities and colleges to integrate technologies such as AI and to promote digital innovation and inclusivity. Commissioner of the CHED, Dr. Ethel Agnes Pascua-Valenzuela, stated that AI technologies have already been used in the educational process through adaptive platforms and virtual labs.

Findings from local studies (Arguson et al., 2024; Cacho, 2024; Hayudini et al., 2025) suggest that students and educators find GenAI to be an advantageous tool in learning processes, especially regarding engagement and higher-order thinking. In comparison, Fudalan (2025) examined the role of artificial intelligence in Philippine education. According to the study, Filipino teachers consider artificial intelligence helpful in the educational process but stress that this technology will never replace essential human qualities such as empathy, mentorship, and value formation.

Nevertheless, challenges remain, including infrastructural issues, insufficient faculty training, and overreliance on AI (Villarino, 2025; Cutillas, 2025). Ethical considerations, digital literacy education, and contextualized strategies have been discussed in other research articles (Manaig et al., 2025; Miranda et al., 2025).

At the same time, Gonzales and Nabua (2025) conducted a study investigating learners' perceptions of the use of artificial intelligence in education and their understanding of Grade 11 life science at Mindanao State University – Iligan Institute of Technology. As the study concluded, Students consider artificial intelligence beneficial in the academic environment, yet note some drawbacks (such as the need for verification of results).

Consequently, Miranda et al. (2025) investigated the prevalence, device utilization, motivations, trust, barriers, and difficulties in using Generative AI among tertiary students in the Philippines. The authors proposed that, to overcome these gaps and barriers, training and guidelines were necessary. Bridging the digital divide will require investments in infrastructure and faculty development programs within a contextual framework (Espartinez, 2025). Although there is growing recognition, there remains a lack of localized research on the use of GenAI in education, particularly in ICT education in the province (Obenza et al., 2024).

Overall, these studies indicate that, for GenAI to be ethically and effectively adopted in Philippine education, there is a need not only for policies but also for investment in building capacity, infrastructure, and pedagogical models, informed by Fudalan's (2025) study on the importance of artificial intelligence in Philippine education.

Although GenAI-related education research in the Philippines is growing, empirical studies remain scarce, particularly in information and communication technology (ICT) subjects and in provincial areas. Obenza et al. (2024) explored the perception of University students toward ChatGPT in Region XI. Their research revealed that GenAI was associated with great popularity and positive perception.

As described by Wiselee et al. (2025) in their work on self-learning in web development via tutoring systems, incorporating an ITS into web development lessons would improve students' independent learning. To prove this claim, an ITS was developed using the Laravel framework in undergraduate web development lessons.

The increasing use of AI tools like ChatGPT in engineering education makes clear how these tools can support writing and other academic tasks (Perante et al., 2024). At the same time, the research conducted by Lagare and Paglinawan (2024) on collaborative teaching techniques and technology orientation for enhancing students' critical thinking skills in Malaybalay City, Bukidnon, revealed that cooperation among teachers and technology orientation help enhance students' critical thinking skills through technology-enabled classes.

It should be noted that students' policy knowledge regarding AI is low due to uncertainty about the implementation process (Villarino, 2024). Inequalities in terms of AI literacy exist between public and private organizations in provincial areas (Bayaga, 2025).

At the same time, Amilhasad (2025) conducted research on the use of artificial intelligence to promote critical thinking skills among Bachelor of Arts in English Language Studies students at Mindanao State University-Sulu. It was concluded that students consider AI helpful in developing critical thinking skills when it is used ethically and practically.

However, the PSITE Northern Mindanao Chapter (2024) has pioneered excellence in AI-driven research as part of a seminar-workshop. In the discussion, the utilization of AI technology in research and educational development among educators in Northern Mindanao was emphasized.

Although there has been growing global discourse on GenAI, there remains a notable dearth of empirical evidence examining the impact of GenAI on the quality of students' outputs, especially in web design classes, in a provincial context in the Philippines. There are not many empirical studies done in rural settings in the Philippines, as most are conducted in urban and resource-rich universities. Therefore, the pedagogical strategies that educators are currently implementing for integrating GenAI lack solid empirical evidence, particularly given the linguistic, cultural, and technological differences in provincial settings, as evidenced by Vergara (2024).

In light of the above, the current research seeks to bridge the identified knowledge gap through investigating the impact of GenAI as a means of integrating technology into pedagogy in the quality of students' output in their web design classes at Gingoog City Colleges, Inc. Through collecting evidence regarding the use of GenAI in education from the Northern Mindanao area, the study will be making a more inclusive and contextual contribution towards the field of research concerned with understanding the educational implications of GenAI.

Theoretical / Conceptual Framework

The research was guided by the Diffusion of Innovation Theory, which described the processes of adopting, using, and implementing new technologies. According to this theory, the success of the innovation is determined not only by its accessibility and frequency of use but also by how it is applied. Relative advantage, compatibility, complexity, trialability, and observability are crucial aspects that determine whether technology yields desirable results.

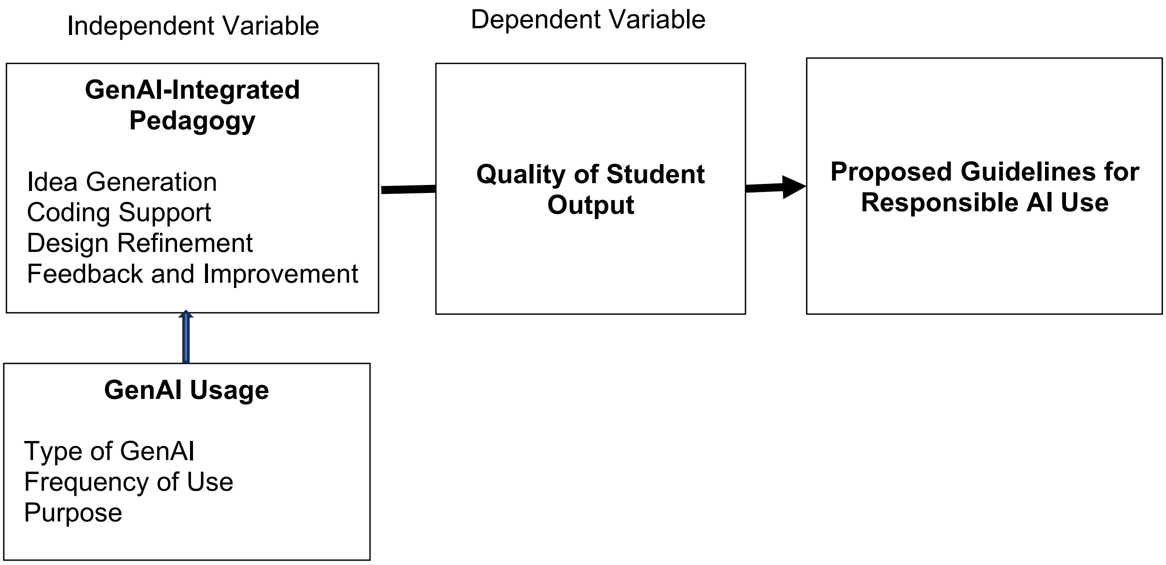
In web design training, GenAI was regarded as an innovative approach for generating ideas, coding, designing, and providing feedback on assignments. Although these innovations provided learners with opportunities to improve their academic performance, their effectiveness did not depend on their presence in the classroom but on how they were implemented in the teaching process.

GenAI-integrated pedagogy was thus considered the independent variable, represented by instruction-related elements such as idea generation, coding assistance, design improvement, and feedback and enhancement. Meanwhile, the dependent variable, quality of student output, was assessed using predetermined web design factors, including simplicity, consistency, color choices, audience relevance, structure/navigation/formatting, as well as resource documentation. Based on Diffusion of Innovations Theory, this paper's research hypothesis posited that the impact of GenAI-integrated pedagogy on students' output quality would vary with the extent of pedagogical integration. In a guided manner, GenAI usage has the potential to improve the quality of student outputs through promoting higher-level thinking and constant improvement. Otherwise, GenAI would contribute to task completion without substantial improvements in output.

Figure 1 on page 19 depicts the conceptual model of the research, showing how GenAI-integration pedagogy affects the quality of students' GenAI-related outputs. The diagram showed the derivation of the guidelines for responsible AI use derived from the results of this research study.

DOI was introduced as both an independent and a grouping variable in the concept map. It showed how the adoption of GenAI is done via usage (type, frequency, and purpose) and integration (compatibility, complexity, and observability). These were the reasons why GenAI integration was characterized as neutral and had poor correlation with output quality.

Figure 1. Conceptual Framework of the Study



Objectives of the Study

This study sought to assess the following objectives: (1) determine the profile of the students on GenAI usage in terms of types of GenAI tools used, frequency of use, and purpose of use; (2) determine the level of GenAI-integrated pedagogy in the web design course in terms of idea generation, coding support, design refinement, and feedback and improvement; (3) determine whether there is a significant difference in the level of GenAI-integrated pedagogy when grouped according to GenAI usage; (4) determine the quality of students' outputs in web design; (5) determine whether there is a significant relationship between GenAI-integrated pedagogy and the quality of students' outputs in web design; and (6) propose guidelines for responsible AI usage in web design courses based on the findings of the study.

Methodology

This study examined the association between Generative Artificial Intelligence (GenAI)-integrated pedagogy and the quality of student outputs in web design courses among Information Technology students at Gingoog City Colleges, Inc., during School Year 2025–2026. Using a descriptive-correlational research design, the study involved 80 second-year BSIT students selected through purposive sampling and total enumeration, as well as three expert evaluators who assessed students' web design outputs. Data were gathered using a validated, reliable, researcher-developed questionnaire (Cronbach's Alpha = 0.971) and a standardized web design rubric. Statistical tools such as frequency and percentage, weighted mean, standard deviation, Kruskal-Wallis H-test, and Pearson r correlation were utilized to analyze GenAI usage, level of GenAI-integrated pedagogy, quality of student outputs, and the significant differences and relationships among variables, providing evidence on the pedagogical implications of GenAI integration in web design instruction.

Results and Discussion

Problem 1. What is the profile of the students on GenAI usage in terms of types of GenAI tools used, frequency of use, and purpose of use?

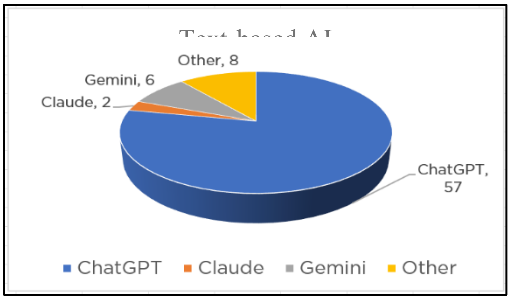


Figure 2. Types of GenAI tools used in terms of Text-based AI Tools

The graph in Figure 2 shows that ChatGPT is the most popular tool used by students for Text-based AI, with very few students using other tools, indicating centralized adoption. This indicates a high perceived relative advantage because students understand that these tools can be efficient for completing tasks. On the other hand, due to a lack of diverse tools, there is very low trialability, as students will be exposed only to a limited range of tool alternatives. In other words, adoption will be broad but limited.

This was consistent with the existing literature, which indicates that ChatGPT is the most popular GenAI tool among students, with a large percentage relying on it to complete their assignments (College Board, 2025). Also, according to the studies, ChatGPT is increasingly becoming a major source of help for students, as it has been used to replace traditional sources like Google searches (Hou et al., 2025). Additionally, students, especially those less experienced, rely extensively on GenAI to complete tasks (Chen et al., 2025).

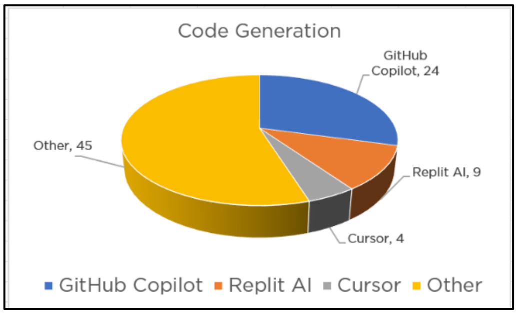


Figure 3. Types of GenAI tools used in terms of Code Generation

According to Figure 3, students employ a variety of code generation tools, with the largest share listed under "Other," followed by GitHub Copilot, Replit AI, and Cursor. Thus, unlike text-based AI tools, where one platform stands out, the use of code generation tools is more dispersed, suggesting greater diversity in their compatibility and complexity levels. Students seem to pick whichever AI code generator best suits their needs, typically one that's convenient and easy to use. GitHub Copilot, mentioned above as one of the top tools used by students, has been described as an "AI pair programmer" that facilitates real-time code generation and completion (Zhou et al., 2025).

Nevertheless, the significant number of responses under "Other" indicates that students also utilize other general-purpose or alternative AI tools to aid in programming tasks. It aligns with previous studies suggesting that when completing programming assignments, college students tend to use multiple AI platforms, including conversational AI tools. Such diversity in behavior is attributed to the need to seek out several platforms to find the one that best suits their needs (Akhoroz & Yildirim, 2025).

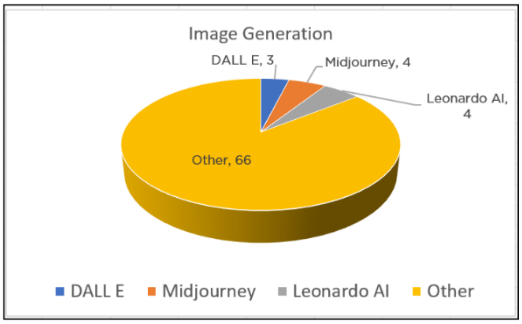


Figure 4. Types of GenAI tools used in terms of Image Generation

Figure 4 shows that the majority of students (66) are in the “Other” category for the use of image-generation tools. In contrast, a few students are using specific tools like DALL·E (3 students), Midjourney (4 students), and Leonardo AI (4 students). Hence, we can infer that the use of image generation tools is sporadic, as no single tool clearly dominates. There is an indication that students are using different, undefined types of tools to generate images. This further implies that image generation is not anchored in a learning setting, as the tools' benefits are not observable in assessment outputs.

This observation is in line with previous research indicating that, although generative AI image-generation tools are advancing rapidly, their use in education is scattered and exploratory, as learners resort to several applications based on availability and suitability (Lim et al., 2023). Moreover, some research suggests that students rely on both general-purpose and dedicated AI applications when working on creative tasks; hence, the lack of standardized approaches leads to inconsistent usage patterns (Dwivedi et al., 2023). Thus, the predominance of students who do not use any particular application indicates a low level of awareness of available options or of interchangeable applications.

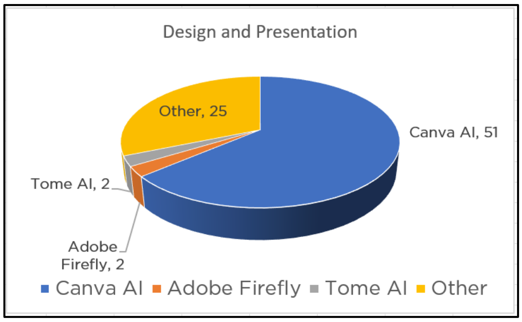


Figure 5. Types of GenAI tools used in terms of Design and Presentation

As shown in Figure 5, Canva AI is the most frequently used software for design and presentation purposes, with 51 students, followed by the "Other" option with 25 responses. At the same time, there were only a few students who mentioned Adobe Firefly (2) and Tome AI (2). This means that, in contrast to code and image generation tasks, where software choices were much more diverse, design and presentation tasks are more centralized and focused on a single software platform, namely Canva AI. The popularity of this software can be explained by its convenience and versatility.

This finding is consistent with the literature, which suggests that the use of design and presentation software tools like Canva is common in educational environments due to their ease of access and use. Evidence suggests that Canva offers an intuitive interface that enables students to generate attractive learning materials collaboratively, making it the preferred choice among learners for design-based assignments (Jamaludin, 2023). Moreover, evidence confirms that the use of AI features in Canva promotes engagement and enhances learning outcomes in graphic design tasks, which contributes to Canva's dominance among students (Ngbarabara & Ndukwu, 2025).

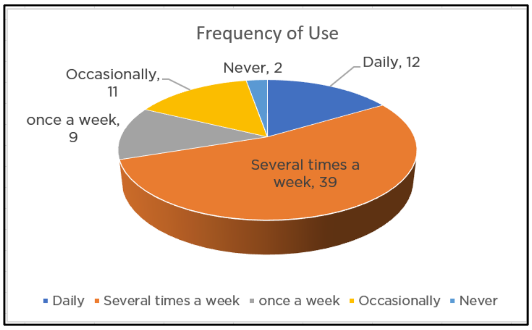


Figure 6. GenAI tools used in terms of Frequency of Use

The graph in Figure 6 shows that most students (39) use GenAI multiple times a week, followed by daily usage (12), occasional usage (11), weekly (9), and just a few (2) who claim to have never used GenAI. While this trend demonstrates adoption and greater trialability, it does not mean that the process will be successful for learning. What it means is that GenAI is no longer seen as an optional or extra learning aid but rather a normal part of the learning process, particularly for things such as coding, content creation, and designing. The reason is that many users who use GenAI multiple times a week show a reliance on it. Those who use it daily further prove this point—the few users who use it occasionally or never show little reluctance to do so.

The results of recent studies suggest that learners are increasingly using generative AI tools in their academic activities, doing so multiple times each week (Kasneci et al., 2023). In addition, the use of AI tools increases one's familiarity with the technology and its perceived usefulness, thereby increasing the likelihood of further use (Dwivedi et al., 2023). Hence, it is not surprising that frequency of use proved to be an important variable affecting learning at the higher-order level. On average, the graph illustrates the regular use of GenAI by the learners studied. Such regular use makes GenAI much more likely to influence learning, but also prompts learners to consider how it may lead to dependency.

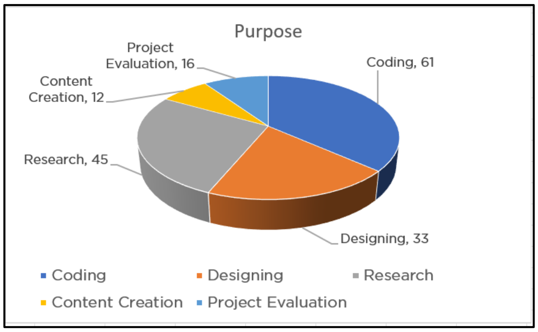


Figure 7. Types of GenAI tools used in terms of Purpose

As shown in Figure 7, the most common use of GenAI is in programming, with 61 students using the technology; next come researching, with 45 respondents, and designing, with 33 respondents. However, only 16 students use GenAI for project evaluation, and 12 respondents report using it to create content. This means that, as GenAI is used predominantly by students for programming and research, there is little room left for its use in evaluation and improvement.

These findings support previous studies, which state that the students use generative AI to complete specific tasks and improve efficiency in programming and research work (Kasneci et al., 2023).

In turn, GenAI has significant potential to foster creativity and evaluate projects; however, its implementation in these areas is hindered by insufficient instruction and knowledge of how to use it effectively (Lim et al., 2023).

Overall, GenAI is primarily used as a practical tool to help students complete specific assignments. Its application for evaluation, reflection, and improvement is much lower. Therefore, teachers need to assist students with applying GenAI in different spheres.

Problem 2. What is the level of GenAI-integrated pedagogy in the web design course in terms of idea generation, coding support, design refinement, and feedback & improvement?

Table 3. ***Level of GenAI-integrated Pedagogy in the Web Design Course in terms of Idea Generation***

Statements	Mean	Verbal Description	Verbal Interpretation
1. My instructor uses GenAI to guide the development of website concepts.	3.03	Neutral	Average
2. My instructor uses GenAI in organizing project ideas.	2.96	Neutral	Average
3. My instructor uses GenAI to demonstrate concept mapping.	2.74	Neutral	Average
4. My instructor integrates GenAI into content planning activities.	2.78	Neutral	Average
5. My instructor uses GenAI in class discussions on project themes.	2.77	Neutral	Average
6. My instructor integrates GenAI in planning website navigation ideas.	2.90	Neutral	Average
7. My instructor uses GenAI in content outline development.	2.79	Neutral	Average
8. My instructor uses GenAI during storyboard planning.	2.70	Neutral	Average
9. My instructor uses GenAI in wireframe concept discussions.	2.82	Neutral	Average
10. My instructor encourages GenAI use for initial project conceptualization.	2.90	Neutral	Average
Overall Mean	**2.84**	**Neutral**	Average

Legend: *Strongly Agree 4.21 - 5.00, Agree 3.41 - 4.20, Neutral 2.61 - 3.40, Disagree 1.81 - 2.60, Strongly Disagree 1.00 - 1.80*

The level of GenAI-assisted pedagogy regarding idea generation in the Web Design class is presented in Table 3. The findings showed that all indicators were rated with mean scores falling under the “Neutral” verbal descriptor and were considered “Average,” with a mean of 2.84. This means that although GenAI is used to assist with idea-generation tasks, there is no clear emphasis on it in the idea-generation process during instruction. Considering the Diffusion of Innovation (DOI) Theory, this means that although the introduction of GenAI into teaching and learning processes is already underway, the extent to which GenAI is used for idea generation has not yet advanced significantly.

The statement with the highest mean score, 3.03, was "GenAI to assist in the formulation of concepts for websites." This implies that GenAI played a crucial role in helping learners develop ideas for websites and, more broadly, projects. The second most effective application of GenAI was in organizing project ideas, with a mean score of 2.96, while the third was in advocating the use of GenAI in the initial stage of project concept formulation, with a mean score of 2.90. The results above indicate that lecturers appreciated GenAI's potential to support learners in the initial stages of project development.

Conversely, the lowest mean score, 2.70, was for the statement about using GenAI for storyboard creation, while the second-lowest mean was for demonstrating concept mapping (2.74). This reveals that although GenAI was sometimes used for idea generation, it still seems to be used only limitedly in more creative, strategic activities such as storyboarding. According to the DOI theory, teachers were still struggling to adjust to and integrate GenAI into these instructional practices, which require higher-order thinking skills.

In general, this study reveals that instructors used a moderate level of GenAI integration when helping students generate ideas. However, the neutral response scores across all measures suggest that more needs to be done to systematically integrate GenAI to facilitate creativity, idea generation, and concept formation in web design instruction. These conclusions have been confirmed by Kumbo et al. (2023), who argued that technology integration should be flexible and strategic.

Table 4. ***Level of GenAI-integrated Pedagogy in the Web Design Course in terms of Coding Support***

Statements	Mean	Verbal Description	Verbal Interpretation
1. My instructor uses GenAI when teaching HTML.	2.70	Neutral	Average
2. My instructor uses GenAI when teaching CSS.	2.77	Neutral	Average
3. My instructor uses GenAI during debugging activities.	2.78	Neutral	Average
4. My instructor uses GenAI to explain coding concepts.	2.63	Neutral	Average
5. My instructor uses GenAI in demonstrating code structure.	2.58	Disagree	Low
6. My instructor integrates GenAI into code optimization lessons.	2.60	Disagree	Low
7. My instructor uses GenAI during practical coding demonstrations.	2.70	Neutral	Average
8. My instructor integrates GenAI in responsive design coding tasks.	2.68	Neutral	Average
9. My instructor uses GenAI in script validation activities.	2.56	Disagree	Low
10. My instructor encourages GenAI use during web design tasks.	2.70	Neutral	Average
Overall Mean	**2.67**	**Neutral**	Average

Legend: *Strongly Agree 4.21 - 5.00, Agree 3.41 - 4.20, Neutral 2.61 - 3.40, Disagree 1.81 - 2.60, Strongly Disagree 1.00 - 1.80*

Table 4 reflects the degree of integration of GenAI into web design pedagogy with respect to the use of code. It can be seen that the average was 2.67, which is “Neutral,” and it means “Average” according to the findings from the OECD (2026), which indicate that general-purpose AI tools have no impact on learning improvement without purposeful pedagogical transformations. Statements No. 2 and No. 3 showed the highest average scores, namely 2.77 and 2.78, but they still did not indicate any high level of implementation. Moreover, there were several disagreeable statements (No. 5: 2.58, No. 6: 2.60, No. 9: 2.56).

From these findings, there appears to be a generally neutral level of GenAI integration in coding, with several factors registering as disagreeing with other metrics, indicating inconsistencies and inefficiencies. Using the Diffusion of Innovations lens, the relative advantages of GenAI in performing fundamental coding tasks are well known, but the perceived complexity of coding and debugging remains a significant barrier to realizing GenAI's full value in education. While GenAI can perform well at generating syntax codes and correcting mistakes, students have difficulty transferring these solutions into comprehension and practical application. It seems that GenAI has become a tool for improving efficiency rather than enhancing learning. One recent study showed that, despite initial confidence in GenAI, students faced significant challenges when applying their knowledge independently, without AI assistance, resulting in what researchers termed "conceptual gaps." Hence, it would not be surprising for some to disagree about how efficient the pedagogical approach is at supporting long-term skills development (Rojas-Galeano et al., 2025).

This is the implication drawn from the general findings, whereby the existing incorporation of GenAI into pedagogy serves only as a foundation for help, not as sufficient actually to feel the assistance provided. In transitioning from "Neutral" to "Agree," it may be necessary for the curriculum to shift its focus from viewing AI merely as a source of code generation to one of critical code analysis and debugging.

Table 5. ***Level of GenAI-integrated Pedagogy in the Web Design Course in terms of Design Refinement***

Statements	Mean	Verbal Description	Verbal Interpretation
1. My instructor uses GenAI in layout refinement tasks.	2.63	Neutral	Average
2. My instructor uses GenAI in user interface design discussions.	2.59	Disagree	Low
3. My instructor uses GenAI in color scheme selection activities.	2.64	Neutral	Average
4. My instructor uses GenAI in typography design discussions.	2.63	Neutral	Average
5. My instructor integrates GenAI in visual hierarchy lessons.	2.51	Disagree	Low
6. My instructor uses GenAI in alignment activities.	2.58	Disagree	Low
7. My instructor uses GenAI in navigation design refinement.	2.70	Neutral	Average
8. My instructor uses GenAI in user experience discussions.	2.68	Neutral	Average
9. My instructor uses GenAI in website aesthetics evaluation.	2.67	Neutral	Average
10. My instructor uses GenAI in interface consistency lessons.	2.68	Neutral	Average
Overall Mean	**2.63**	**Neutral**	**Average**

Legend: *Strongly Agree 4.21 – 5.00, Agree 3.41 – 4.20, Neutral 2.61 – 3.40, Disagree 1.81 – 2.60, Strongly Disagree 1.00 – 1.80*

According to Table 5, there appears to be a "Neutral" attitude (Overall Mean: 2.63) toward the role of GenAI-enhanced teaching methods in developing students' abilities to polish up their website designs. It would appear that, although GenAI can be used effectively in the initial brainstorming stages, it is less effective at the more detailed design stage.

This result is consistent with the observations of Chen (2026), who found that students tended to give neutral responses regarding the role of AI in visual elaborations. Based on their research, it seems that because students already have sufficient skills in this area, the AI-generated results "lack originality and artistic quality" and do not reach the level of creativity required in professional classes.

Lastly, the overall neutrality of the results can be attributed to the inherent difficulty of capturing AI nuances during the refinement stage. As pointed out by Fleischmann (2024), there is deep concern among students about the loss of "the human touch" and the limitations of AI in understanding human feelings and aesthetics. This problem becomes even more pronounced when it comes to subtle changes that are essential to the user experience, which students see as purely human tasks.

In conclusion, the "Neutral" score of the total mean can be explained by difficulties in practice. As Dai (2024) explains, there may be a misalignment between what AI generates and what students need to create for their projects. Hence, for pedagogy to advance beyond this neutral point, it should focus on refining generated work under constraints using GenAI tools.

Ultimately, the neutral score indicates that respondents have no strong belief that GenAI can effectively improve the quality of website design output. In relation to the theory of the diffusion of innovations, this can be associated with a low level of compatibility between the output results generated by artificial intelligence and the complex requirements of design tasks, including creative work. Moreover, it cannot be expected that using artificial intelligence to refine design will yield clear benefits, since this process requires context-specific judgments that AI tools cannot make effectively.

Table 6. ***Level of GenAI-integrated Pedagogy in the Web Design Course in terms of Feedback & Improvement***

	Questions	Mean	Verbal Description	Verbal Interpretation
1.	My instructor uses GenAI to identify errors in student outputs.	2.67	Neutral	Average
2.	My instructor uses GenAI to suggest improvements for projects.	2.73	Neutral	Average
3.	My instructor uses GenAI during output review sessions.	2.48	Disagree	Low
4.	My instructor integrates GenAI in a rubric-based assessment.	2.51	Disagree	Low
5.	My instructor uses GenAI in formative assessment activities.	2.55	Disagree	Low
6.	My instructor uses GenAI in project consultation sessions.	2.59	Disagree	Low
7.	My instructor uses GenAI in peer review activities.	2.56	Disagree	Low
8.	My instructor uses GenAI in performance evaluation.	2.58	Disagree	Low
9.	My instructor integrates GenAI in quality-check discussions.	2.58	Disagree	Low
10.	My instructor encourages the use of AI-generated feedback before submission.	2.59	Disagree	Low
	Overall Mean	**2.58**	**Disagree**	Low

Legend: *Strongly Agree 4.21 – 5.00, Agree 3.41 – 4.20, Neutral 2.61 – 3.40, Disagree 1.81 – 2.60, Strongly Disagree 1.00 – 1.80*

As shown in Table 6, the level of GenAI-integrated pedagogy in the web design course regarding feedback and improvement is rated 2.58 on the scale, which falls between the "Disagree" category and is the least positively scored item across all four pedagogical dimensions explored in this study. This finding suggests that learners do not view their teachers as being successful in incorporating AI technology into evaluating, correcting, and iterating learning practices in the web design class. Two items (Items 1 and 2) were scored as Neutral, indicating a slightly better perception of AI's ability to detect errors and offer suggestions for improvement.

This data shows a low level of GenAI integration for feedback and improvement. This shows that this is the weakest area regarding AI integration. According to the Diffusion of Innovations theory, the relative advantage that GenAI offers in iterative feedback activities is very low, since students do not see AI as providing effective evaluation of their work. Additionally, a lack of structure for engaging with AI and using it for feedback prevents trying out the innovation, thereby preventing its potential advantages from being discovered.

The above results are consistent with previous research, which shows that effective application of AI in education depends not just on the accessibility of such technology tools but also on their integration into pedagogy. According to Holmes et al. (2022), AI tools should be included in guided learning frameworks to enable students' higher-order abilities, such as evaluation and enhancement, rather than just information creation. As per Dwivedi et al. (2023), generative AI could assist in generating new ideas but would require a specific approach to learning to contribute to an iterative process. Furthermore, Kasneci et al. (2023) report that most students make passive use of AI tools, failing to engage in deeper learning activities such as analysis and improvement.

In conclusion, the poor rating on design refinement indicates a distinction between using GenAI and using it effectively in the classroom. The study makes clear that teachers are responsible for ensuring their lessons are infused with feedback-driven, iterative activities that extend beyond merely using GenAI to produce content.

Table 7. ***Summary Table on the Level of GenAI-integrated Pedagogy in the Web Design Course***

Indicators	Mean Scored	Verbal Description	Verbal Interpretation
1. Idea Generation	2.84	Neutral	Average
2. Coding Support	2.67	Neutral	Average
3. Design Refinement	2.63	Neutral	Average
4. Feedback & Improvement	2.58	Disagree	Low
Grand Mean	**2.68**	Neutral	Average

Legend: *Strongly Agree 4.21 – 5.00, Agree 3.41 – 4.20, Neutral 2.61 – 3.40, Disagree 1.81 – 2.60, Strongly Disagree 1.00 – 1.80*

Table 7 presents a summary of the level of GenAI integration in the teaching pedagogy of the web design course across the four dimensions of instruction: idea creation, code writing, design enhancement, and feedback and improvement. Based on the results, the grand mean is 2.68, which is "Neutral" or "Average" on a verbal scale. This shows that the integration of GenAI into pedagogy had occurred, but only to a moderate extent and not yet embedded in the instructional process. According to the DOI theory, teachers have adopted GenAI technology in teaching, but this is still in the transitional stage, as there is no pedagogical implementation at this point. Compatibility, perceived complexity, and observability might have affected the level of implementation.

Amongst the four dimensions, idea generation scored the highest mean rating of 2.84, while coding support rated 2.67 and design refinement rated 2.63, all three being considered "Neutral," equivalent to "Average." Based on these results, it can be concluded that teachers would have used GenAI more often for activities such as brainstorming, concept formation, and basic coding support, rather than for other instructional purposes. A higher score in idea generation can indicate greater applicability and accessibility of GenAI in creative and planning-related activities. The findings were consistent with those of Lively et al. (2023), who found that GenAI could support concept formation, productivity, and coding assistance in web design learning processes. In addition, Kumbo et al. (2023) noted that integrating technology is more useful in learner-oriented, flexible instructional practices.

In contrast, feedback and improvement had the lowest mean score of 2.58, which, in verbal terms, translates to "Disagree," meaning "Low." GenAI was not as incorporated in those activities that revolve around the process of evaluating and improving students' performance. When considering the insights that can be derived from the DOI Theory in this regard, one can conclude that the level of complexity in employing the technology for evaluative purposes was viewed as higher than its use for idea generation and coding.

However, the results suggest that the integration of GenAI in the web design class remained moderate and focused primarily on basic instructional functions. Overall neutral ratings may imply that instructors were still searching for appropriate ways to integrate technology into teaching. This assertion is consistent with the opinion voiced by Opre (2021), according to which the success of technology integration is more about alignment of instructional practices with pedagogical principles and less about technology itself.

Problem 3. Is there a significant difference in the level of GenAI-integrated pedagogy when grouped according to GenAI usage?

Table 8. ***Test on the Difference in the Level of GenAI-integrated and Text-based AI Tools***

GenAI Usage	GenAI Integrated Pedagogy	*x^2-value*	*p-value*	Interpretation	Decision
Text-based AI Tools	Idea generation	0.498	0.919	Failed to Reject Ho	Not Significant
	Coding support	0.362	0.948	Failed to Reject Ho	Not Significant
	Design refinement	1.275	0.735	Failed to Reject Ho	Not Significant
	Feedback & improvement	1.525	0.676	Failed to Reject Ho	Not Significant
Code Generation	Idea generation	8.380	0.039	Reject Ho	Significant
	Coding support	7.740	0.052	Failed to Reject Ho	Not Significant

	Design refinement	8.860	0.031	Reject Ho	Significant
	Feedback & improvement	8.380	0.039	Reject Ho	Significant
Image Generation	Idea generation	4.110	0.250	Failed to Reject Ho	Not Significant
	Coding support	5.220	0.156	Failed to Reject Ho	Not Significant
	Design refinement	4.730	0.193	Failed to Reject Ho	Not Significant
	Feedback & improvement	2.120	0.547	Failed to Reject Ho	Not Significant
Design and Presentation	Idea generation	7.190	0.066	Failed to Reject Ho	Not Significant
	Coding support	7.970	0.047	Reject Ho	Significant
	Design refinement	6.090	0.107	Failed to Reject Ho	Not Significant
	Feedback & improvement	6.670	0.083	Failed to Reject Ho	Not Significant
Frequency of Use	Idea generation	10.030	0.040	Reject Ho	Significant
	Coding support	7.740	0.102	Failed to Reject Ho	Not Significant
	Design refinement	12.860	0.012	Reject Ho	Significant
	Feedback & improvement	14.820	0.005	Reject Ho	Significant
Purpose	Idea generation	1.120	0.892	Failed to Reject Ho	Not Significant
	Coding support	1.230	0.874	Failed to Reject Ho	Not Significant
	Design refinement	1.410	0.843	Failed to Reject Ho	Not Significant
	Feedback & improvement	1.740	0.783	Failed to Reject Ho	Not Significant

Correlation@ 0.05 (two-tailed)

Table 8 shows that there is no significant difference in the level of GenAI-integrated pedagogy when grouped according to text-based AI tools, as all computed p-values exceeded the 0.05 level of significance, specifically idea generation (p = 0.919), coding support (p = 0.948), design refinement (p = 0.735), and feedback and improvement (p = 0.676). These findings indicate that the type of text-based AI tool used by students does not significantly influence their perceived level of GenAI integration in the web design course. Hence, the null hypothesis was not rejected, suggesting that variations in text-based AI tools do not yield meaningful differences in pedagogical integration. This finding supports Kasneci et al. (2023), who emphasized that conversational AI tools become educationally effective only when systematically integrated into instructional strategies rather than merely utilized for task completion.

Similarly, the findings reveal a significant difference in the level of GenAI-integrated pedagogy based on code generation tools in terms of idea generation (p = 0.039), design refinement (p = 0.031), and feedback and improvement (p = 0.039) since the computed p-values are lower than the 0.05 level of significance. However, coding support (p = 0.052) does not differ significantly, indicating that code generation tools may vary in their influence on higher-order learning functions but not necessarily in coding assistance. Thus, the null hypothesis is rejected for idea generation, design refinement, and feedback and improvement, but not for coding support. This finding is consistent with Alanazi et al. (2025), who found that AI-assisted coding tools significantly influence creativity, iterative improvement, and feedback processes in programming-related learning.

Likewise, the results indicate that image generation tools do not significantly differ across all dimensions of GenAI-integrated pedagogy, with p-values of 0.250 for idea generation, 0.156 for coding support, 0.193 for design refinement, and 0.547 for feedback and improvement, all of which are above the 0.05 significance level. This implies that the use of image-generation tools does not significantly affect students' perceptions of GenAI integration in web design instruction. Therefore, the null hypothesis was not rejected, indicating that students' experiences were consistent regardless of the image-generation tool used. This finding aligns with Dwivedi et al. (2023), who reported that visual generative AI applications are often used for content creation rather than for promoting higher-order cognitive engagement in learning.

Moreover, findings demonstrate a significant difference in the level of GenAI-integrated pedagogy according to design and presentation tools only in terms of coding support (p = 0.047), while idea generation (p = 0.066), design refinement (p = 0.107), and feedback and improvement (p = 0.083) remain statistically insignificant. This means that design and presentation tools contribute differently only to coding-related support but do not significantly influence the remaining dimensions of pedagogical integration. Consequently, the null hypothesis is rejected only for coding support and not for the other variables. This finding supports Alam et al. (2022), who emphasized that AI tools become more effective when aligned with specific instructional objectives and learning activities.

Furthermore, the findings reveal a significant difference in the level of GenAI-integrated pedagogy by frequency of use for idea generation (p = 0.040), design refinement (p = 0.012), and feedback and improvement (p = 0.005). However, coding support (p = 0.102) shows no significant difference, suggesting that repeated use of GenAI tools may influence some pedagogical dimensions more than others. Thus, the null hypothesis is rejected for idea generation, design refinement, and feedback and improvement, but not for coding support. This finding corroborates Mollick (2023), who emphasized that repeated interaction with generative AI improves learners' proficiency and ability to maximize higher-order learning opportunities.

Lastly, the findings indicate that there is no significant difference in the level of GenAI-integrated pedagogy when grouped according to the purpose of use, as all p-values exceeded the 0.05 level of significance, namely idea generation (p = 0.892), coding support (p = 0.874), design refinement (p = 0.843), and feedback and improvement (p = 0.783). This indicates that regardless of whether students used GenAI for coding, research, or design, their perceptions of GenAI integration remained largely similar. Therefore, the null hypothesis was not rejected, implying that intended use alone does not significantly influence pedagogical integration. This finding is supported by Kasneci et al. (2023), who argued that the effectiveness of AI in education depends more on instructional implementation than on the mere purpose for which the technology is used.

Problem 4. What is the quality of students' output in web design?

Table 9. ***Panel 1 Evaluation of the Quality of Students' Web Design Output***

Criteria	Mean	Verbal Description
Simplicity	2.00	Developing
Consistency	1.91	Developing
Color Scheme	1.88	Developing
Audience	1.66	Beginning
Structure/Navigation/Format	1.66	Beginning
Resource Documentation	1.60	Beginning
Overall Mean	**1.79**	**Developing**

Legend: *Above standard 3.26 – 4.00, Meet standard 2.51 – 3.25, Developing 1.76 – 2.50, Beginning 1.00 – 1.75*

The findings presented in Table 9 reveal that Panel 1 assessed the quality of students' web design work as at the Developing stage, with a mean score of 1.79. Of the six categories analyzed, three—simplicity (M=2.00), consistency (M=1.91), and color scheme (M=1.88)—were assessed as Developing, suggesting that students have attained some degree of competence in fundamental visual design components. On the other hand, the other three categories—audience consideration (M=1.66), structure/navigation/format (M=1.66), and resource documentation (M=1.60)—were assessed as Being, implying that students face challenges in areas that demand user-oriented and structural considerations.

The trend reveals that students are relatively confident in their ability to select aesthetically pleasing colors and maintain visual consistency. However, they have yet to grasp the underlying principles of web design. The literature indicates that the procedural use of GenAI in learning activities yields lower-level outcomes when no additional knowledge acquisition occurs. That assessment design must compel learners to reflect critically on AI outputs to achieve maximum gains (Pallant et al., 2026). This is exemplified in the low marks given to audience and navigation, implying that even AI-assisted production of material does not suffice for purposeful and thoughtful consideration.

Empirical studies on GenAI in design education by Rana et al. (2025) indicate that GenAI can only revolutionize creativity and critical thought if the learning environment treats learners not as recipients of knowledge but as co-creators of knowledge alongside AI. Based on insights from Panel 1, this ideal learning setting has yet to be achieved, thereby confining learners to basic levels of output.

Table 10. ***Panel 2 Evaluation of the Quality of Students' Web Design Output***

Criteria	Mean	Verbal Description
Simplicity	1.97	Developing
Consistency	1.88	Developing
Color Scheme	1.86	Developing
Audience	1.66	Beginning
Structure/Navigation/Format	1.70	Beginning
Resource Documentation	1.55	Beginning
Overall Mean	**1.77**	**Developing**

Legend: *Above standard 3.26 – 4.00, Meet standard 2.51 – 3.25, Developing 1.76 – 2.50, Beginning 1.00 – 1.75*

The findings in Table 10 are from the Panel 2 evaluation and have been compared with those of Panel 1, yielding an average of 1.77, indicating Development as well. Simplicity (M=1.97), consistency (M=1.88), and color scheme (M=1.86) continued developing, but audience (M=1.66), structure/navigation/format (M=1.70), and resource documentation (M=1.55) still rated as Beginning. The average score for resource documentation in this panel was 1.55, which is concerning, as it indicates students' inability to reference all the tools and materials they use when creating a website.

It is important to note that the results are consistent between the two evaluators, thereby strengthening the validity of the finding that the students are still at an early stage in their web design competency. In the research conducted by Jia et al. (2025), it was found that when students rely heavily on GenAI, the immediate gains from the shortcuts it provides may not reflect genuine acquisition of knowledge and skills. Moreover, heavy reliance on GenAI may impair students' ability to learn autonomously, think critically, and reason. This finding is particularly significant for low grades awarded for the documentation and structure aspects, as it clearly indicates a lack of actual skill acquisition.

Table 11. ***Panel 3 Evaluation of the Quality of Students' Web Design Output***

Criteria	Mean	Verbal Description
Simplicity	2.00	Developing
Consistency	1.95	Developing
Color Scheme	1.91	Developing
Audience	1.71	Beginning
Structure/Navigation/Format	1.70	Beginning
Resource Documentation	1.62	Beginning
Overall Mean	**1.82**	**Developing**

Legend: *Above standard 3.26 – 4.00, Meet standard 2.51 – 3.25, Developing 1.76 – 2.50, Beginning 1.00 – 1.75*

The unanimous agreement among all three panels that students' designs have not crossed the Developing phase is clear evidence of students' lack of proficiency in their web design projects. In a systematic literature review of studies between 2018 and 2024, Hon (2026) concluded that while there was mixed evidence about the effectiveness of GenAI in enhancing teaching processes, several of the studies noted limitations such as overdependence on AI and inconsistency in its effectiveness in various academic fields, thereby calling for more extensive longitudinal studies in this field. The fact that all three panels had consistent scores of Developing suggests an existing problem with how GenAI-assisted learning is integrated into web design education that needs improvement.

Overall, the assessment of the students' output has revealed a moderate level of quality across simplicity, consistency, coloring, audience, structure, and documentation. Although GenAI technology is used extensively worldwide, this level of achievement does not indicate any considerable improvement in output quality.

Regarding the DOI theory, one can state that this is due to the low observability of the improvements AI technologies provide. Indeed, although GenAI can create some content, it fails to provide any necessary improvement or enhancement to the content it creates. As such, the low likelihood of effective use of AI technologies is evident in the lack of feedback structures.

Table 12. ***Summary Table on the Evaluation of the Quality of Students' Web Design Output***

Evaluators	Mean Score	Verbal Description
Panel 1	1.79	Developing
Panel 2	1.77	Developing
Panel 3	1.82	Developing
Grand Mean	**1.79**	**Developing**

Legend: *Above standard 3.26 – 4.00, Meet standard 2.51 – 3.25, Developing 1.76 – 2.50, Beginning 1.00 – 1.75*

The summary of the quality of students' web design outputs as evaluated by the three experts is shown in Table 12 below. From the data analysis, the grand mean was 1.79, indicating "Developing." It means that the overall quality of the students' web design outputs was not yet fully satisfactory, and that improvements were still needed in their web design, including quality, execution, organization, and presentation. According to the Diffusion of Innovations Theory, although the use of GenAI tools was prevalent in the teaching-learning process, their adoption had not yet led to highly developed web design outputs by students.

From among the three panels, the highest mean score was obtained from Panel 3 at 1.82, while the lowest mean score was obtained from Panel 2 at 1.77. While there might be minor differences in how the panels scored the outputs, it is clear that the three panels assessed them as "Developing." This is evidence of a similar assessment by all three evaluators: while students exhibited the basic abilities necessary for good web design, they could not produce more advanced, sophisticated outputs.

The findings were consistent with the study by Sarwanti et al. (2024), which noted that, unless pedagogically well planned, the incorporation of artificial intelligence technologies would result only in superficial participation and not in analytical thinking among students. This view is also supported by Bai and Wang (2025), who emphasized that the success of using GenAI to enhance student learning depended primarily on the quality of interactions rather than merely on having GenAI technologies readily available. In other words, the present study's findings are consistent with the idea that moderate GenAI integration does not guarantee high-quality web design outputs.

In general, the findings indicated growing skills among students in web design; however, much more could still be done to develop creativity, usability, consistency, structure, and quality. According to the DOI Theory, the reasons for ineffective transfer of GenAI integration into students' work were linked to poor pedagogical alignment, inconsistent instruction delivery, and neglect of higher-level learning processes.

Problem 5. Is there a significant relationship between Gen AI-integrated pedagogy and students' web design output?

This is shown in Table 13 below, which presents the relationship between GenAI-integrated pedagogy and students' web design output according to the three expert panels. The results showed that all computed p-values exceeded the 0.05 significance level, indicating that none of the relationships were significant. In consequence, the null hypothesis was not rejected in all cases.

The computation in panel 1 shows that the following indicators were non-significant, with the corresponding r-value being -0.062 (p-value = 0.603) for idea generation; -0.123 (p-value = 0.302) for coding support; -0.045 (p-value = 0.708) for design refinement; and -0.109 (p-value = 0.358) for feedback and improvement. For panel 2, similar findings were observed, with p-values ranging from 0.326 to 0.735. Likewise, in panel 3, the findings were consistent, with the highest p-value recorded in design refinement, at p = 0.954. As shown, the computed r-values indicate very weak negative relationships. This finding implies that there was no significant relationship between the level of GenAI technology integration and output quality, as assessed by the indicators stated above.

Table 13. ***Relationship Between Gen AI-integrated Pedagogy and the Students' Output in Web Design***

Panel	GenAi Integrated Pedagogy	*r-value*	*p-value*	Interpretation	Decision
Panel 1	Idea generation	-0.062	0.603	Failed to Reject Ho	Not Significant
	Coding support	-0.123	0.302	Failed to Reject Ho	Not Significant
	Design refinement	-0.045	0.708	Failed to Reject Ho	Not Significant
	Feedback & improvement	-0.109	0.358	Failed to Reject Ho	Not Significant
Panel 2	Idea generation	-0.040	0.735	Failed to Reject Ho	Not Significant
	Coding support	-0.117	0.326	Failed to Reject Ho	Not Significant
	Design refinement	-0.059	0.618	Failed to Reject Ho	Not Significant
	Feedback & improvement	-0.081	0.494	Failed to Reject Ho	Not Significant
Panel 3	Idea generation	-0.035	0.767	Failed to Reject Ho	Not Significant
	Coding support	-0.069	0.561	Failed to Reject Ho	Not Significant
	Design refinement	-0.007	0.954	Failed to Reject Ho	Not Significant
	Feedback & improvement	-0.055	0.644	Failed to Reject Ho	Not Significant

***Correlation @ 0.05 (two-tailed)**.

According to the Diffusion of Innovation (DOI) Theory, the results show that even the adoption and use of GenAI alone did not significantly improve students' outcomes. According to the DOI Theory, innovation is productive and successful only when it is integrated into practice and aligned with learning goals. In the current study, GenAI served as an auxiliary means of completing tasks and was not used to promote learning, creativity, and critical thinking, or to improve outcomes consistently.

The results were consistent with the research of Sarwanti et al. (2024), which showed that the lack of proper planning could turn AI technologies into mere encouragement of surface-level involvement rather than critical thinking. Furthermore, according to Bai and Wang (2025), the success of GenAI integration depended heavily on the level of interaction and instructional integration rather than on the tool's usage or availability. The results were also congruent with those of Opre (2021), who noted that the importance of integrating technology lies in its alignment with pedagogical practices.

In conclusion, the study shows that, despite the successful integration of GenAI into the teaching process, it does not have a profound effect on the quality of students' results. The findings underscore the need to use appropriate GenAI strategies in web design to enhance the quality of the final product. In other words, successful integration requires moving from simple technology implementation to developing cognitive skills and continuously improving outcomes.

Problem 6. Based on the findings of the study, what guidelines for responsible AI usage on web design courses may be proposed?

1. Integrate GenAI within structured instructional design.
   Based on the research findings, incorporating Generative Artificial Intelligence (GenAI) into web design classes requires an organized, results-driven, and learning-oriented approach. The recommendations below arise directly from the findings provided in Tables 3-13:
   - Clearly defined AI-related learning objectives
   - Lesson plans with guided AI activities

- AI-integrated laboratory exercises
- Rubrics for evaluating AI-assisted outputs
- Alignment of AI use with course outcomes
- Instructor supervision during AI-assisted tasks
- Policies on acceptable and unacceptable AI usage

2. Use GenAI as a cognitive support tool rather than a replacement for learning.
   Merge GenAI in structured instructional design. This recommendation arises from the neutrality of GenAI-infused pedagogy in idea generation, coding assistance, and design improvement (Tables 3-5). From this, it is clear that there is some use of AI, but it is not embedded in the course. From this, it can be deduced that, without structuring its utilization, learning will be inconsistent. Below are the components that need to be observed:
   - Activities requiring student explanation of AI-generated outputs
   - Reflection papers or process documentation
   - Manual coding and design exercises alongside AI use
   - Critical thinking and problem-solving tasks
   - Instructor questioning and validation activities
   - Limits on fully AI-generated submissions
3. Promote continuous improvement through feedback and revision processes.
   Category GenAI as a cognitive support instrument, and not a replacement. With high utilization frequencies (Figure 6) and no difference across textual software types and purposes of use (Tables 7 & 12), it becomes clear that merely using GenAI does not contribute to learning. From this, it can be concluded that students utilize GenAI often but ineffectively. These elements need to be considered:
   - Iterative design activities
   - Peer-review sessions
   - AI-assisted revision exercises
   - Draft-and-revision submission system
   - Instructor feedback checkpoints
   - Reflection journals documenting improvements
   - Evaluation of revisions, not only final outputs
4. Develop students' analytical and evaluative skills.
   Promote continuous improvement through feedback and improvement processes. This suggestion is heavily based on the low degree of integration between feedback and improvement (Table 6) and the existence of disagreement responses to refinement questions. It reflects students' lack of participation in the improvement process, which is very important in design-based learning. These factors need to be considered:
   - Error detection and debugging exercises
   - Website evaluation and critique activities
   - Comparative analysis of AI-generated and student-made outputs
   - Testing and validation tasks
   - Research-based justification of design choices
   - Case studies involving ethical and functional issues

   Problem-based learning activities
5. Uphold academic integrity and ethical AI usage.
   Foster students' analytical capabilities. According to the study results, GenAI is mainly used for coding and research (Figure 8), but not for analysis (Figure 9). In addition, the application of image generators had little effect (Table 10). Hence, students are dependent on AI for production rather than evaluation. These elements need to be considered:
   - Institutional AI usage policy
   - Guidelines for citing AI-generated content
   - Academic honesty orientation sessions
   - AI disclosure statements in student submissions

- Discussions on copyright, plagiarism, and bias
- Ethics modules integrated into coursework
- Monitoring mechanisms for misuse of AI tools

6. Encourage diversified and purposeful use of AI tools.
   Maintain ethics and integrity. Given the predominance of a single platform (ChatGPT) and the high frequency of AI application use (Figures 2 and 6), students tend to be dependent on a single technology. Thus, they may submit works created with AI's help without mentioning it. The findings inform the following suggestions:
   - Exposure to multiple AI platforms and applications
   - Comparative tool evaluation activities
   - Training on selecting appropriate AI tools
   - Activities involving text, code, and image generators
   - Tool-specific demonstrations and workshops
   - Balanced use of AI and traditional design methods
   - Performance evaluation across different AI tools
7. Establish monitoring and quality assurance mechanisms.
   Encourage diversified engagement with AI tools. From the varied use of code- and image-generating tools (see Figures 3 and 4) and the large discrepancy between code-generation processes and usage frequencies (see Tables 9 and 12), it is evident that learning achievement is inconsistent depending on how the tools were utilized. Therefore, not all AI tools and ways of using them provide the same learning benefits. Below are the components that need to be observed:
   - Standardized rubrics for AI-assisted outputs
   - Portfolio-based assessment
   - Progress monitoring and consultations
   - Documentation of student design processes
   - Performance tracking systems
   - Instructor review and validation procedures
   - Feedback collection from students and evaluators
8. Provide faculty training.
   Ensure monitoring and quality control. The general results, particularly the lack of a strong association between AI tool use and output quality (see Problem 5), suggest that the present methods are insufficient to ensure improved learning. Below are the necessary Seminar and Workshop Topics for Responsible AI Integration:
   - Introduction to Generative Artificial Intelligence (GenAI) in Education
     - Overview of AI concepts and applications
     - Functions and limitations of GenAI tools
     - Current trends in AI-assisted teaching and learning
   - AI-Integrated Pedagogy for Web Design Courses
     - Strategies for integrating AI into lesson planning
     - Designing AI-assisted classroom activities
     - Balancing AI use with student-centered learning
   - Prompt Engineering and Effective AI Usage
     - Creating effective prompts for coding and web design
     - Improving AI-generated outputs through prompt refinement
     - Evaluating the accuracy and relevance of AI responses
   - Ethical and Responsible AI Usage
     - Academic integrity and plagiarism prevention
     - Proper disclosure and citation of AI-generated content
     - Addressing bias, misinformation, and overreliance on AI
   - Assessment and Evaluation of AI-Assisted Outputs
     - Developing rubrics for AI-integrated projects

    - Assessing originality, creativity, and technical skills
    - Monitoring student learning despite AI assistance
- AI Tools for Web Design and Development
    - Training on coding assistants and AI design tools
    - Demonstrations of text, image, and code generators
    - Comparison of different AI platforms and applications
- Cybersecurity and Data Privacy in AI Usage
    - Safe handling of student and institutional data
    - Privacy risks in AI platforms
    - Responsible sharing of AI-generated content
- Research and Innovation in AI-Enhanced Education
    - Emerging practices in AI-assisted teaching
    - Classroom-based action research on AI integration
    - Continuous improvement of AI-supported instruction
- Technical Capability Enhancement
    - Hands-on workshops in HTML, CSS, JavaScript, and AI-assisted coding
    - Troubleshooting AI-generated code
    - Integrating AI tools into existing learning management systems
- Policy Orientation and Institutional Compliance
    - Institutional guidelines for AI usage
    - Standard procedures for responsible AI implementation
    - Faculty roles and responsibilities in AI governance

In summary, these principles show that even though GenAI technology was frequently employed, its educational significance is insignificant unless accompanied by a systematic pedagogical approach, learning process, and governance, thus proving that the success of these technologies lies not in their frequency of use but in their application.

Conclusions

From the results of the experiment, the following conclusions were made:

1. The students primarily utilized GenAI tools for productivity-related purposes such as idea generation, coding, research, and content organization rather than for reflective learning, evaluation, and continuous output improvement. The findings revealed that while learners frequently integrated GenAI into task completion, its use in feedback and refinement processes remained limited. Hence, GenAI served more as a facilitative tool for efficiency than as a mechanism for deeper learning and iterative improvement.
2. The level of GenAI-integrated pedagogy in web design courses remained at a moderate level, as reflected by the overall grand mean of 2.68, interpreted as “Neutral” or “Average.” The findings suggested that GenAI integration was evident in idea generation, coding support, and design refinement but remained weak in feedback and improvement. Thus, GenAI had not yet been fully integrated into instructional practices that promote higher-order thinking and deeper engagement in learning.
3. Significant differences in the level of GenAI-integrated pedagogy were observed only in selected variables, particularly code generation tools and frequency of use. At the same time, most dimensions yielded no statistically significant differences. This implies that the availability and use of GenAI tools alone do not necessarily improve pedagogical integration. Therefore, the effectiveness of GenAI in instruction largely depends on how well these tools align with learning objectives and pedagogical goals.
4. The quality of students’ web design outputs was at the “Developing” level, with a grand mean of 1.79 based on the evaluation of the three expert raters. The findings indicated that students’ outputs still showed limitations in areas such as usability, creativity, consistency, organization, and

overall quality despite the use of GenAI tools. Hence, the quality of outputs remained dependent on learners' critical thinking, refinement, and application of web design principles.

5. There was no statistically significant relationship between GenAI-integrated pedagogy and the quality of students' web design outputs, as all computed p-values exceeded the 0.05 level of significance. This finding suggested that increased integration or utilization of GenAI did not automatically translate into improved student performance or output quality. Therefore, technology adoption alone was insufficient to ensure effective instruction and meaningful learning outcomes.
6. Responsible AI usage guidelines in web design courses are necessary to ensure the ethical, purposeful, and pedagogically sound integration of GenAI in instruction. The findings highlighted the need for structured policies and instructional strategies that encourage students to use GenAI not only for productivity but also for critical thinking, feedback use, creativity, and the continuous improvement of their outputs. Thus, the proposed guidelines may serve as a framework for promoting responsible and effective AI integration in web design education.

Recommendations

From the findings and conclusions of this study, the following recommendations are made:

Academic Administrators. They shall institute policies and practices that foster the responsible, ethical, and effective use of GenAI in learning institutions. The policy considerations must encompass issues of academic integrity and the disclosure of AI-enabled outputs. In addition, capacity-building activities through faculty development programs and training workshops on integrating AI into instruction and assessment must be instituted within institutions.

Faculty Members. They shall incorporate more structured, targeted instructional methods when introducing GenAI in web design classes. Teachers should incorporate learning exercises that prompt students to analyze and refine GenAI's output rather than relying solely on its production capabilities. There should be more focus on improving simplicity, coherence, color combinations, audience relevance, formatting/structure/navigation, and resource sourcing to improve the outcomes of students' work. Faculty members should encourage reflection, creativity, and critical thinking to ensure GenAI serves as an educational tool, not only a productivity tool.

Students. The students shall utilize the technology as a supportive means for learning, creativity, and skill development rather than relying on it to replace effort and cognitive processes. Students should participate in efforts to polish their work to ensure it is usable, original, well-designed, and suitable for their target audience. Ethical and responsible use of AI technologies, especially avoiding overreliance on them, must be practiced by students throughout the process.

Future researchers. Future researchers may study the long-term effects of technology on other educational fields. The causal relationship between AI technology integration and output needs to be investigated. Researchers shall also examine how technology affects the usability, creativity, attractiveness, and user experience of web design.

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