

**JOURNAL OF INFORMATION
SYSTEM AND TECHNOLOGY
MANAGEMENT
(JISTM)**www.gaexcellence.com/jistm**GENERATIVE ARTIFICIAL INTELLIGENCE IN HIGHER
EDUCATION: A CONCEPTUAL FRAMEWORK LINKING
UTAUT, SELF-EFFICACY, AI BEHAVIOURAL USE, AND
ACADEMIC PERFORMANCE**

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Article Info:**Article history:**

Received date: 27.07.2026

Revised date: 20.08.2026

Accepted date: 24.09.2026

Published date: 30.09.2026

Abstract:

The widespread use of Generative Artificial Intelligence (GenAI)-based tools like ChatGPT, Copilot, and Gemini has revolutionised the higher education system in Malaysia and abroad. Although there have been many examples of such approaches employed to support the teaching and learning experience, little attention is paid to how these adoption patterns influence the acceptance behaviours and internal psychological

To cite this document:

Yahya, K. N., Gizip, I. A., Monil, M., Shah, F. M., Bakrin, S. S., Hamzah, A. A., Bernard, D. A. P., & Mohamad, Z. (2026). Generative Artificial Intelligence in Higher Education: A Conceptual Framework Linking UTAUT, Self-Efficacy, Ai Behavioural Use, And Academic Performance. *Journal of Information System and Technology Management*, 11 (44), 938-951.

variables of students and their academic impact. In this paper, we develop a theoretical framework that integrates the Unified Theory of Acceptance and Use of Technology (UTAUT) and Self-Efficacy Theory to investigate what factors drive AI Behavioural Use and how they can mediate the relationship between AI Behavioural Use and Academic Performance. To validate this framework, a future empirical testing plan is proposed using a quantitative cross-sectional design involving 400 undergraduate students across public higher education institutions in Kota Kinabalu, Sabah, with data to be analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS 4.0. The proposed model establishes a direct pathway of Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, and Self-Efficacy to AI Behavioural Use and an indirect route to Academic Performance. To this end, this study seeks to bridge the intention-behaviour gap in educational technology research, providing valuable ideas for institutional policy development, pedagogical strategy planning, and equitable distribution of digital resources within regional educational systems.

DOI: 10.35631/JISTM.1144055

Keyword:

Generative Artificial Intelligence, UTAUT, Self-Efficacy, AI Behavioural Use, Academic Performance, Public Higher Education, Sabah



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Introduction

Generative Artificial Intelligence (GenAI) refers to advanced computational architectures such as large language models (LLMs) including ChatGPT, Copilot, and Gemini capable of generating text, code, and analytical insights through natural language prompting. Public higher education institutions (HEIs) continue to be a vital component of Sabah's socio-economic platform, providing employment, skilled talent delivery, as well as development implementation underpinning intellectual capital and services to other sub-sectors such as technology, governance, and corporate infrastructure. The size of the higher education ecosystem in the state capital, Kota Kinabalu, is extensive, with major public campuses including Universiti Malaysia Sabah (UMS), Universiti Teknologi MARA (UiTM) Sabah Branch, and Politeknik Kota Kinabalu (PKK) catering to tens of thousands of youths carrying direct state academic interests (The Borneo Post, 2025). Examining GenAI adoption within the Sabah higher education context is particularly vital due to its unique regional digital infrastructure constraints and rich demographic diversity. While national digital economy initiatives expand rapidly, local educational environments reflect heterogeneous readiness profiles. For instance, the Malaysia Productivity Corporation (2024) highlighted a significant regional disparity, showing that only 40% of educational and public cohorts in Sabah had received formal training in advanced digital technologies compared to 68% in Peninsular

Malaysia. Furthermore, labor-market statistics indicate heightened youth unemployment in Sabah reaching 7.9% in Q4 2024 and 6.2% in Q2 2025 against the national average of 3.0% (Department of Statistics Malaysia, 2024, 2025). These regional disparities and performance pressures underscore an urgent need to examine how undergraduates in developing regional ecosystems adapt their study habits and utilize emergent AI tools to maintain scholastic effectiveness.

Despite growing interest in educational technology, a significant explanatory gap remains in the existing GenAI literature regarding student-level academic performance. Prior GenAI studies have predominantly focused on direct adoption intentions or broad technological acceptance using the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, often treating actual usage behaviour merely as an outcome variable rather than an underlying explanatory mechanism. However, previous research has not adequately addressed how students' internal psychological capabilities specifically self-efficacy interacts with structural technology acceptance factors to drive actual AI behavioural use, nor how this actual behavioural engagement translates into both task and contextual academic performance. To address these limitations, this study aims to develop an integrated framework explaining the factors influencing students' AI behavioural use and its relationship with academic performance.

To provide a robust theoretical explanation, this conceptual paper integrates the Unified Theory of Acceptance and Use of Technology (UTAUT) with Self-Efficacy Theory. While UTAUT constructs (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions) account for external, structural, and environmental technology expectations, Self-Efficacy Theory (Bandura, 1997) captures the internal psychological confidence required to navigate complex, non-linear, and prompt-dependent conversational AI tools. Combining these frameworks explains not only whether the environment and infrastructure support AI adoption, but also whether students possess the cognitive confidence to experiment, iterate, and persist with AI platforms when facing ambiguous academic tasks.

By repositioning Generative AI (GenAI) Behavioural Use as an individual-level adjustment mechanism, the proposed framework models AI Behavioural Use as a mediator connecting technology acceptance factors and self-efficacy to academic performance. The framework expands the conceptualization of this framework extends educational performance conceptualization by defining academic performance across two distinct domains: task performance (core assignment execution and grading) and contextual performance (collaborative knowledge sharing and proactive problem-solving). To this end, this paper makes three key contributions:

- it proposes an integrated explanatory model that incorporates structural technology expectations (UTAUT factors), individual psychological capability (self-efficacy), and environmental technology context within one student-level framework
- it specifies GenAI Behavioural Use as a proximal, mechanism-based mediating pathway through which these determinants influence scholastic outcomes under modern academic pressures, and
- it offers a comprehensive conceptual blueprint to guide future empirical validation involving 400 undergraduate students across public HEIs in Kota Kinabalu using Partial Least Squares Structural Equation Modelling (PLS-SEM).

Literature Review

Definition of Academic Performance

Academic performance is a multidimensional construct, usually comprising task performance as well as contextual performance. Task performance refers to a student's effectiveness in performing core academic functions, such as completing graded assignments, sitting exams, and obtaining required GPA outputs, whereas contextual performance refers to their non-core behaviours that underlie the institutional social, psychological, and coordination infrastructure, such as peer cooperation, learning initiative, and change-supportive academic behaviour (Borman & Motowidlo, 1993, 1997; Organ, 2018). Such differentiation is important when considering transformations around learning tasks in digitally advancing universities, as academic workflows are often re-designed through online learning systems and automated data-driven platforms, and successful academic execution often depends on contextual contributions to performance, including peer knowledge sharing, mutual helping, and proactive problem-solving. Conventional frameworks, therefore, consider performance as a set of observable learning behaviours rather than a strict exam-based index alone, and stress the benefits of measuring core execution and collaborative academic performance as a combined act (Koopmans et al., 2011). To address measurement ambiguity, this study explicitly defines Academic Performance as perceived academic performance (evaluating self-reported learning effectiveness, perceived quality of core study outputs, and subjective scholastic achievements) alongside contextual behavioural engagement, rather than actual objective cumulative grade point average (CGPA) records from official university administrative transcripts. Thus, academic performance for student roles in a digital transformation context is most effectively understood as a dual-domain outcome, with sustaining core task output and enacting supportive contextual behaviours jointly determining student scholastic effectiveness.

GenAI Behavioural Use as the Adjustment Mechanism on Academic Performance

GenAI Behavioural Use is now a theoretically significant capability for maintaining academic effectiveness in turbulent and ceaselessly transforming educational environments. It is generally defined as the actual frequency, variety, and qualitative depth of integrating platforms like ChatGPT, Copilot, and Gemini into daily study workflows to notice educational changes, react swiftly and with competence, and use flexible digital interactions to learn, solve problems, and coordinate academic tasks (Nöthel et al., 2023; Sherehiy & Karwowski, 2014). Behavioural tool use is not only about a speed of execution, according to Sherehiy and Karwowski (2014); it also includes a behaviour of adaptive functioning characterising cognitive openness and responsive coordination in technical interfaces. Nöthel et al. (2023) also characterize digital tool use as a multidimensional behavioural capability that emerges when individuals effectively negotiate novelty, uncertain information, changing curriculum requirements, and assignment pressures without sustained deterioration of output efficiency. In other words, educational digital transformation could be viewed as a disruption of correspondence, or disruption of process where there may be disruptions in the form of ways in which learners are studying; where new generative platforms, new prompt engineering sequences, and performance parameters for academic requirements are altered. In this perspective GenAI Behavioural Use becomes this kind of accommodation capacity, and it is able to reinstate correspondence; which is how students can restore correspondence or perform academically when learning and academic profiles evolve. However, within this conceptual paper, the positioning of GenAI Behavioural Use as an adjustment mechanism represents a

proposed mediating relationship (a hypothesized indirect pathway) connecting acceptance drivers and internal efficacy to perceived academic performance, rather than an empirically established finding. By establishing this proposed indirect relationship, the theoretical framework seeks to explain how structural technology drivers

Technology Acceptance (UTAUT Constructs) on Academic Performance

Technology acceptance based on several of the central domains of the Unified Theory of Acceptance and Use of Technology (UTAUT) is no longer limited to a foundational knowledge of computers, but it has evolved to provide students with the means to operate digital systems, realize information utility, and collaborate through digital channels for educational purposes (Ferrari, 2012; van Deursen et al., 2016). The four core technology acceptance architectures Performance Expectancy (perceived productivity gains), Effort Expectancy (perceived ease of use), Social Influence (peer and instructor normalization), and Facilitating Conditions (campus Wi-Fi and institutional guidelines) demonstrate the breadth of modern digital requirements in higher education (van Deursen et al., 2016; Venkatesh et al., 2003). On the performance side, robust acceptability of technology reduces cognitive demand by promoting application effectiveness and information processing quality. Research in public instructional settings suggests that constructs of technology acceptance are found to positively contribute to overall performance and learner empowerment, indicating that higher degrees of digital acceptability in learning may enhance student control through technology (Ochoa Pacheco & Coello-Montecel, 2023). Similarly, complementary evidence in contemporary hybrid learning contexts has connected structured technology acceptance with collaboration and individual performances where coordination relies strongly on digital ecosystems (Wilms et al., 2022). Given that, high technology acceptance promotes the well-performing learning set of students against digitally intensified academic demands, decreasing learning misfit and facilitating timeously recalibrating actual behavioural engagement when courseware is redesigned, in the context of which continued academic performance is expected.

- **Performance Expectancy:** Perceived utility and speed in task execution encourage students to embed GenAI into regular study routines.
- **Effort Expectancy:** The lower the perceived technical difficulty in constructing prompts, the higher the user's operational engagement with AI tools.
- **Social Influence:** Peer normalization and instructional encouragement foster higher individual behavioral adoption of AI applications.
- **Facilitating Conditions:** Campus infrastructure, access to high-speed internet, and clear institutional policy guidelines provide the structural support needed for continuous system usage.

Self-Efficacy on Academic Performance

Self-efficacy in digital contexts is a variation in confidence on the part of a student to test, adopt, and persist in using complex technologies independently (Agarwal & Prasad, 1998; Bandura, 1997). In stark contrast from structural acceptance constructs, self-efficacy represents an internal psychological capability and predisposition to cope with technical novelty and to manage complex, autonomous conversational systems such as generative AI, which has tremendous significance in learning environments where assignment prompt conditions are ambiguous and self-determined iteration is important. While Agarwal and Prasad (1998) theorize individual tech efficacy as a stable tendency to be engaged with new technologies, this

suggests a higher degree of behavioural commitment to systems and a lower threshold for trial or error. In contrast, prior research relating efficacy beliefs to proactive adoption behaviour in digital service contexts demonstrates that self-efficacy is a key driver of behaviour regarding technology use, specifically in terms of engagement and persistence with this technology (Lu et al., 2005), suggesting that it has the potential to facilitate the optimal pattern of activity in tech-enabled users. For instance, when interacting with a conversational AI tool like ChatGPT for a complex assignment, a student with high digital self-efficacy does not abandon the tool upon receiving an initial inaccurate or superficial output. Instead, they actively refine prompt parameters, cross-examine reasoning pathways, and iterate until the generated output meets rigorous academic criteria. This psychological disposition is therefore very performancerelevant to student academic outcomes, as it has the potential to increase the likelihood of students trying out new text generation scenarios and learning continuously while adapting to new digital tools, while decreasing behavioural withdrawal as the initial learning curve is steep. In contexts in which higher education consistently introduces digital procedures, high self-efficacy that underlies the ability to achieve higher task performance and contextual contributions can be supported by active, continuous engagement.

Material and Method

Based on the synthesis of the Unified Theory of Acceptance and Use of Technology (UTAUT) and Self-Efficacy Theory, this conceptual paper establishes a theoretical framework to explain student academic performance in GenAI-enabled higher education environments. However, as a conceptual paper, all direct pathways and mediating linkages specified below represent proposed theoretical relationships and hypothesized indirect pathways designed for future empirical validation, rather than established empirical findings.

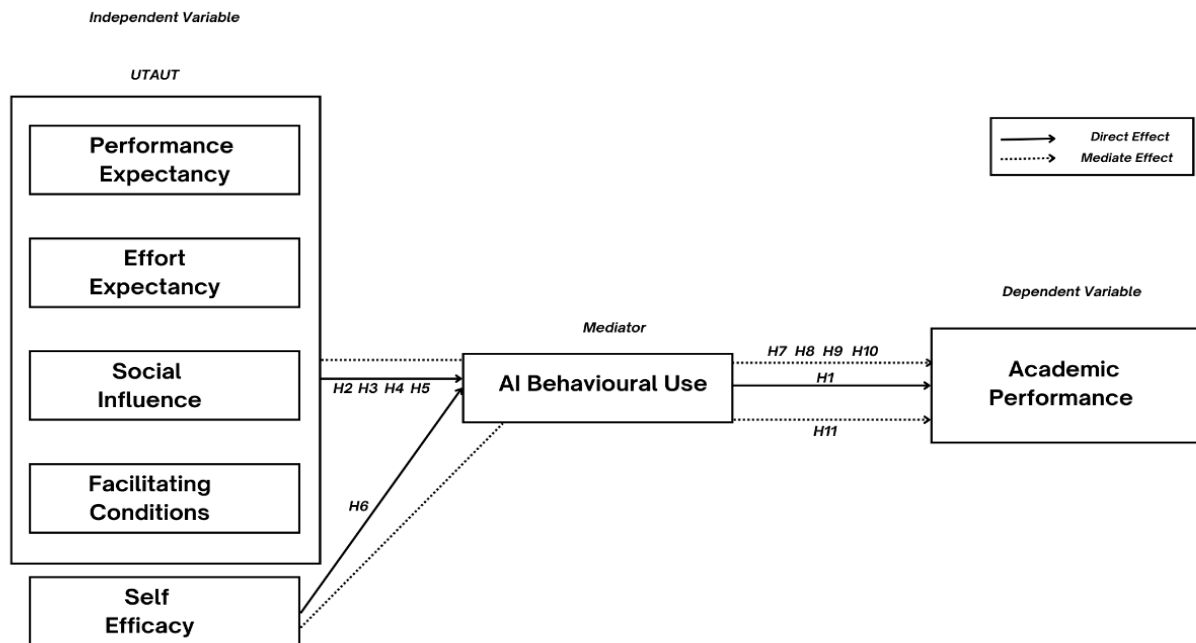


Figure 1: Conceptual Framework Model

Source: Figure 1 presents the proposed conceptual framework for this study. The core constructs measuring technology acceptance are adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT) model proposed by Venkatesh et al. (2003), integrated with Self-Efficacy Theory (Bandura, 1977, 1997) to examine the structural impact on academic performance.

Direct Proposed Relationships to GenAI Behavioural Use

The structural determinants driving GenAI adoption involve four technology acceptance drivers alongside individual psychological efficacy:

- **Performance Expectancy:** Students who perceive GenAI tools as effective instruments for enhancing study efficiency and output quality are more likely to integrate these tools into their daily learning routines.
- **Effort Expectancy:** Lower perceived technical difficulty and intuitive interface interactions encourage higher frequency and variety of GenAI behavioural use.
- **Social Influence:** Peer usage, instructor encouragement, and institutional normalization positively incentivize individual student engagement with GenAI applications.
- **Facilitating Conditions:** Adequate campus digital infrastructure, reliable Wi-Fi, and clear operational guidelines provide the baseline structural support necessary for sustained GenAI tool interaction.

- **Self-Efficacy:** Higher internal cognitive confidence enables students to independently experiment, refine prompts, and persist in utilizing complex conversational AI systems during ambiguous academic tasks.

To this end, the direct hypotheses to GenAI Behavioural Use are proposed as follows:

- **H1:** Performance Expectancy has a positive **proposed relationship** with GenAI Behavioural Use.
- **H2:** Effort Expectancy has a positive **proposed relationship** with GenAI Behavioural Use.
- **H3:** Social Influence has a positive **proposed relationship** with GenAI Behavioural Use.
- **H4:** Facilitating Conditions have a positive **proposed relationship** with GenAI Behavioural Use.
- **H5:** Self-Efficacy has a positive **proposed relationship** with GenAI Behavioural Use.

Direct Proposed Relationship to Academic Performance

GenAI Behavioural Use reflects the actual adaptive application of AI tools to accomplish study tasks, solve complex assignment problems, and coordinate academic responsibilities. Higher qualitative depth and adaptive usage of GenAI enable students to optimize study workflows, leading to enhanced perceived academic performance.

H6: GenAI Behavioural Use has a positive **proposed relationship** with perceived Academic Performance.

Proposed Mediating Role of GenAI Behavioural Use

To clarify the structural mechanics of the model, GenAI Behavioural Use is specified as a proximal adjustment mechanism (a proposed mediator). Technology acceptance drivers (PE, EE, SI, FC) and psychological capabilities (SE) do not automatically guarantee superior academic output on their own; rather, their influence on scholastic outcomes is transmitted through actual, sustained behavioural engagement with GenAI tools.

However, the mediating function of GenAI Behavioural Use represents a hypothesized indirect pathway subject to future empirical testing via PLS-SEM, rather than an established empirical finding.

To this end, the direct hypotheses to GenAI Behavioural Use are proposed as follows:

- **H7:** GenAI Behavioural Use positively mediates the **proposed relationship** between Performance Expectancy and perceived Academic Performance.
- **H8:** GenAI Behavioural Use positively mediates the **proposed relationship** between Effort Expectancy and perceived Academic Performance.
- **H9:** GenAI Behavioural Use positively mediates the **proposed relationship** between Social Influence and perceived Academic Performance.
- **H10:** GenAI Behavioural Use positively mediates the **proposed relationship** between Facilitating Conditions and perceived Academic Performance.
- **H11:** GenAI Behavioural Use positively mediates the **proposed relationship** between Self-Efficacy and perceived Academic Performance.

Discussion

The proposed research model considers student academic performance in relation to educational digital transformation as a correspondence-and-adjustment process. As digital learning initiatives change assignment sequences, grading metrics, and the way academic collaboration is coordinated, this translates to an interruption of the person environment correspondence among university students. The proposed research model considers student perceived academic performance. As the proposed proximate adjustment mechanism, GenAI Behavioural Use is theorized to play a pivotal role because it reflects a student's capability.

These essential determinants operate as complementary structural and psychological levers. External Technology acceptance drivers (UTAUT) facilitate student academic capacity by reducing the physical and social friction associated with technology-mediated tasks and ensuring students possess structural enablers through access to digital workflows, resulting in faster and more accurate adaptation as university software systems shift. They play a vital mode of facilitation through manipulation of cultural acceptance to digital technologies, by influencing students' behavioural intention to use technology, perceived usefulness, perceived ease-of-use and facilitating conditions. Internal digital Self-Efficacy leads to proactive prompt engineering, persistent system exploration and psychological resilience when confronted with flawed AI outputs. However, negative influence of Self-Efficacy through learning fatigue shapes individuals' behavioural intentions to seek assistance, rather than developing effective prompting strategies on their own. The model has implications from a practical point of view for public higher education in Sabah where continuous pressures in terms of academic achievement and diverging regional digital readiness profiles demonstrate that any differences in student performance cannot be attributed to institutional structures or raw technological availability in isolation. Rather, outcomes depend on how students can do to actively revise their learning habits and support execution at a time when digital initiatives are altering their academic tasks. From this lens, the framework provides an approach to understand why some undergraduates do deliver reliable assignment tasks and provide constructive contextual contributions in the face of digital disruption, while others struggle with decreasing academic performance, by theoretically positioning GenAI Behavioural Use as the proposed mediating mechanism that translates external technology acceptance and internal Self-Efficacy into sustained perceived academic performance.

Conclusion

This study aims to bridge the gap between theory and practice on digital transformation and higher education in Sabah. Specifically, section one highlights how universities in Sabah and the State are embracing digital transformation as a strategic tool to improve operational efficiency and academic performance amid the COVID-19 pandemic. However, it is essential for universities to more deeply understand the factors contributing to students perceived academic performance and how technology acceptance and self-efficacy influence it. Thus, section two proposes a mediation framework that investigates the impact of the Unified Theory of Acceptance and Use of Technology (UTAUT) on perceived academic performance. The study also considers how the emerging technology of GenAI affects students perceived academic performance as part of their transition process to digital transformation by proposing GenAI behaviour as a mediator in this relationship. The structural equation model (SEM) of the framework was tested using SmartPLS 4.0 (PLS-SEM). The model's predictive performance is evaluated using a power-analysed target sample ($n = 400$), rigorous instrument

pre-testing, and a bootstrapped mediation analysis. This paper offers several contributions to the scholarly understanding of digital transformation and higher education, including a novel mediation framework and a consideration for how emerging technology can improve higher education. While this study is contextualized within the State of Sabah, its theoretical insights offer a transferable blueprint for other developing regions globally.

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- Acknowledgements:** The author would like to express sincere gratitude to Universiti Teknologi MARA (UiTM) Sabah Branch and the Arshad Ayub Graduate Business School for providing academic support and research resources. Special appreciation is extended to thesis advisors Associate Professor Dr. Imelda Albert Gisip and Dr. Muzalifah Binti Monil for their invaluable guidance.
- Funding Statement:** This research received no external financial support from funding agencies in the public, commercial, or non-profit sectors.
- Conflict of Interest Statement:** The author declares no conflict of interest regarding the publication of this conceptual paper.
- Ethics Statement:** This study did not involve human participants, clinical trials, or sensitive personal data requiring institutional review board approval at this conceptual stage. Future empirical data collection will adhere strictly to academic integrity and voluntary informed consent standards.
- Author Contribution Statement:** **Khairi Nazmi Yahya:** Conceptualization, methodology, theoretical framework integration, literature review synthesis, manuscript drafting, and structural path design.
Imelda Albert Gisip: Supervision, conceptual validation, critical review, and refinement of the theoretical framework.
Muzalifah Monil: Supervision, methodology guidance, literature review curation, and manuscript editing.
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Almizar Amil Hamzah: Background research, reference compilation, and drafting of the empirical testing plan.
Debbie Annabell Peter Bernard: Data collection plan design, formatting, and structural editing of the manuscript.
Zulfadlihusni Bin Mohamad: Critical revision, theoretical discussion enhancement, and final manuscript checking.
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