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How Do Generative AI Usage and Academic Discipline Influence Perceived Limitations and Acceptance Among Senior High School Students?

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ABSTRACT

BACKGROUND & CONTEXT

The increasing use of generative AI (GenAI) tools such as ChatGPT in education has introduced both opportunities and challenges for adolescent learners. While research on GenAI adoption in higher education is growing, little is known about how secondary students perceive these technologies, especially in Southeast Asia. In the Philippines, where digital transformation in education is accelerating, understanding students' awareness of GenAI limitations is essential to ensure responsible and informed use.

PURPOSE OR GOAL

This study examined how Filipino senior high school students perceive the limitations of GenAI and how these perceptions influence their acceptance of such tools. Guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), it investigated whether students' frequency of GenAI use and academic discipline (STEM vs. non-STEM) affect their awareness and acceptance. The study also explored whether greater awareness of GenAI's limitations correlates with higher levels of acceptance.

APPROACH OR METHODOLOGY

A cross-sectional survey was administered to 100 students in a highly digitized private school in Manila. Instruments measuring GenAI acceptance and awareness of its limitations showed strong reliability. Nonparametric tests were used due to non-normal data distributions.

OUTCOMES

No significant differences were found based on usage or discipline. However, a statistically significant moderate positive correlation ($\rho = .399$, $p < .001$) was observed between limitation awareness and acceptance.

CONCLUSIONS

Findings underscore the importance of integrating critical GenAI literacy into the curriculum. Awareness of limitations enhances, rather than hinders, acceptance, supporting responsible student engagement with AI.

KEYWORDS

Generative AI, Technology Acceptance, Critical Digital Literacy.

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Introduction

The emergence of generative artificial intelligence (GenAI) tools, such as ChatGPT, Gemini, and Microsoft Copilot, is rapidly transforming how students interact with information, perform academic tasks, and engage in learning environments. These technologies promise increased personalization, productivity, and creativity in educational settings (Ahmed et al., 2024; Giannakos et al., 2024). However, their integration also introduces significant challenges, including concerns about ethical use, academic integrity, and erosion of critical thinking, especially among adolescents who are still developing evaluative and reflective competencies (Higgs & Stornaiuolo, 2024; Chan & Lee, 2023).

While considerable research has explored GenAI adoption in higher education and specialized fields, such as medical and engineering education (Bahroun et al., 2023; Chen et al., 2023), comparatively little is known about how students in secondary education perceive GenAI. Even fewer studies have considered specific learner characteristics such as academic discipline (e.g., STEM and non-STEM) and frequency of use, which affect students' understanding of GenAI's limitations and their openness to using such tools (Avci, 2024; Oc et al., 2024). This gap is particularly evident in the Southeast Asian context, like the Philippines, where digital transformation in basic education has accelerated in recent years, yet empirical evidence to guide localized, ethical, and equitable AI integration remains limited (Espinosa et al., 2023)

Addressing this gap, this study investigates how Filipino senior high school students perceive the limitations of GenAI and how this perception correlates with their willingness to adopt these technologies. Informed by the Unified Theory of Acceptance and Use of Technology (UTAUT), this study introduces awareness of GenAI limitations, such as inaccuracy, bias, and lack of human sensitivity, as a contextual factor to acceptance.

This study offers multiple contributions. Theoretically, it extends the UTAUT model to better account for the awareness of the limitations of GenAI use among adolescent learners. Practically, it provides educators, administrators, and policymakers with evidence-based insights for designing GenAI education initiatives that go beyond access and adoption to emphasize critical AI literacy. As AI tools continue to be introduced into classrooms, especially in low- and middle-income countries, this research underscores the need for inclusive, context-sensitive strategies that empower diverse learners to navigate the digital world with discernment and responsibility.

Theoretical Framework

This study is based on the Unified Theory of Acceptance and Use of Technology (UTAUT) as its theoretical foundation to examine high school students' acceptance of generative AI technologies. Initially developed by Venkatesh et al. (2003), the UTAUT framework integrates four core determinants of technology acceptance, namely, performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs have been widely validated across educational and technological contexts and are especially relevant when analyzing how individuals make adoption decisions in response to emerging technologies.

To address the unique challenges GenAI presents to adolescent users, this study proposes a theoretical extension to UTAUT by introducing a new contextual construct: awareness of GenAI limitations. These limitations include (1) difficulty with complex tasks, (2) the potential to generate factually inaccurate or contextually inappropriate content, (3) susceptibility to algorithmic bias, (4) statistical overgeneralizations, and (5) lack of emotional intelligence. These limitations are especially consequential for secondary students, whose metacognitive and critical literacy skills are still developing and who may struggle to evaluate AI-generated outputs without adequate guidance (Chan & Hu, 2023).

Incorporating awareness of GenAI's limitations into UTAUT as an antecedent to acceptance emphasizes functionality with an ethical dimension rooted in critical digital literacy. Rather than

seeing technology adoption solely as a function of usefulness or ease of use, this framework recognizes the role of reflective understanding in shaping responsible and sustainable engagement with emerging technologies.

In the Philippine setting, where students face disparities in access to digital infrastructure and where AI education is still emerging (DepEd Order No. 21, 2019; Fabito et al., 2020), extending the UTAUT framework in this way offers both theoretical refinement and context-sensitive relevance for the Global South. It is particularly relevant for informing policy and practice in schools where students may be exposed to GenAI tools before receiving formal instruction on their limitations or ethical implications. This study will not only contribute to theoretical advancement but also set the stage for designing inclusive and future-ready AI education policies in resource-diverse settings by embedding critical awareness within a widely used adoption model.

Research Questions

RQ1: Do students' perceptions of GenAI limitations significantly differ based on their frequency of use and academic discipline (STEM vs. non-STEM)?

RQ2: Do students' acceptance of GenAI differ significantly based on their academic discipline?

RQ3: Is there a significant relationship between students' awareness of GenAI limitations and their acceptance of the technology?

Research Hypotheses

H1: There is no significant variation in students' understanding of GenAI limitations based on their frequency of use.

H2: Students from STEM and non-STEM disciplines do not significantly differ in their level of knowledge regarding the GenAI limitations.

H3: There is no significant difference in GenAI acceptance between students from the STEM and non-STEM disciplines.

H4: Students' knowledge of the limitations of Generative AI is not significantly correlated with their level of acceptance of the technology.

Methods

Research Design

This study employed a cross-sectional quantitative survey design to explore senior high school students' perceptions of GenAI limitations and their acceptance of such technologies. This design was chosen to facilitate the comparison of perceptions across different groups, specifically by frequency of use and academic discipline, at a single point in time, thereby enabling group-level analysis without requiring longitudinal data collection.

Participants and Context

The study was conducted in a private senior high school in Manila, Philippines, which was selected for its active implementation of digital technologies across various academic disciplines. A total of 100 Grade 11 and 12 students (ages 16–19) participated, including 57 females and 43 males. Participants were drawn from both STEM (n = 53) and non-STEM (n = 47) tracks.

A convenience sampling method was used due to practical constraints, including class availability and administrative access. While this limits generalizability, the site was purposefully chosen to reflect an environment with sustained exposure to educational technologies, thus maximizing relevance for a study on GenAI engagement.

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Instruments

Two instruments were used to assess the main variables of interest. The GenAI Acceptance Scale, a 20-item tool adapted from Yilmaz et al. (2023), measured four constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT): performance expectancy, effort expectancy, social influence, and facilitating conditions. Participants responded using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), and the instrument demonstrated excellent internal consistency (Cronbach's $\alpha = .961$). To measure students' awareness of GenAI limitations, the questionnaire was adapted from Chan and Hu (2023) and consisted of six items that assessed their understanding of GenAI limitations, including issues such as factual inaccuracy, algorithmic bias, statistical overgeneralization, and a lack of contextual or emotional nuance. This scale also used a 5-point Likert format and showed high reliability (Cronbach's $\alpha = .922$).

Procedure and Ethics

Data were collected through an online survey administered using Google Forms. Before participating, students reviewed an informed consent form that explained the study's objectives, the voluntary nature of participation, data privacy protections, and potential risks involved. For participants under 18 years of age, written consent was obtained from their parents or guardians.

Respondents were informed of their right to discontinue participation at any time without consequence. All collected data were anonymized and securely stored with restricted access to the principal investigator. The research protocol adhered to the institution's ethical guidelines, including a data retention policy of three years, after which all records will be deleted.

Data Analysis

All statistical analyses were performed using Jamovi (version 2.6.17). Preliminary tests for normality (Shapiro-Wilk) and homogeneity of variances (Levene's test) indicated violations of normal distribution for both GenAI limitation awareness ($p < .001$) and acceptance variables ($p = .027$), prompting the use of nonparametric methods. To address the research questions, the Kruskal-Wallis H test was employed to examine differences in limitation awareness across usage frequency groups, while the Mann-Whitney U test compared STEM and non-STEM students. The Mann-Whitney U test was also used to assess differences in GenAI acceptance by academic disciplines. Lastly, Spearman's rank-order correlation was conducted to determine the relationship between students' awareness of GenAI limitations and their acceptance of the technology. Effect sizes were reported using epsilon-squared (ε^2) for Kruskal-Wallis, rank-biserial correlation (r) for Mann-Whitney U, and ρ for Spearman's correlation.

Results

This section presents both descriptive and inferential statistics addressing the study's three research questions. All tests were conducted using nonparametric methods, given the violation of normality assumptions for both the GenAI limitation awareness and acceptance variables. Effect sizes accompany p-values to support the interpretation of practical significance.

RQ1: Do students' perceptions of GenAI limitations significantly differ based on their frequency of use and academic discipline (STEM vs. non-STEM)?

Table 1. Result of the Kruskal-Wallis H test on students' knowledge of GenAI limitations based on usage frequency

Group	N	Mean	Median	IQR	χ^2	df	p	ε^2
Always	11	3.80	4.33	1.00	5.12	3	0.163	0.0517
Often	41	3.88	4	0.83				
Sometimes	41	3.64	3	1.33				
Rarely	7	3	3.67	1.17				

Note. *No participants selected the "Never" option (n = 0)*

Table 1 presents the results of the Kruskal-Wallis H test, which assesses differences in students' perceived knowledge of GenAI limitations based on their frequency of GenAI usage. The analysis revealed no statistically significant differences in students' perceived knowledge of GenAI limitations across groups defined by usage frequency, $\chi^2(3) = 5.12$, $p = .163$. The effect size ($\varepsilon^2 = .0517$) was small, indicating minimal practical differences between the groups.

Table 2. Result of the Mann-Whitney U test on students' knowledge of GenAI limitations based on academic discipline

Group	N	Mean	Median	SD	Statistic	p	Effect Size
STEM	53	3.59	3.67	0.974	1014	0.109	-0.186
Non-STEM	47	3.85	4.00	0.931			

Table 2 summarizes the Mann-Whitney U test comparing STEM and non-STEM students on their awareness of GenAI limitations. The difference was not statistically significant ($U = 1014$, $p = .109$), with non-STEM students having a slightly higher median score (4.00) than STEM students (3.67). The effect size ($r = -0.186$) suggests minimal practical significance.

RQ2: Do students' acceptance of GenAI differ significantly based on their academic discipline?

Table 3. Result of the Mann-Whitney U test on students' GenAI acceptance based on academic discipline

Group	N	Mean	Median	SD	Statistic	p	Effect Size
STEM	53	69.9	72.0	15.6	1082	0.260	-0.131
Non-STEM	47	73.9	75.0	16.0			

Table 3 details the Mann-Whitney U test results on GenAI acceptance between academic tracks. Although non-STEM students reported a slightly higher median score (75.0) than STEM students (72.0), the difference was not statistically meaningful ($U = 1082$, $p = .260$). The effect size ($r = -0.131$) was negligible.

RQ3: Is there a significant relationship between students' awareness of GenAI limitations and their acceptance of the technology?

Table 4. Result of the Spearman's rho correlation on students' GenAI acceptance and knowledge of its limitations

		Knowledge of GenAI Limitation
Gen AI Acceptance	**Spearman's rho**	0.399
	df	98
	p-value	<.001

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Table 4 presents the results of Spearman's rho correlation analysis. Correlation analysis revealed a significant, moderate positive relationship between students' knowledge of GenAI limitations and their acceptance of GenAI technologies ($\rho = 0.399$, $p < .001$).

Discussion

This study examined how Filipino senior high school students perceive the limitations of generative AI (GenAI) and how these perceptions relate to their acceptance of such technologies. By extending the UTAUT framework to include limitation awareness as a contextual antecedent, the study addressed both conceptual and empirical gaps in adolescent-centered technology acceptance research, particularly within Global South educational settings.

Challenging Assumptions About Exposure and Literacy

Contrary to prevailing assumptions, the data revealed no significant differences in students' awareness of GenAI limitations based on usage frequency. This finding suggests that frequent interaction with AI tools does not automatically cultivate a deeper understanding, a concern echoed in previous studies that warn of superficial or instrumental GenAI use among adolescents (Chan & Hu, 2023; Yilmaz et al., 2023). These results highlight a crucial implication for educators: access alone is insufficient. Without explicit instruction on AI ethics and functionality, even digitally fluent students may remain unaware of the limitations of GenAI.

Similarly, the absence of significant differences between STEM and non-STEM students in both limitation awareness and acceptance challenges common beliefs about disciplinary advantages in technological engagement. While STEM students are often presumed to be more technologically literate (Thongsri et al., 2019; Das & Bhattacharyya, 2023), this study's findings support the view that critical GenAI literacy must be explicitly taught, rather than presumed to arise from disciplinary connections or technical exposure. Moreover, this finding may be explained by recent national curricular reforms (DepEd Order No. 21, 2019), which emphasize the cross-disciplinary integration of digital competencies, potentially equalizing exposure across academic disciplines. Such reforms may have begun to narrow the gap in technological awareness and access to digital tools across academic disciplines (Cabasan, 2024). Another possible explanation is the increasingly homogenous technology adoption across disciplines, especially among digital-native student cohorts (Thompson, 2013). In the Philippine setting, the widespread integration of educational technology, both during and following the pandemic, has normalized the use of digital tools in classrooms across all academic disciplines. Thus, acceptance may reflect broader exposure to GenAI through both formal and informal learning channels, rather than discipline-specific experiences.

Critical Awareness as a Driver of Responsible Adoption

The most theoretically significant finding was the moderate, statistically significant correlation between limitation awareness and GenAI acceptance. Rather than inhibiting interest in AI tools, students who better understood the constraints of GenAI appeared more open to using them. This challenges simplistic assumptions that critical perspectives reduce enthusiasm for innovation. Instead, it aligns with the emerging consensus that informed users are more likely to adopt technology responsibly, with realistic expectations (Yi & Choi, 2023; Choung et al., 2022; Venkatesh & Bala, 2008)

This supports the study's central theoretical claim: embedding critical literacy into UTAUT, especially for adolescent users navigating novel, powerful technologies.

Implications for Educational Practice

These findings reinforce the urgent need to move beyond exposure-focused AI rollouts and toward curriculum-embedded digital literacy instruction. Teaching students explicitly about bias, misinformation, and algorithmic limitations can not only improve ethical reasoning but

may also foster more meaningful, intentional engagement with GenAI tools (Veldhuis et al., 2024; Ruiz et al., 2024). For instance, lateral reading strategies produce measurable gains in students' accuracy when evaluating online information (Brodsky et al., 2021; McGrew, 2024). Likewise, case-based ethical reasoning with structured argumentation and formative assessment tied to explicit ethical outcomes has improved the quality of engineering students' ethical analyses in course tasks (Jonassen et al., 2009; Keefer et al., 2014). Together, such targeted interventions offer a more intentional pathway for developing the critical literacy essential for responsible AI use in education and beyond.

Limitations

Despite offering meaningful contributions to the understanding of generative AI (GenAI) perceptions and acceptance among Filipino senior high school students, this study is subject to several limitations. First, the cross-sectional design precludes causal interpretations between students' awareness of GenAI limitations and their acceptance of the technology. Second, the sample was drawn from a single private institution in Manila with advanced digital infrastructure. While this context was purposefully selected, it may not reflect the realities of students in public or rural schools, where access to GenAI technologies and pedagogical support may differ markedly. The use of convenience sampling further constrains the generalizability of the findings. Third, the reliance on self-report instruments introduces the possibility of response biases, including social desirability and overestimation of one's actual understanding or acceptance. Lastly, the study focused solely on student perceptions, omitting influential factors such as teacher practices, institutional policies, parental attitudes, or socioeconomic disparities that may mediate or moderate GenAI engagement.

Recommendations for Future Research

Future investigations should consider longitudinal and mixed methods approaches to gain a deeper and more dynamic understanding of how students' perceptions and use of GenAI evolve. While the current study provides a useful snapshot, extended timelines and the inclusion of qualitative methods could offer richer insight into student attitudes and experiences. Expanding the scope of participants is also important. Future studies should include students from public schools, remote communities, and socioeconomically diverse backgrounds. This would help uncover how disparities in infrastructure, teacher support, and resource availability affect students' digital engagement and AI literacy. Another promising direction is to examine the role of teachers and school administrators in facilitating or hindering GenAI integration. Understanding how educators perceive and model responsibility for GenAI use could offer practical strategies for scaling ethical AI instruction. Additionally, discipline-specific investigations may also prove valuable. By comparing how GenAI is used in subjects like mathematics, literature, and the arts, researchers can explore whether pedagogical norms influence how students approach AI tools. Lastly, future work should focus on designing and testing educational interventions aimed at strengthening students' critical digital literacy. For instance, lesson modules on AI bias, misinformation, and algorithmic limitations could be experimentally tested to assess their impact on both awareness and responsible tool use.

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