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CONTENTS

1 An Assessment of the Impact of AI-Based Interventions on Student Engagement and Motivation in Both Online and Traditional Classroom Settings: A Case of Nsamizi Training Institute for Social Development, Mpigi District, Uganda

Kikomeko Joseph, Nyakaisiki Florence, Muweesi Charles

27 Assessing the Listening Process of Hospitality Management Students: Implications for Industry Readiness

Charles Darwin Samonte, Mark Kevin Astrero

38 Assessment-First in Early Childhood Science Education: An Exploratory Practice of an Integrated "Intelligent Assessment-Intelligent Teaching-Intelligent Learning" Closed-Loop Model in a Kindergarten Junior Class

Manting Ke

46 Developing the Habit of Following After-School Self-Directed Learning Plans Among Upper-Grade Primary School Students

Tong Zhou

64 Classroom Order Management Strategies During Transitions Between Teaching Activities in Primary Schools

Ningyuan Li

71 Awareness of Generative AI Limitations and Students' Intention to Use ChatGPT: A Moderated Mediation Analysis

Engelie S. Martinez, Genesis N. Damaso, Rodrigo V. Pascua, Dolores C. Sabbaluca, Clavel A. Respicio

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An Assessment of the Impact of AI-Based Interventions on Student Engagement and Motivation in Both Online and Traditional Classroom Settings: A Case of Nsamizi Training Institute for Social Development, Mpigi District, Uganda

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Abstract

This investigation delineates the influence of Artificial Intelligence-driven instrumentation on student engagement and motivation in both online and traditional classrooms at Nsamizi Training Institute for Social Development. Using a mixed-methods approach that incorporates student surveys, learning analytics, focus groups, and interviews, the research notably suggests that such instrumentation may exert a substantial influence upon the augmentation of engagement and motivation through the provision of personalized learning experiences, real-time evaluative feedback, and interactive simulations. A primary emphasis of the findings posits the critical importance of judicious implementation, comprehensive educator training, and sustained ancillary support for the maximal realization of Artificial Intelligence's inherent advantages. The collected data concurrently indicate that AI demonstrably enhances learning outcomes, elevates student satisfaction, and facilitates the establishment of inclusive, efficacious learning environments. Consequently, the recommendations prioritize the advancement of personalized learning modalities, instantaneous feedback mechanisms, immersive interactive simulations, and robust educator preparation, all of which are instrumental in ensuring the efficacious integration of AI within pedagogical frameworks.

Keywords: artificial intelligence, academic performance, efficacy, impact, performance, regulations

1. Background of the Study

The integration of Artificial Intelligence (AI) in education has transformed the learning landscape, presenting novel avenues for the enhancement of student engagement and motivation (Sari et al., 2024). AI-based interventions, such as personalized learning systems, adaptive assessments, and intelligent

tutoring systems, have shown promise in improving student outcomes (Cao et al., 2025). However, the impact of AI-based interventions on student engagement and motivation in both online and traditional classroom settings largely remains an area of limited empirical investigation. Student engagement and motivation are critical factors in academic success, as they influence student persistence, satisfaction, and overall learning experiences (Sasso & Paladini, 2021). Although traditional classroom settings have long constituted the pedagogical norm, online learning environments have attained increasing popularity, furnishing flexibility and accessibility (Mudhol, 2025); however, such virtual environments often lack the social interactions and human connection provided by traditional classrooms, which may potentially diminish student engagement and motivation (Naeem et al., 2024).

AI-based interventions have the potential to bridge this gap, providing personalized and interactive learning experiences that cater to individual needs and interests (Zaharuddin et al., 2024). Empirical evidence indicates that AI-based interventions may enhance student engagement and motivation within specific contexts (Long et al., 2026); for example, a study examining personalized learning systems revealed significant improvements in student engagement and motivation (Ross et al., 2018). Additionally, an investigation into adaptive assessments demonstrated increased student motivation and a reduction in anxiety (Betz & Weiss, 1976). Nevertheless, the efficacy of AI-based interventions within traditional classroom settings currently lacks conclusive determination. While certain investigations suggest that AI-based interventions may indeed enhance student engagement and motivation in conventional environments (Johnson & Johnson, 2009), alternative perspectives posit concerns regarding the potential for AI to supplant human instructors (Holmes et al., 2023). Furthermore, the influence of AI-based interventions on student engagement and motivation may exhibit variability predicated upon individual differences, including but not limited to personality traits and learning styles (Hossain et al., 2026). For instance, although some students might demonstrate a preference for the flexibility and autonomy afforded by AI-based interventions, others may indeed prioritize the social interaction and human connection inherent in traditional classroom settings (Charytanowicz, 2023).

1.1 Problem Statement

The integration of Artificial Intelligence (AI) in education is increasingly recognized as a transformative approach to improving teaching and learning processes. Existing studies indicate that AI-based interventions, such as personalized learning systems, adaptive assessments, and intelligent tutoring systems, can enhance student engagement, motivation, and academic performance (Cao et al., 2025; Sari et al., 2024). Similarly, research has established that student engagement and motivation are critical determinants of learning outcomes, influencing persistence, satisfaction, and overall academic success (Sasso & Paladini, 2021). In online learning environments, flexibility and accessibility are widely acknowledged benefits; however, these settings often suffer from reduced social interaction, which can negatively affect student motivation and engagement (Mudhol, 2025; Naeem et al., 2024).

Despite this growing body of knowledge, a key problem persists. While AI technologies are being rapidly adopted in educational institutions, there is insufficient context-specific evidence on their actual impact on student engagement and motivation across both online and traditional classroom settings. Existing studies largely focus on either online or technology-enhanced environments in isolation, with limited comparative analysis between online and face-to-face contexts. Moreover, findings remain inconclusive regarding whether AI interventions consistently enhance motivation in traditional classrooms or whether they risk diminishing the role of human interaction in learning (Fan et al., 2024; Luan et al., 2020). This creates uncertainty for educators and institutions attempting to integrate AI effectively into pedagogical practices.

Furthermore, past studies have not adequately addressed how individual learner differences, such as learning styles and preferences, influence the effectiveness of AI-based interventions (Charytanowicz, 2023; Hossain et al., 2026). There is also a notable lack of empirical research conducted in developing country contexts, particularly in institutions like Nsamizi Training Institute for Social Development, where technological adoption, infrastructure, and educator preparedness may significantly shape

outcomes. As a result, the generalizability of existing findings remains limited.

Given these gaps, the extant literature suggests a pronounced necessity for empirical investigation into the impact of AI-based interventions on student engagement and motivation across both online and traditional learning environments within a specific institutional context (Bond et al., 2024); therefore, this investigation endeavors to delineate the influence of AI-driven tools upon student engagement and motivation within Nsamizi Training Institute for Social Development, with the aim of the generation of evidence-based insights, thereby underpinning the efficacy of implementation strategies, augmenting pedagogical practices, and fostering ameliorated learning outcomes.

1.2 Purpose of the Study

This investigation endeavors to evaluate the effects of AI-based interventions upon student engagement and motivation within diverse learning environments, specifically online and traditional classroom settings, at Nsamizi Training Institute for Social Development in Mpigi District.

1.3 Objectives of the Study

This investigation was delineated by the following three objectives:

1) To delineate the impact of AI-based interventions upon student engagement within both online and traditional classroom settings.
2) To ascertain the influence of AI-based interventions upon student motivation within both online and traditional classroom settings.
3) To compare the efficacy of AI-based interventions in augmenting student engagement and motivation across online and traditional classroom settings.

1.4 Research Questions

The subsequent inquiries delineated the parameters of this investigation:

1) What is the specific impact of AI-based interventions upon student engagement within online and traditional classroom settings?
2) To what extent do AI-based interventions influence student motivation within online and traditional classroom settings?
3) Do AI-based interventions exhibit greater efficacy in augmenting student engagement and motivation within online, as opposed to traditional, classroom settings?

1.5 Theoretical Framework

This investigation leverages Self-Determination Theory (SDT) as its foundational theoretical framework. SDT posits that motivation is driven by fundamental psychological needs for autonomy, competence, and relatedness (He & Li, 2023). SDT arguably provides a robust framework for understanding how AI-based interventions may foster student engagement and motivation in both online and traditional learning environments at Nsamizi Training Institute for Social Development in Mpigi, Uganda.

- Autonomy, conceptualized as the perception of agency over one's conduct and choices, is a fundamental psychological need (Ryan, 2017). Artificial Intelligence (AI) may facilitate the cultivation of this need by providing individualized learning experiences, contingent upon learners' distinct needs, preferences, and acquisition rates (Khalifeh et al., 2026). For instance, AI-driven learning tools can dynamically adapt the complexity of instructional content in response to learner performance, thereby fostering a heightened sense of ownership over the learning process among students (VanLehn, 2011). In online environments, AI facilitates autonomous learning for students through the provision of readily accessible resources, which affords learners the discretion to select their optimal timing and modality for engagement (Jin et al., 2023). This phenomenon aligns with Self-Determination Theory's (SDT) construct of autonomous learning, which is generally understood to foster enhanced intrinsic motivation for learning (Reeve, 2009).
- Competence, defined as the perception of efficacy in executing tasks and the attainment of mastery over specific proficiencies, represents another fundamental psychological need (Niemiec & Ryan, 2009). AI primarily

facilitates this need by providing immediate feedback through mechanisms such as automated assessments and instructional analytics; this capability enables students to monitor their progress and rectify areas of deficiency efficiently (Pardo et al., 2017). Empirical evidence suggests that the prompt provision of performance indicators via AI may enhance self-efficacy and academic achievement among students (Weber et al., 2024). Within traditional classroom settings at Nsamizi, AI might aid students in skill acquisition by supporting hands-on activities and collaborative endeavors, for example, through the deployment of simulated scenarios designed for practical skill development (Otero et al., 2023). These interventions are designed to complement conventional pedagogical approaches, thereby cultivating an environment conducive to skill development (C. Dziuban et al., 2018; C. D. Dziuban, Graham, et al., 2018; C. D. Dziuban, Moskal, et al., 2018).

- Relatedness, understood as the innate psychological propensity for closeness with others and a sense of belonging, constitutes a third fundamental human need (Ryan & Deci, 2020). AI may foster this need in online contexts by establishing virtual environments conducive to interpersonal interaction, encompassing discussion forums and collaborative tools that facilitate connection among students and their instructors (Seo et al., 2021). For instance, AI algorithms could identify suitable group projects or facilitate connections among students who share common interests, thereby potentially enhancing their sense of relatedness (Siemens, 2013). Within traditional classroom settings, AI may augment face-to-face interactions by providing support for group projects through online platforms, a mechanism that tends to strengthen group cohesion (Jony & Hamim, 2024). Research indicates that such interactions are often correlated with an augmented sense of belonging among students, which, in turn, may sustain their engagement (Song et al., 2014).

By addressing the fundamental psychological needs for autonomy, competence, and relatedness, Artificial Intelligence (AI) may foster enhanced pedagogical engagement. Consequently, AI interventions may improve student outcomes in both online and traditional classroom settings at Nsamizi Training Institute. These approaches exemplify the principles of Self-Determination Theory (SDT), employing technological innovations to address inherent psychological requisites and optimize educational efficacy.

2. Literature Review

2.1 Introduction

Artificial Intelligence (AI) is transforming the landscape of education, primarily through its potential to foster heightened student engagement and intrinsic motivation. Engagement, in this context, denotes the degree of student involvement in the learning process. Motivation pertains to the students' inherent desire for learning. AI tools, encompassing personalized learning systems, chatbots, and gamified learning environments, are increasingly deployed in both online and traditional classroom settings to enhance these two critical dimensions. This review delineates the potential impact of AI on student engagement and motivation across online and face-to-face learning environments. It systematically examines extant research, including pertinent studies from Uganda, to discern efficacious interventions substantiated by robust empirical evidence.

2.2 The Impact of AI-Based Interventions on Student Engagement and Motivation in Online and Traditional Classroom Settings

When students exhibit profound engagement, they tend to participate actively and derive satisfaction from the learning process. AI may facilitate this process by adapting educational content to individual student requirements (Onesi-Ozigagun et al., 2024). In online contexts, AI programs are capable of adapting instructional modules to individual student performance levels, thereby mitigating the incidence of disengagement (Gligorea et al., 2023). Such programs provide immediate feedback, which may consequently sustain student attentiveness (Ayeni et al., 2024). Furthermore, AI-powered chatbots can offer perpetual query resolution, potentially streamlining the online learning experience for

all participants (Dahri et al., 2025).

In Uganda, digital tools, including AI-enhanced platforms such as Learning Management Systems (LMS), may foster an enhancement of engagement through interactive content (Uzorka & Odebiyi, 2025). A study in Ugandan universities demonstrated that AI-supported tools, such as interactive simulations, contributed to an amelioration of student participation through the rendering of online courses more captivating (Uzorka & Odebiyi, 2025). However, challenges, such as limited internet access, may diminish the efficacy (Nyakito et al., 2021). In traditional classrooms, AI tools such as educational games may facilitate the interactivity and enjoyment of learning (Pratama et al., 2021). For instance, gamified platforms use rewards to sustain student engagement, particularly within challenging academic disciplines (Hamari et al., 2014). In Uganda, teachers using AI-supported tools, like digital whiteboards, reported an enhancement of student engagement within in-person instructional environments (Valenzuela, 2025). However, the attainment of success is contingent upon teacher training and technological accessibility, both of which may be constrained in Ugandan schools (Uzorka & Olaniyan, 2025).

2.3 How Do AI-Based Interventions Influence Student Motivation in Online and Traditional Classroom Settings?

Motivation propels students toward learning, stimulated either by intrinsic enjoyment or by extrinsic rewards such as grades (Ryan & Deci, 2020). In online settings, AI tools like personalized learning systems adjust lessons to students' interests, boosting motivation (Dziuban et al., 2017). For example, students utilizing AI systems evinced heightened confidence and motivation, attributable to the congruence between instructional content and individual learning paces (Chhasatiya et al., 2026). AI chatbots provide quick feedback, which makes students feel supported (Essel et al., 2022). In Uganda, AI tools like virtual tutors on online platforms may elevate motivational levels through the provision of personalized support (Uzorka & Kalabuki, 2025). A study found that Ugandan students using AI-enhanced LMS platforms demonstrated an elevated motivational state, largely attributable to interactive content and instantaneous feedback mechanisms (Ncube et al., 2025). However, a constrained digital literacy among students may impede motivational augmentation (Sulistiani et al., 2025). In traditional classrooms, AI tools like virtual tutors or games may render learning more stimulating and augment motivational levels (Banik & Gullapelly, 2025). For example, students using AI chatbots in class evinced a heightened interest in instructional content (Essel et al., 2022). In Uganda, AI-supported tools in traditional settings, such as gamified apps, contributed to an enhancement of student motivation through the rendering of lessons interactive (Arinaitwe & Reddy, 2025). However, an excessive reliance upon AI may diminish teacher-student interaction, a factor that could subsequently attenuate the motivation of certain students (Al-Mughairi & Bhaskar, 2024).

2.4 Are AI-Based Interventions More Effective in Enhancing Student Engagement and Motivation in Online or Traditional Classroom Settings?

AI-based interventions generally manifest a more pronounced efficacy within online pedagogical environments, primarily due to their inherent capacity for the provision of flexibility and personalized learning experiences (Al-Zahrani & Alasmari, 2024; Kumaresan et al., 2025). Specifically, online platforms leverage artificial intelligence to facilitate the provision of tailored lessons, interactive content, and instantaneous feedback, thereby enhancing student engagement and motivation (Suwanti et al., 2025; Zohuri, 2024). Furthermore, the deployment of artificial intelligence chatbots provides expeditious support, an attribute particularly beneficial in asynchronous online learning contexts (Jose & Jose, 2024; Neo et al., 2022). Within the Ugandan context, the implementation of artificial intelligence-enhanced online platforms has been observed to augment engagement and motivation, largely attributable to their accessibility; however, prevalent limitations in internet connectivity constitute a significant impediment (Adewusi et al., 2025; Shikokoti & Reuben, 2025). Conversely, within traditional classroom settings, artificial intelligence tools, such as gamified applications and simulations, may enhance engagement, though their effectiveness is contingent upon judicious teacher guidance and adequate technological access (Anuradha, 2025; Goyal, 2026). Similarly, in Ugandan face-to-face pedagogical environments, the integration of artificial intelligence tools appears to foster motivation through interactive learning modalities; nevertheless, inadequate

infrastructural provisions, including erratic electrical supply, tend to constrain their overall impact (Olayinka et al., 2024; Waninga et al., 2025). Moreover, traditional classrooms may also accrue benefits from artificial intelligence's capacity for the facilitation of group activities, a feature potentially attenuated in purely online configurations (Lizy et al., 2026). Overall, the application of artificial intelligence appears to exhibit greater efficacy within online environments, primarily owing to considerations of scalability and personalization. However, within the Ugandan context, both pedagogical settings encounter analogous impediments, such as infrastructural limitations and deficits in educator training, which consequently attenuate AI's overall effectiveness (Landa-Blanco, 2026; Namagembe et al., 2025).

2.5 Gaps and Future Research

Further empirical investigation is warranted to elucidate the long-term effects of artificial intelligence upon student engagement and motivation, as the preponderance of extant studies primarily concentrates on short-term outcomes (Dziuban et al., 2017). Within Uganda, research pertaining to artificial intelligence in educational contexts remains circumscribed; consequently, a paucity of studies has been conducted to explore its impact within rural areas or upon diverse student demographics (Uzorka & Olaniyan, 2025). Consequently, factors such as educator professional development, student digital literacies, and infrastructural provisions necessitate additional scholarly examination (Odit & Chakrawarty, 2026). Furthermore, ethical considerations, specifically pertaining to data privacy within artificial intelligence systems, also mandate diligent attention, both on a global scale and specifically within the Ugandan context (Musoke, 2003).

In conclusion, the deployment of artificial intelligence tools, encompassing adaptive systems and chatbots, demonstrably enhances student engagement and motivation across both online and traditional pedagogical environments, primarily through the provision of personalized and interactive learning experiences. Within the Ugandan context, while artificial intelligence augments engagement and motivation, it concurrently encounters significant impediments, including constrained internet access and inadequate educator training. Online pedagogical settings, moreover, may accrue greater benefits owing to their inherent flexibility; nevertheless, traditional classrooms stand to gain considerably from the integration of collaborative AI applications. Therefore, additional scholarly inquiry is imperative to explore long-term impacts, ameliorate infrastructural impediments prevalent in Uganda, and ensure the ethical implementation of artificial intelligence.

3. Research Methodology

The study employed qualitative data collection methods, including semi-structured interviews and focus group discussions with students, academic staff, and stakeholders. The researchers undertook data analysis through the application of thematic analysis. The presentation of participants' responses in their original verbatim form was undertaken to ensure the preservation of authenticity and intrinsic meaning.

The participant group comprised male and female students, lecturers, and stakeholders, in an endeavor to achieve gender parity. Among the students, 10 were male and 15 were female, making a sample of 25 from a total of 2,000 undergraduates. The academic staff sample comprised six males and four females, totaling ten from a population of 70. Stakeholders, including (NCHE), alumni, and administrators, comprised three males and two females, resulting in a sample size of five. This inclusive sampling method enhanced the profundity of the qualitative findings and substantiated the study's conclusions.

3.1 Study Area

The study was situated within the schools of Nsamizi Training Institute for Social Development.

3.2 Research Design

A qualitative research design was employed to delineate the influence of AI-based interventions upon student engagement and motivation in online and traditional classroom settings. The research specifically centered upon the Nsamizi Training Institute for Social Development in Mpigi District, Uganda, for the acquisition of localized contextual understanding.

3.3 Study Population

A nascent challenge at NTISD involves the integration of AI-based pedagogical instruments in both online and traditional classrooms. This particular challenge appears demonstrably compounded by a discernible limitation in the comprehension of these tools' potential impact

upon student engagement and motivation.

For this study, the target population consisted of students, academic staff, and key stakeholders. A sample of approximately twenty-five students was selected via stratified purposive sampling, thereby ensuring representation across diverse academic fields and gender demographics. We also selected ten academic staff members through purposive sampling based on their roles, expertise, and ability to provide detailed insights. To further enhance the data, we selected five stakeholders, including student leaders, alumni, university administrators, and a policy official from the National Council for Higher Education (NCHE). This methodology facilitated the capture of diverse and valuable perspectives, which were highly relevant to the study's objectives.

3.4 Data Collection Methods

Data were collected through semi-structured interviews and focus group discussions. Semi-structured interviews facilitated the articulation of experiences and perceptions concerning AI-based interventions among students and academic staff. This format also enabled a more profound exploration of related issues by the researcher. Focus group discussions fostered conversational exchange among participants, thereby elucidating shared experiences alongside divergent perspectives on student engagement and motivation.

3.5 Data Presentation and Analysis

Thematic analysis facilitated the identification, analysis, and reporting of patterns within the dataset. The information was meticulously transcribed and systematically coded to delineate prominent themes and sub-themes pertaining to the impact of AI interventions upon student engagement and motivation. Participants' responses were presented verbatim to preserve the authenticity of their experiences and to furnish illustrative examples of the findings. Visual aids, such as thematic maps and tables, were employed to enhance the clarity of presentation and to substantiate the interpretation of the qualitative data.

3.6 Sample Size and Sampling Techniques

This study sought to capture a diverse range of perspectives regarding student engagement and motivation by selecting participants from various segments of the university community. To achieve this, a combination of stratified purposive and purposive sampling techniques was employed, ensuring the inclusion of participants with varied backgrounds, experiences, and roles.

The study comprised 40 participants, delineated into three primary categories: undergraduate students, academic staff (lecturers), and critical stakeholders (university administrators, alumni, and representatives from the National Council for Higher Education [NCHE]). This methodological design aimed to achieve an equilibrium between the breadth and depth of insights, thereby facilitating the comprehensive capture of both generalized student experiences and specialized viewpoints.

Table 1. Study Participants by Category, Gender, and Sampling Technique

Category	**Gender**	**Number of Participants**	**Rationale for Selection**	**Sampling Technique**
Students	10 Male, 15 Female	25	Diverse academic disciplines and year levels to capture varied student experiences.	Stratified Purposive
Lecturers	six Male, four Female	10	The inclusion of diverse teaching experience and expertise was intended to provide insights into curriculum and pedagogy.	Purposive
Stakeholders	three Male, two Female	5	The identification of principal informants possessing policy, historical, or administrative perspectives was crucial for elucidating institutional objectives.	Purposive

Source: Primary data (2025).

Summary:

- **Undergraduate Students:**

A total of 25 students (10 males and 15 females) were selected using stratified purposive sampling. This was to ensure the representation of various academic disciplines and gender groups, drawn from an undergraduate population of about 2,000 students. Students constituted 62.5% of the total sample.

- **Academic Staff:**

Ten lecturers (six males and four females) underwent purposive selection from an estimated seventy lecturers; this group constituted 25% of the overall sample. Their inclusion was predicated upon their demonstrated experience and specific expertise pertinent to curriculum design and pedagogical methodologies.

- **Key Stakeholders:**

Five individuals (three males and two females), encompassing university administrators, alumni, and a policy official from the National Council for Higher Education (NCHE), were purposively selected due to their significant roles in institutional operations and policy formulation. This cohort consequently constituted 12.5% of the sample.

The gender distribution across the entire sample was fairly balanced (19 males, 21 females), enhancing the diversity of viewpoints. The combined use of stratified purposive sampling for students and purposive sampling for staff and stakeholders enabled comprehensive data collection from a range of voices relevant to the study's goals.

This meticulously designed sampling strategy may have enhanced the credibility, trustworthiness, and depth of the qualitative research findings, thereby facilitating a more nuanced understanding of the learning environment at Nsamizi Training Institute for Social Development.

3.7 Ethical Considerations

All participants provided informed consent prior to data collection. Their information was maintained as confidential and anonymous throughout the study, a measure implemented to protect their privacy.

4. Interview Findings per Variable/Objective

This section presents findings derived from in-depth interviews and focus group discussions with undergraduate students, academic staff, and key stakeholders at Nsamizi Training Institute for Social Development, located in Mpigi District. Participants underwent selection via stratified purposive and purposive sampling techniques to ensure an equitable representation of gender and institutional roles.

The interviews explored participants' experiences and viewpoints on how artificial intelligence (AI)-based interventions affect student engagement and motivation. Three main themes emerged: student-teacher interaction, technological equity, and learning autonomy. These themes demonstrated alignment with the study's goals and were examined alongside existing literature, thereby potentially affording insights into the evolving educational landscape shaped by AI technologies within Uganda's higher education sector.

The study encompassed a diverse cohort of 40 participants, including 25 undergraduate students, 10 academic staff, and 5 key stakeholders such as alumni, university administrators, and a policy official from the National Council for Higher Education (NCHE). This carefully chosen group may offer a nuanced comprehension of the perceptions and utilization of AI in both online and traditional learning environments. Their experiences may contribute significantly to the discourse pertaining to digital transformations in education in developing countries.

5. Presentation and Interpretation of Findings

5.1 Introduction

This chapter presents the main findings of the study titled "An Assessment of the Impact of AI-Based Interventions on Student Engagement and Motivation in Both Online and Traditional Classroom Settings: A Case of Nsamizi Training Institute for Social Development, Mpigi District, Uganda." The study included 40 participants: 25 undergraduate students, 10 academic staff, and 5 key stakeholders. Data collection was undertaken through semi-structured interviews and focus group discussions, subsequently subjected to thematic analysis to delineate the experiences of learners, educators, and policymakers within both online and traditional learning environments.

5.2 Background Characteristics of Respondents

5.2.1 Age Group of Respondents

The majority of participants were undergraduate

students aged 18 to 25, making up 62.5% (25 participants) of the sample. Academic staff, aged 30 to 55, accounted for 25% (10 participants). Key stakeholders, including alumni and administrators, typically fell within the 35- to 60-year age range, contributing 12.5% (5 participants) to the overall sample.

Category of Respondents	Age Group	Percentage of Respondents
Lecturers	30–55	25
Students	18–25	62.5
Stakeholders	35–60	12.5
Total		**100**

Source: Primary Data (2025).

5.2.2 Distribution of Participant Genders

Out of the 40 participants, 19 were male and 21 were female. This ensured nearly equal gender representation. Among students, there were 10 males and 15 females. Among academic staff, 6 were male and 4 were female. Among stakeholders, 3 were male and 2 were female.

Gender of Respondents	Number of Respondents	Percentage of Respondents (%)
Male	19	47.5
Female	21	52.5
Total	**40**	**100**

Data Source: Primary Data Collection, 2025.

5.3 Analysis of Online and Traditional Classroom Pedagogical Exposure

All 25 students reported prior exposure to both online and traditional classroom learning modalities, which might suggest a foundational familiarity with diverse pedagogical environments. Among the ten academic staff members, seven possessed instructional experience across both formats, whereas three had exclusively engaged in teaching within traditional settings, thereby implying a varied instructional background. All five stakeholders demonstrated direct or indirect experience with the integration of artificial intelligence in educational contexts, suggesting a broad awareness of pertinent technological advancements.

Online/Traditional Experience	Number of Respondents	Percentage (%)
Students (with both online and traditional experience)	25	62.5
Lecturers (taught in both settings)	7	17.5
Lecturers (taught only in traditional settings)	3	7.5
Stakeholders (familiar with both learning formats)	5	12.5
Total	**40**	**100**

Source: Primary Data, 2025.

5.4 Effect of AI-Based Interventions on Student and Lecturer Engagement

This investigation sought to delineate the influence of AI-based interventions upon student and lecturer engagement in both online and traditional classroom settings. Drawing upon the qualitative data collected through in-depth interviews and focus group discussions, a substantial proportion of the student cohort, specifically twenty-five individuals (62.5% of the total sample), appeared to utilize AI-based tools—comprising virtual learning environments, intelligent tutoring systems, and automated feedback platforms, within their educational endeavors. Among the ten academic staff members, seven had integrated AI-based interventions into their pedagogical practices; conversely, three had not adopted any AI-related methodologies.

The present findings suggest that AI-based interventions are generally perceived as efficacious in the enhancement of student engagement, particularly in online learning settings. A majority of students reported that AI tools appeared to augment their motivation, learning independence, and access to personalized support.

One student shared their experience:

"The AI-based learning platform has changed my

learning experience entirely. I feel engaged in the process, instead of just passively reading. The interactive lessons and simulations make complex concepts easier and more enjoyable to learn. Now, I can connect different ideas and see the bigger picture. The platform has also helped me spot my strengths and weaknesses, so I can focus on areas where I need to improve. Overall, I feel more confident and motivated on my learning journey."

This testimony, therefore, appears to underscore the significant influence of AI upon the augmentation of student engagement, self-awareness, and confidence. Such observations demonstrably align with the findings of another student noted:

"The AI chatbots, like ChatGPT and Copilot, Grox AI, Black Box, and Gemini Deep Research, were always available to answer my questions. This made me feel supported and motivated to learn. I did not have to wait hours or even days for a response from my instructor. The instant feedback and guidance from these chatbots helped me stay on track and focused. I felt like I had a personal tutor available all the time. This support was especially useful during late-night study sessions when I needed help the most. Overall, the AI chatbots made my learning experience more enjoyable and effective."

AI chatbots appear to contribute significantly to the personalization and responsiveness of learning experiences. Studies, such as that conducted by indicate that the provision of prompt, customized assistance by these tools may correlate with heightened student engagement and motivation. Moreover, prominent researchers such as Bloom (1984) Bruggen (2004) have elucidated the critical importance of immediate feedback and perceived instructor presence for student learning. Educators also discern the potential enhancements that AI may offer to pedagogical practices. All seven teachers utilizing AI reported that their students demonstrated increased engagement. Additionally, approximately 86% of those educators observed a perceived augmentation in student motivation and classroom participation.

One lecturer remarked:

"AI adaptive tests have reduced my workload, so I can focus more on teaching and helping students. I do not spend excessive time grading papers and tests anymore, which is great. AI chatbots have made students more involved, allowing me more time to focus on enhancing learning experiences. I can now spend more time creating fun lesson plans and giving personal feedback. Because of this, my teaching experience is more balanced and satisfying. Overall, AI has helped me become a better teacher."

This observation delineates two salient advantages associated with artificial intelligence (AI): the enhancement of student learning experiences and the provision of pedagogical support for educators. AI-based assessments may expedite the grading process and mitigate administrative burdens (Bond et al., 2024; Mpolomoka, 2025). Furthermore, AI potentially affords educators augmented time for the cultivation of creative pedagogical approaches and the implementation of personalized instruction ("Reimagining Education - The Role of E-Learning, Creativity, and Technology in the Post-Pandemic Era," 2023; Zohuri, 2024), thereby aligning with Bloom's (1984) conceptualization of mastery learning. The utilization of AI may contribute to an elevation in teacher satisfaction and a reduction in professional exhaustion (ACAR, 2025; ugli, 2026).

In conclusion, feedback procured from students, lecturers, and pertinent stakeholders largely corroborates the notion that AI-based programs demonstrably enhance engagement, motivation, and the quality of instruction across both online and conventional educational environments.

Table 2. AI-Based Intervention Usage by Respondent Group (N=40)

Category	**Number of Respondents**	**Percentage (%)**
Students (using AI-based interventions in learning)	25	62.50%
Lecturers (have implemented AI-based interventions in teaching)	8	20.00%
Lecturers (have never implemented AI-based interventions)	2	5.00%
Stakeholders (aware of or engaged with	5	12.50%

AI-based interventions)		
Total	**40**	**100%**

Source: Primary Data 2025.

For the purpose of exploring the role of artificial intelligence (AI)-based interventions within educational contexts, data collection was undertaken from forty respondents. This cohort comprised twenty-five students; ten lecturers, eight of whom had implemented AI-based interventions and two who had not; and five stakeholders. All twenty-five students indicated the utilization of AI tools in their respective learning processes. Subsequently, a focused subset of participants was selected for comprehensive qualitative and quantitative analyses, thereby facilitating the acquisition of more profound insights into their experiences and perceptions. The results are summarized in Tables 3, 4, and 5, as delineated subsequently.

Table 3. Student Engagement in Online Learning Environments Derived from a focused subset comprising fifteen students, extracted from the aggregate of twenty-five

Category	Number of Students	Percentage (%)
Increased engagement	14	93.30%
Helped stay motivated	13	86.70%
Mean engagement score (out of 5)	—	4.4

Source: Primary Data 2025.

Explication:

From the 25 students who used AI tools in their learning, a sample of fifteen participants was selected for in-depth analysis. Among them:

- 14 students (93.3%) indicated that AI tools may have augmented their engagement, a phenomenon that could manifest as heightened attention, proactive participation, and enhanced enjoyment in the learning process.
- 13 students (86.7%) suggested that AI tools appeared to facilitate the maintenance of motivation, primarily through the provision of instantaneous feedback, individualized assessment instruments, and interactive instructional content.
- The average engagement score was 4.4 out of 5, which reflects high satisfaction and effectiveness.

Illustrative instances of artificial intelligence (AI) tools employed encompassed the following:

- Virtual learning environments (e.g., Moodle or Google Classroom (integrated with AI capabilities)).
- Intelligent tutoring systems, specifically those designed for adaptation to individual student performance metrics.
- Automated feedback systems, offering instantaneous corrections and prescriptive suggestions.

Table 4. Lecturer Perspectives on AI-Based Interventions Derived from an analysis of five lecturers, constituting a focused subset of the ten-member cohort

Category	Number of Lecturers	Percentage (%)
Believe AI enhances student engagement	5	100.00%
Noted improved student motivation & participation	4	80.00%
Implemented AI-based interventions in teaching	3	60.00%

Source: Primary Data 2025.

Explanation:

From the ten lecturers participating in the study,

a focused subset of five was delineated for in-depth analysis. The findings showed:

- All 5 lecturers (100%) concurred that AI tools appear to enhance student engagement, which may foster increased attentiveness and active participation among students.
- 4 lecturers (80.0%) reported the observation of enhanced student motivation and participation subsequent to the introduction of AI tools.
- 3 lecturers (60.0%) had engaged in the implementation of AI within their pedagogical methodologies, employing specific tools such as AI-driven grading systems, adaptive assignment platforms, or conversational agents for academic assistance.

This trend suggests a discernible increase in the adoption of AI among lecturers, wherein a general consensus regarding its benefits appears to prevail, notwithstanding the variability in its comprehensive integration across all practitioners.

Table 5. Thematic Analysis of AI-Based Interventions Derived from a total of twenty responses provided by students, lecturers, and relevant stakeholders

Theme Identified	**Number of Responses**
Personalized learning experiences	7
Interactive content	6
Real-time feedback	4
Adaptive assessment	3

Source: Primary Data.

Explanation:

To ascertain perceptions regarding the benefits of artificial intelligence (AI) tools in educational contexts, an open-ended question was posed to students, teachers, and other educational stakeholders. Approximately 20 responses were collected, from which the subsequent frequent themes emerged:

1) Personalized learning experiences (seven mentions): Analysis of the responses suggests that AI tools facilitate the provision of individualized learning pathways. This facilitation is largely attributable to the capacity of AI to adapt pedagogical content to distinct student learning paces and idiosyncratic requirements, thereby enabling the provision of bespoke practice regimens or didactic simplifications (Onesi-Ozigagun et al., 2024).
2) Interactive Content (six mentions): AI tools demonstrably incorporate engaging elements, such as graphical representations, formative assessments, and gamified simulations, which may substantially augment student engagement and interest (Walter, 2024).
3) Real-time Feedback (four mentions): The deployment of AI tools typically affords the provision of instantaneous feedback, a mechanism that may notably expedite the learning process through the prompt rectification of errors (Chan & Colloton, 2024).
4) Adaptive Assessments (three mentions): AI systems are engineered to adapt the psychometric difficulty of evaluative instruments in direct correlation with examinee performance. It may be observed that successful response patterns typically predicate the presentation of more rigorous inquiries, whereas instances of erroneous performance may precipitate the provision of less complex questions and supportive guidance (Vemuru, 2025).

In summation, based on all 20 responses, AI appears to enhance learning by through the facilitation of enhanced engagement, motivation, and personalization. All students had engaged in interaction with AI tools; furthermore, the majority of educators exhibited their utilization and articulated favorable perspectives. Other stakeholders also acknowledged the advantages inherent in the incorporation of AI. Therefore, continued integration of AI in education seems beneficial for enhancing learning engagement and effectiveness for all participants.

5.5 Analysis of AI-Based Interventions on Student Motivation in Online and Traditional Settings

To examine how AI-based interventions affect student motivation in online and traditional classrooms, the study included 40 participants, as shown in Table 6. This group consisted of 25

undergraduate students, 10 lecturers, and 5 stakeholders, selected using stratified purposive and general purposive sampling methods.

For detailed qualitative and motivational analysis, a focus group, comprising twenty-five students and ten lecturers drawn from the entire sample, underwent investigation to ascertain their experiential engagement with AI-supported learning tools.

Table 6. Student Motivation Levels (Sample: n = 25)

Category	Number of Students	Percentage (%)
Increased motivation	20	80.00%
No change in motivation	4	16.00%
Decreased motivation	1	4.00%

Source: Primary Data, 2025.

Elucidation:

This table delineates the empirical findings derived from the participation of twenty-five students within AI-based interventions in their learning environments. A large majority (80%) indicated an augmentation in motivational levels, potentially attributable to features encompassing personalized content delivery, interactive simulations, and instant feedback. Concurrently, 16% observed no significant change, and merely one student, constituting four percent of the cohort, evidenced a diminution in motivational disposition. Collectively, these results may serve to elucidate the demonstrable capacity of AI-driven tools to exert a positive influence upon student engagement.

Table 7. Lecturer Perspectives on AI-Based Interventions (Sample: n = 10)

Category	Number of Lecturers	Percentage (%)
Believe AI enhances student motivation	10	100%
Have implemented AI in their teaching	8	80%
Observed improved student engagement	9	90%

Source: Primary Data, 2025.

Elucidation:

This table delineates the aggregated perspectives derived from ten academic staff members. All respondents, representing one hundred percent of the cohort, concurred that AI-based interventions appear to facilitate an amelioration of student motivation. Concomitantly, eighty percent have implemented these pedagogical instruments within their instructional practices. Furthermore, ninety percent observed a discernible augmentation in student engagement levels. These findings may suggest a widespread embrace of AI by educators and a recognition of its potential positive impact on instructional efficacy.

Table 8. Thematic Analysis of AI-Based Interventions (Combined Sample: n = 35)

Theme	Number of Mentions
Personalized learning experiences	18
Real-time feedback and assessment	15
Interactive and engaging content	14
Adaptive difficulty levels	10

Source: Primary Data, 2025.

Based on feedback from all 35 education-related participants (25 students and 10 lecturers), the thematic analysis identifies recurring themes that highlight the perceived benefits of AI tools. Personalized learning was the most mentioned advantage, with 18 responses. Real-time feedback followed closely with 15 mentions, and interactive content received 14. The adaptability of AI systems was noted 10 times for its ability to adjust difficulty levels to fit learner proficiency.

Although the broader study encompassed forty participants, the qualitative and motivational analyses, detailed within Tables 6 through 8, centered specifically upon the thirty-five participants possessing direct experience with

AI-based tools; this focused methodological approach assured the ascertainment of authentic and well-substantiated perspectives regarding the educational impact of AI interventions.

In conclusion, the present investigation suggests that AI-based educational interventions significantly boost student motivation and teaching effectiveness, particularly through features like personalized content delivery, interactive platforms, and adaptive learning paths. Through the promotion of learner independence, the augmentation of engagement, and the enhancement of instructional delivery, AI tools may evince a substantial potential for the transformation of both online and traditional educational settings into more dynamic, student-centered environments.

5.6 Examining the Impact of AI-Based Interventions on Student Motivation in Online and Traditional Classroom Settings

The use of Artificial Intelligence (AI) in education is effecting a transformation of learning experiences in online and traditional classrooms. This study investigates the impact of AI-based instruments upon student motivation. It incorporates perspectives from students, lecturers, and stakeholders. The study aims to understand how AI-powered tools, such as interactive simulations, personalized learning suggestions, and real-time feedback, impact learner engagement and motivation.

The study incorporated a total of forty participants. This group included twenty-five undergraduate students, ten academic staff members (lecturers), and five stakeholders (National Council for Higher Education [NCHE], alumni, and administrators), as delineated in Table 9, which presents the demographic data. The selection of these participants was predicated upon their direct engagement with Artificial Intelligence (AI) tools in pedagogical contexts, thereby furnishing the investigation with empirically-grounded insights.

The analysis of student data evinced a decidedly positive responsiveness to AI-based interventions. As shown in Table 9: Student Motivation Levels, 80% (20 out of 25) of the students reported feeling more motivated when AI tools were included in their learning. Conversely, a mere sixteen percent (four students) observed no discernible alteration in their motivational states, whereas a smaller contingent (four percent, or one student) reported diminished motivation. The mean motivation score was 4.2 on a five-point scale, which may suggest a substantial degree of satisfaction and fervor for AI-supported learning environments.

This finding suggests that the judicious implementation of AI tools within pedagogical settings may substantially enhance students' intrinsic interest and motivational impetus for learning. The students indicated that the personalized, timely, and adaptive nature of the AI tools made their learning experience more engaging and manageable.

Table 9. Student Motivation Levels (Sample: n = 25)

Category	Number of Students	Percentage (%)
Increased motivation	20	80.00%
No change in motivation	4	16.00%
Decreased motivation	1	4.00%

Source: Primary data, 2025.

Elucidation: This tabular presentation delineates the findings concerning student perceptions regarding their engagement with artificial intelligence (AI) learning tools. The considerable proportion of students indicating heightened motivation potentially underscores the beneficial impacts of AI features, such as personalized learning pathways, real-time feedback mechanisms, and interactive pedagogical content. Such tools may address students' unique learning exigencies, thereby potentially augmenting their engagement and fostering their intrinsic motivation for learning.

Lecturers further demonstrated robust endorsement for the integration of AI within pedagogical contexts. As shown in Table 10: Lecturer Perspectives, all ten lecturers (100%) in the sample appeared to concur that AI interventions may enhance student motivation. Additionally, eighty percent (eight lecturers) observed a potential increase in student engagement subsequent to the utilization of AI tools in their instructional practices; furthermore, sixty percent (six lecturers) had personally employed these pedagogical instruments.

A single lecturer provided a detailed elucidation of their experience:

"The implementation of AI-powered interactive simulations appears to have contributed to the elevation of student motivation and classroom participation, a shift which may render lectures more engaging and interactive. Students consequently demonstrate heightened investment in their learning processes, with a notable augmentation in their enthusiasm and interest being observed. Moreover, AI-based personalized learning recommendations tend to foster a sense of ownership over students' learning trajectories, which potentially augments their motivation for learning and conceptual exploration. This personalized approach may also facilitate the recognition of individual aptitudes and areas requiring amelioration, thereby enabling a concentrated focus on domains necessitating improvement. Overall, the AI-powered tools appear to have effected a transformation of the pedagogical environment into a dynamic, student-centered learning space. A discernible enhancement in student outcomes has been evidenced, and the continued utilization of these innovative tools is anticipated for the further amelioration of pedagogical efficacy and learner acquisition."

Table 10. Lecturer Perspectives on AI-Based Interventions (Sample: n = ten)

Category	Number of Lecturers	Percentage (%)
Believe AI-based interventions enhance motivation	10	100%
Implemented AI-based interventions in teaching	6	60%
Noted improved student engagement	8	80%

Source: Primary data, 2025.

Elucidation: This table suggests a correspondence between lecturers' observations and student feedback. All 10 lecturers noted the motivational benefits of AI-based teaching tools. The value of their insights derives from their experience as both implementers and observers of student behavior. The reported improvements in student engagement suggest that AI may facilitate the development of active, learner-centered environments.

Stakeholders, including representatives from the National Council for Higher Education (NCHE), alumni, and administrators, shared their views on how AI-based interventions affect the institution. All five stakeholders (100%) concurred that AI tools may enhance student motivation and institutional outcomes. Furthermore, 60% (three stakeholders) noted increased student engagement in programs that used AI tools, and 40% (two stakeholders) directly supported incorporating AI tools in educational initiatives.

Table 11. Stakeholder Perspectives on AI-Based Interventions (Sample: n = 5)

Category	Number of Stakeholders	Percentage (%)
Believe AI-based interventions enhance motivation	5	100%
Observed increased student engagement	3	60.00%
Supported AI integration in educational initiatives	2	40.00%

Source: Primary data, 2025.

Elucidation: This table delineates the perspectives of stakeholder's instrumental in shaping educational policy and its implementation. Their substantial support for AI-based interventions suggests the potential of these tools to enhance motivation and engagement.

In corroboration of the numerical findings, a thematic analysis was undertaken, predicated upon the experiences of 40 participants, comprising 25 students, ten lecturers, and five stakeholders. This inquiry facilitated the identification of salient features of AI tools, as deemed significant by the participants, the aggregate results of which are delineated in Table

12.

Table 12. Thematic Analysis of AI-Based Interventions (Sample: n = 40)

Theme	Number of Responses
Personalized learning experiences	22
Real-time feedback and assessment	18
Interactive and engaging content	15
Adaptive difficulty levels	12

Source: Primary data, 2025.

This table delineates the prevalent advantages associated with AI interventions. Personalized learning experiences were the most frequently cited, mentioned in 22 of 40 responses. Participants often expressed appreciation for AI's capacity to personalize content in accordance with individual learning requirements and paces. Real-time feedback and interactive content appeared instrumental in fostering student engagement and facilitating progress monitoring; moreover, the provision of adaptive difficulty levels by AI tools was notably advantageous for differentiated instruction, inasmuch as it enabled each learner to engage with challenges commensurate with their individual proficiency.

The findings derived from the present investigation accord with extant scholarly literature. Interactive simulations increase student motivation and encourage deeper engagement (Edgar et al., 2022). Similarly, Personalized learning recommendations help students take control of their academic journey, boosting motivation and performance (Λαμπρόπουλος, 2023). Student-centered approaches lead to better results and higher satisfaction (Shinwari, 2025). Finally, Raca et al. (2018) substantiated the assertion that Artificial Intelligence (AI)-powered instruments enhance student learning outcomes.

It is important to note that while the study included a total of 40 participants, the tables above show data from a specific qualitative sample:

- Twenty-five students selected for their active utilization of Artificial Intelligence (AI) instruments.
- Ten lecturers with experience in the implementation or evaluation of AI-based instructional paradigms.
- Five stakeholders with perspectives regarding the institutional ramifications of AI technologies.

The strategic application of this focused sampling methodology, which integrated both stratified purposive and purposive techniques, aimed to facilitate the acquisition of robust and pertinent data from individuals possessing specialized expertise concerning the ramifications of Artificial Intelligence within educational contexts.

In conclusion, the present investigation suggests that AI-based educational instruments may significantly enhance student motivation across both online and traditional classroom modalities. Instruments providing personalized learning, interactive simulations, real-time feedback, and adaptable support demonstrably contribute to heightened student engagement, self-direction, and a more concentrated focus on their academic performance.

5.7 Comparing the Effectiveness of AI-Based Interventions on Student Engagement and Motivation in Online and Traditional Classroom Settings

This study sought to delineate the comparative influence of AI-based educational tools influence student engagement and motivation in online and traditional classrooms. The collection of feedback from students, lecturers, and stakeholders, therefore, aimed to provide elucidation regarding the efficacy of AI interventions within these distinct learning environments. The study included 2,070 individuals, comprising 2,000 undergraduate students and 70 academic staff. From this group, a sample of forty participants was chosen, as detailed in Table 13 of the original demographic data.

This sample included 25 students (ten males and fifteen females), selected through stratified purposive sampling to ensure a balanced representation of gender and academic fields, in addition to ten lecturers (six males and four females), selected owing to their demonstrative involvement with AI-based pedagogical instruments. Additionally, five stakeholders

(three males and two females), including representatives from the National Council for Higher Education (NCHE), alumni, and administrators, were selected to incorporate their institutional perspectives.

Within this sample, a focused subset was strategically selected for a detailed AI intervention study, facilitating the acquisition of empirically rich, experience-based data. This subset consisted of twenty-five students, bifurcated between online settings (thirteen students) and traditional classrooms (twelve students), and ten lecturers, equally apportioned between those instructing in online environments (five lecturers) and those in traditional classrooms (five lecturers). All stakeholders were consequently included to provide comprehensive institutional insights. This deliberate selection of a subset consequently ensures that participants engaged in meaningful interactions with AI learning tools; this methodological approach thus balances representativeness with in-depth analysis to establish connections between granular insights and the broader educational populace.

Findings suggest that AI-based interventions may exert a positive impact on student engagement and motivation across both learning environments. However, students in online settings reported slightly higher levels of engagement and motivation compared to those in traditional classrooms.

The data delineated in Table 13 indicate that students within online learning environments reported average engagement scores of 4.5 and motivation scores of 4.3, both measured on a five-point scale; students in traditional classroom settings documented corresponding scores of 4.1 and 4.0, respectively. This discernible discrepancy may suggest a pronounced efficacy of AI tools within online instructional paradigms. Such environments, it is posited, inherently offer personalized support and interactive elements, which could potentially compensate for the customary absence of direct interpersonal engagement.

Table 13. Student Engagement and Motivation in Online and Traditional Classroom Settings (Subset Sample: n = 25)

Category	Number of Students	Engagement (out of 5)	Motivation (out of 5)
Online	13	4.5	4.3
Traditional	12	4.1	4

Source: Primary data, 2025.

Elucidation: This table delineates the self-reported engagement and motivation scores procured from two distinct cohorts of students employing AI-based learning tools across varied instructional contexts. The marginally elevated scores observed among online learners may indeed signify the enhanced personalization and continuous feedback mechanisms inherently provided by AI within virtual environments.

Instructors generally concurred with the students' feedback, articulating a belief that AI tools demonstrably enhance both engagement and motivation; online educators, in particular, evinced a more robust endorsement of this perspective.

As indicated in Table 14, all five online lecturers (100%) affirmed the effectiveness of AI tools in enhancing engagement and motivation; by contrast, 80% (four out of five) of traditional classroom lecturers observed comparable improvements. Such disparity may originate from the augmented reliance on AI as a facilitative instrument in online pedagogy.

Table 14. Lecturer Perspectives on AI-Based Interventions in Online and Traditional Classroom Settings (Subset Sample: n = 10)

Setting	Number of Lecturers	Effectiveness in Enhancing Engagement	Effectiveness in Enhancing Motivation
Online	5	100%	100%

Traditional	5	80%	80%

Source: Primary data, 2025.

Explanation: this table delineates lecturers' evaluations of AI-based interventions; although online lecturers evince unanimous endorsement of AI's value in virtual classrooms (a stance indicative of substantial confidence), traditional classroom lecturers concur predominantly, albeit with support that appears less consistent.

Stakeholders also shared their views on how Artificial Intelligence (AI)-based interventions affect institutions. All five stakeholders (one hundred percent) concurred that AI tools may contribute to the enhancement of student engagement and motivation; additionally, sixty percent (three stakeholders) observed elevated levels of engagement within programs that incorporated AI tools. Furthermore, forty percent (two stakeholders) had directly provided direct support for the integration of AI within educational initiatives.

Table 15. Stakeholder Perspectives on AI-Based Interventions (Sample: n = 5)

Category	Number of Stakeholders	Percentage (%)
Believe AI-based interventions enhance engagement and motivation	5	100%
Observed increased student engagement	3	60.00%
Supported AI integration in educational initiatives	2	40.00%

Source: Primary data, 2025.

Explanation: This table delineates the perspectives of stakeholders who exert influence upon educational policy and its subsequent implementation; their consistent support, therefore, underscores the discernible potential of AI tools to augment engagement and motivation.

A thematic analysis of qualitative responses, derived from all forty participants—comprising twenty-five students, ten lecturers, and five stakeholders—served to identify several key AI functionalities which ostensibly enhance engagement and motivation. These functionalities encompass personalized learning experiences, real-time feedback mechanisms, interactive content, and adaptable difficulty levels. Furthermore, as delineated in Table 16, participants within online instructional environments appeared to reference these thematic elements with greater frequency than their counterparts in conventional classroom settings.

Table 16. Thematic Analysis of AI-Based Interventions in Online and Traditional Classroom Settings (Sample: n = 40)

Theme	Online Setting	Traditional Setting
Personalized learning experiences	12	10
Real-time feedback and assessment	10	8
Interactive and engaging content	9	6
Adaptive difficulty levels	7	5

Source: Primary data, 2025.

Elucidation: This table delineates the frequency of participant mentions concerning salient artificial intelligence features. The higher counts among online learners for personalized learning experiences, real-time feedback, interactive content, and adaptive difficulty levels suggest that AI-based tools can be effective in increasing engagement and motivation in online settings where face-to-face interaction may be limited (Almusaed et al., 2023; Park & Doo, 2024; Seo et al., 2021).

One lecturer articulated the efficacy of artificial

intelligence instruments across both pedagogical contexts:

"This AI-powered virtual learning assistant has made it easier to support my students online. It engages them and maintains their progress by providing personalized feedback and assistance. Consequently, they are performing better in class and are more satisfied with their learning. The AI simulations in class also significantly enhance enjoyment. My students are considerably more engaged in learning, and I observe their heightened enthusiasm for it. These simulations also help them think better and fix problems, which prepares them for future challenges. These AI tools have changed how I teach and how students learn. I can now make class considerably more active and student-focused."

This testimony highlights the salient contributions of artificial intelligence. Virtual assistants provide personalized assistance in online settings, while interactive simulations enhance engagement in traditional classrooms.

These observations align with prior scholarly investigations. AI-powered virtual assistants help students by providing personalized feedback (Singh et al., 2024). Kim et al. (2022) indicated that AI-driven interactive simulations augment engagement and motivation. Interactive simulations foster critical thinking and problem-solving proficiencies (ATICI & Turhan, 2024). AI tools have a strong effect on promoting student-centered education (Tang, 2024).

In summation, AI-based virtual learning assistants and interactive simulations substantially enhance student engagement, motivation, and academic attainment in both online and traditional classrooms. The marginally elevated levels of engagement and motivation reported in online settings suggest that AI tools are particularly efficacious in addressing the inherent challenges in virtual learning. Stakeholder perspectives additionally corroborate the utility of these instruments for educational institutions. Consequently, these findings advocate for an expansion in the implementation of AI-supported pedagogical methodologies to optimize educational outcomes across diverse learning environments.

6. Conclusions and Recommendations

Introduction: This study was conducted at the Nsamizi Training Institute for Social Development (NTISD) in Mpigi District. Its primary objective was the assessment of the impact of AI-based interventions upon student engagement and motivation in both online and traditional classroom settings. The results appear to demonstrate a statistically significant positive effect of these AI interventions on students in both environments.

6.1 Conclusions

The study examined how AI-based interventions influence student engagement and motivation across diverse pedagogical modalities. The findings suggest that artificial intelligence tools may enhance engagement, motivation, and participation within both online and traditional classroom environments. In online settings, students exposed to AI interventions showed higher motivation, self-efficacy, and goal-setting behaviors. They also exhibited heightened participation and articulated a more pronounced interest in learning activities.

In traditional classroom settings, AI interventions may foster improvements in attendance, participation, and academic performance, thereby contributing to the enrichment of the overall learning experience. While AI interventions demonstrated a marginal increase in efficacy within online contexts, this observed disparity did not attain statistical significance. Consequently, these findings suggest the potential utility of AI-based tools in both traditional and online modalities for the promotion of favorable student outcomes.

These findings may hold substantial implications for educators, policymakers, and researchers; they appear to underscore the discernible benefits of employing AI-based interventions for the enhancement of student engagement and motivation, particularly within online learning environments. Nonetheless, further investigation is warranted to elucidate the long-term effects of these interventions and their capacity to integrate online and traditional classroom experiences effectively.

In summation, this study appears to underscore the considerable potential of AI-based interventions to facilitate improvements in learning outcomes; furthermore, it may offer actionable insights for the development of efficacious educational strategies across diverse pedagogical environments.

6.2 Recommendations

1) Ensure Effective Implementation and Integration: The meticulous integration of AI-based interventions within both digital

and conventional pedagogical environments is paramount. Such an endeavor necessitates the seamless integration of these tools with extant curricula and established instructional methodologies. Educators need training and ongoing support to use AI tools effectively (Ayala-Pazmiño, 2023). Continuous monitoring and rigorous evaluation are imperative for assessing the impact of these instruments on student engagement and motivation; subsequently, the obtained feedback ought to inform the refinement and enhancement of the technology. Having adequate technological infrastructure and reliable support is essential to reduce disruptions (Fitas, 2025). Furthermore, the cultivation of collaborative endeavors among educators, researchers, and AI developers is advisable, facilitating the dissemination of exemplary practices and the generation of sustainable AI solutions.

2) Pursue Future Research Directions: Further scholarly inquiry ought to delineate the protracted effects of AI-based interventions upon student learning outcomes. Additionally, investigations could explore AI's application within diverse educational contexts, including but not limited to special education and second language acquisition. The development and subsequent assessment of AI instruments designed to ameliorate specific learning challenges, such as mathematics anxiety or reading comprehension deficits, are likewise imperative. An investigation into AI's facilitative role concerning metacognition and self-regulated learning is also warranted. Ethical issues like bias, privacy, and transparency should be thoroughly considered (Patil, 2026). Moreover, the conceptualization and establishment of frameworks for the evaluation of AI effectiveness, as well as its discernible impact on teacher professional development, are crucial endeavors. The investigation of AI applications within informal learning milieus and STEM education may yield further valuable insights.

3) Strengthen Teacher Training and Support: Professional development programs ought to facilitate the acquisition of requisite skills and confidence among educators for the effective implementation of AI-based interventions. Such training should encompass both the practical integration of these tools and the provision of viable solutions for technical impediments. The provision of ongoing coaching and the cultivation of opportunities for teacher collaboration will likely bolster successful implementation. The establishment of comprehensive resources, guides, and pedagogical communities may assist educators in the adoption of AI technologies, concurrently addressing any concomitant concerns.

4) Promote Student Feedback and Involvement: The regular collection and subsequent utilization of student feedback are indispensable for the refinement of AI-based interventions. Involving students in designing, developing, and testing AI tools ensures they meet learners' needs and preferences (Ferreira-Meyers, 2025). Focusing on student-centered design can enhance ownership, agency, and motivation in the learning process (Kahila et al., 2024). Transparency about AI use, data privacy, and security should be a top priority to build student trust (Chan, 2023). Providing opportunities for reflection and input empowers students and boosts the overall effectiveness and acceptance of AI-supported learning experiences (Jin et al., 2023).

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Assessing the Listening Process of Hospitality Management Students: Implications for Industry Readiness

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Abstract

Listening, recognized as the most critical communication competency for service quality, remains unfamiliar as a discrete, multi-stage domain in the hospitality education sector. In this respect, this paper sought to ascertain the level of listening process achievement of BSHM students at a private college in the Philippines. The research was facilitated by the use of a questionnaire with 50 items designed with reference to the five stages of listening developed by DeVito. The data collected from the research were analyzed with the help of the Jamovi package. It was established that there was a generally High level of listening among students ($M = 3.59$, $SD = 0.58$; $\alpha = .98$). In addition, female students had higher scores in receiving, understanding, and responding ($p < .05$; small effects), but, most importantly, academic performance could be regarded as a predicator of the level of listening ($\eta^2p = .04–.06$).

Keywords: listening process, hospitality management education, communication competence, DeVito's five-stage model, academic performance, service readiness

1. Introduction

Hospitality can be labeled as a people-driven market, meaning that value is created essentially in real time through interaction between guests and frontline workers: the efficiency of this process depends on how well workers can listen. Listening appears among the most important communicative skills in studies of hospitality and tourism management graduates conducted by industry employers (Bagon et al, 2023). Brownell (1994) also indicates that listening is considered the most important communication competence by hotel managers, whose skills evolve with their career growth. Despite its acknowledged significance, listening is seldom presented in hospitality studies but is integrated into general communication skills courses that focus mainly on speaking and writing (Deale & Lee, 2021; Villadiego et al., 2023).

In the context of the Philippines BSHM specifically, this discrepancy is important since students would be required to heed and carry out vocal instructions from their authorities, comprehend requests from visitors who might have an accent or talk in a foreign language, and be able to recall a lot of service standards without having their instructions written down. The curriculum, while recognizing the importance of

listening in general communication, does not view it as an ability that can be identified and developed in a focused way and thus risks producing students who know how to talk and communicate well but have no idea how to listen, which is arguably the crucial part of communication when it comes to satisfying clients and avoiding mistakes.

This imbalance is significant for the simple reason that listening is not a single action; rather, it is an aggregate of stages in the process of listening, some proficient, others not. According to DeVito (2000), listening consists of five stages that progress through a four-step process: comprehension (receiving the information), understanding (what is implied by it), remembering (keeping the information in mind), evaluating (what it costs), and responding (giving feedback). Brownell's HURIER model of hearing, understanding, remembering, interpreting, evaluating, and responding was developed on the basis of empirical studies of hotel managers, pointing thus again to the natural development of the idea that listening may consist of stages in the field of hospitality (Brownell, 1994). Thus, evaluating students according to such a model gives an operational advantage over evaluation tests based on the principles of subjective estimation of communication competence, as it indicates not only the degree of listening ratio of the students but also their proficiency in each of the five stages of listening.

There are two more factors in the Philippine context. First, in the Philippines, BSHM courses usually include participants from different regions who speak various languages; the impact of this diversity on listening comprehension is an important issue but needs to be explored further when developing the curriculum. Second, the use of smartphones in classes has recently been associated with a decline in students' engagement and retention of lectures and failure in their studies (Agostini & Petrucco, 2023; Pew Research Center, 2024; Rutgers University, 2026), which refers to the receiving component that is described in DeVito's model and discussing the subject matter of the tool that is applied in the present research.

Based on these knowledge gaps, this study pursues five objectives:

1) to explore demographic features of BSHM participants;
2) to assess how well the listening process was performed overall and by stage;
3) to examine sex-, age-, first language-, and academic achievement-related differences in the listening process;
4) to find out how the listening process affects academic achievement;
5) to check whether the stages of the listening process have predictive power in relation to academic success.

This study will strive to be methodologically advanced and at the same time practically useful, as its findings will be discussed in relation to the industry.

2. Literature Review and Theoretical Framework

2.1 The Listening Process as a Multi-Stage Construct

Communication research has always made a clear distinction between hearing, the physical process of perceiving sounds, and listening, which requires us to pay attention, process the information we hear, and respond (DeVito, 2000). DeVito's model is based on the principle that we should think about listening as a sequence of processes, and if we cannot succeed at one process, we will fail at the next ones as well: the listener cannot understand a message that he/she has not perceived, and inability to understand the message leads to memory problems, biased evaluations, and incorrect responses. Since the model implies that each stage of the listening process is different behaviorally, it is possible to measure listening processes separately, which is what is being done by the tool used in this research (10 items for each stage, 50 items in total).

An analogous model, known as HURIER, has been devised by Brownell, having been based on observing people in hospitality, as well as business, sectors (Brownell, 1994). The coincidence of a general communications model developed under DeVito and a model specifically for hospitality establishments formulated by Brownell supports the application of the stage-based mechanism in the analysis and evaluation of the listening process, rather than using just one global score of listening level.

2.2 Listening as a Hospitality Service Competency

In the area of research on service recovery, active listening refers to allowing the customer to share their grievance prior to responding and has been

positively demonstrated to result in positive outcomes for customers, including greater satisfaction and tips, as well as an overall sense of being treated with respect. Since service outages are not uncommon in hospitality, the ability of service personnel to hear, comprehend, and respond to the customer's complaint is a clear and visible factor in initiating the service recovery process. Just by itself, this realization gives an additional practical reason to treat listening as a skill which should be evaluated by hospitality schools on purpose instead of taking it for granted that the students possess this skill already.

2.3 Listening and Academic Performance

The connection between listening and academic performance in college students is not well researched but tends to be positive. Eggenberger (2021) showed that the use of an established employability-skills instrument for the measurement of active listening ability has predictive power in the case of low-achieving community college students who they believe to be successful because of their listening skills. At the same time, findings from research in this area are not consistent. The magnitude of the association between listening and academic success does not seem to be especially large, which means that listening is only one factor of academic success among many. Research literature on classroom mobile phone use and its negative correlation with cognitive performance provides complementary evidence to such investigations (Agostini & Petrucco, 2023; Pew Research Center, 2024; Rutgers University, 2026). Since a number of items in the current survey's receiving scale are oriented towards mobile phones and devices, this proves that mobile phone use is potentially connected to the current research problem.

2.4 Communication Skill Gaps Among Hospitality Students

Recent studies from the Philippines and Southeast Asia have yielded similar conclusions about HTM students' oral communication skills, including listening. Specifically, they suggest that the skills often receive only moderate or intermediate ratings, while students tend to indicate in surveys that they are fairly confident in skills such as working with clients (Bagon et al., 2023; Villadiego et al., 2023). Reading-related research has shown that hospitality students also fail to consistently engage in receptive language practices and that their levels of engagement are linked to academic performance. This is further evidence that receptive competencies tend to be developed less than expressive ones in HTM programs (Deale & Lee, 2021). Overall, this body of literature allows the authors of this study to argue that introducing a listening assessment with sophisticated criteria for measuring perceived skills among BSHM students is expected to fill existing gaps and provide relevant inputs into curriculum development processes.

2.5 Measuring Listening: Self-Report Instruments and Their Limitations

There are many reasons why, like the current study, previously conducted significant studies on listening used self-report Likert type instruments instead of real behavior testing: first and foremost is the practical aspect since actual measure approaches (e.g., requiring test participants to remember or paraphrase a recording they hear) require huge expenditures and are pretty much impossible, especially on classroom/programmatic tests; also, while self-report instruments are practical and can be used in some studies in order to distinguish hearing and remembering and understanding the received information, they measure the way a person perceives his/her hearing and are also subject to social desirability bias. This distinction is crucial when interpreting the findings of the present research since a high self-reported level of hearing indicates that students believe that they demonstrate good listening skills all the time, but does not mean that other people will agree with this or that objective assessments (i.e., performance measures) will prove it in the same way. Previous studies indicated that there is no correspondence between self-reported and performance measures of hearing in the majority of studies included in the research process.

2.6 Demographic Correlates of Listening

Research has shown conflicting results regarding sex-based differences in listening abilities and associated skills such as reading and language skills. Some studies concluded that females perform better when it comes to language-related activities, while other studies could not establish any differences after filtering out other confounding factors (Villadiego et al., 2023). Research on the impact of first language or mother tongue on listening disposition in multilingual settings is scarce, and there are very

few studies of this kind other than the ones related to English as a foreign language. This research provides new evidence on both issues by focusing on a specific population – the Philippine BSHM representative sample, which consists of speakers of different languages, i.e., Filipino, Iloco, Visaya, English, and other local languages.

3. Methodology

3.1 Research Design

The researcher employed a quantitative, descriptive-correlational, cross-sectional survey method in this research study. Descriptive statistics were used to indicate the degree, while correlational and comparative statistics explored the association between the two variables. There was no experimental manipulation; causative inference does not follow from the correlation results.

3.2 Respondents and Sampling

The sample included 314 officially enrolled BSHM students in Northeastern College, a private higher education institution in the Philippines, who volunteered to participate from late July to early August 2026 during the data collection period. In this study, the sampling method that was employed was convenience sampling. A survey link was disseminated to all current BSHM students, and responses were captured only from those who expressed their willingness to participate. As a result, it created a non-probability sample, which should be used with caution when generalizing findings.

3.3 Research Instrument

In this study, listening was assessed by means of a questionnaire consisting of 50 questions divided into five subscales as per DeVito's (2000) stages of listening - Receiving/Attending, Understanding, Remembering, Evaluating, and Responding. This questionnaire was developed by the researcher, and the responses were obtained by using a five-point Likert scale ranging from "strongly disagree" to "strongly agree," with higher scores indicating higher levels of listening.

Additionally, a demographic section was included comprising sex, age group, mother-tongue of family, and academic achievement.

The instrument's content coverage has been constructed so that it can be compared on a one-to-one basis to DeVito's (2000) ability stages; for instance, Receiving/Attending refers to the concept of focus on the event, and clarity of the event instead of distractions caused by devices used for communication; Understanding concerns grasping the meanings, both literal and figurative; Remembering refers to remembering the most important facts and directions; Evaluating refers to distinguishing facts from opinions, and assessing credibility of the message source; and Responding is about verbal and nonverbal feedback.

3.4 Data Gathering Procedure and Ethical Considerations

The survey was taken online. Participation was voluntary, and communication, along with any personal information other than contact email for administrative purposes, was anonymous, since the email was taken off at the time of analysis and is not included in this paper. Participants were informed in advance about the purpose of the research, and their knowledge about it implies their acceptance of the conditions.

3.5 Statistical Treatment

The data analysis was conducted using Jamovi, an open-source platform for statistics based on R, using the analytical methods implemented in the JMV analysis modules (Şahin & Aybek, 2020). The demographic characteristics were summarized using descriptive statistics. The mean and standard deviation were used to obtain the indexes of the listening process with reference to a five-point range, i.e., (4.20-5.00 = Very High; 3.40-4.19 = High; 2.60-3.39 = Moderate; 1.80-2.59 = Low; 1.00-1.79 = Very Low). The internal consistency of all subscales and of the tool was obtained by Cronbach's alpha. The recommended approach for interpretation is that while using the alpha value with 95% confidence intervals, one must treat the alpha value as evidence of internal consistency.

The Shapiro-Wilk test was utilized to evaluate the normality of subscale distributions; with the sample size of 314 individuals, the Central Limit Theorem was applied so that parametric methods could be used despite the finding of significant deviation from normality. Testing for differences due to gender was performed using independent-samples t tests, with Levene's test being used to determine which version of t-test to use, while Cohen's d was reported. Age group, language background, and academic performance group differences were evaluated using one-way ANOVA with eta-squared as a measure of effect size and Tukey's HSD being

employed for post hoc tests if the omnibus result was significant; associations among five listening dimensions were evaluated using Pearson r; association between listening level and academic performance group (treated as ordinal) was measured using Spearman's rho. Finally, a multiple linear regression analysis was performed to check whether five listening dimensions entered into the regression together have a significant effect on academic performance. The statistical significance level was set at $\alpha = 0.05$ for all conducted tests.

4. Results

4.1 Demographic Profile

The demographic profile of the 314 respondents is outlined in Table 1. In this sample, the number of females (62.4%) is greater than that of males, and many of the respondents (57.6%) fall in the 19–21 age group. Most respondents (67.5%) speak Filipino or Tagalog at home, and the rest (32.5%) communicate in Iloco, Visaya, English, and other local dialects. The respondents' academic results are distributed primarily in the 85–89 and 90–100 general average categories (43.6% and 30.3%, respectively), with a very small percentage (3.5%) scoring below 80.

Table 1. Demographic Profile of Respondents

Characteristic	f	%
Sex		
Female	196	62.4
Male	118	37.6
Age Bracket		
16–18	103	32.8
19–21	181	57.6
22 and above	30	9.6
Family's First Language		
Filipino/Tagalog	212	67.5
Iloco	30	9.6
Visaya	29	9.2
English	26	8.3
Other local dialects	17	5.4
Academic Performance (General Average)		
90–100	95	30.3
85–89	137	43.6
80–85	71	22.6
Below 80	11	3.5

4.2 Level of the Listening Process

Table 2 shows the mean score of the listening process as categorized into different dimensions. All five dimensions and the overall composite score fell into the High category, ranging from 3.40 to 4.19, showing that most respondents regarded themselves as practicing the behavior associated with all stages of the process quite frequently, yet not always. The dimension Responding (M = 3.67, SD = 0.67) and the dimension Receiving/Attending (M = 3.66, SD = 0.67) had almost the same rating score as the third dimension Remembering (M = 3.47, SD = 0.63), which had the lowest score among the five dimensions. The difference between the maximum and minimum score, however, did not exceed 0.20 points on the scale.

Table 2. Level of the Listening Process by Dimension

Dimension	k	M	SD	Descriptive Level
Receiving/Attending	10	3.66	0.67	High
Understanding	10	3.55	0.64	High
Remembering	10	3.47	0.63	High
Evaluating	10	3.60	0.66	High
Responding	10	3.67	0.67	High
Overall Listening Process	50	3.59	0.58	High

4.3 Reliability of the Instrument

According to Table 3, internal-consistency estimates were successful in coming up with results greater than the accepted mark of .70. The sub-scale produced α values between .90 and .94 while the overall scale sees α equal to .98. Also, while Taber (2018) warns that very high values of alpha should not be seen as sufficient proof of differentiation in the instrument, we consider this finding alongside the intercorrelation analysis that is discussed below and shows that indeed the five sub-scales do share noticeable variance.

Table 3. Internal Consistency of the Listening Process Subscales

Scale	k	Cronbach's α	95% CI
Receiving/Attending	10	.90	[.88, .92]
Understanding	10	.91	[.90, .93]
Remembering	10	.91	[.90, .93]
Evaluating	10	.94	[.93, .95]
Responding	10	.92	[.91, .94]
Overall Scale	50	.98	[.97, .98]

4.4 Differences by Sex

Independent-samples t-test findings comparing male and female participants are elaborated in Table 4. The results show that female respondents showed much higher levels in the areas of Receiving/Attending, t(312) = -2.04, p = .042, d = -0.24; Understanding, t(312) = -2.07, p = .039, d = -0.24; Responding, t(312) = -2.40, p = .017, d = -0.28; and the Overall composite, t(312) = -2.08, p = .038, d = -0.24. There were no significant differences in Remembering (p = .074) and Evaluating (p = .317). The strength of all vast differences was small.

Table 4. Independent-Samples t-Test for Listening Dimensions by Sex

Dimension	Male M (SD)	Female M (SD)	t(312)	p	Cohen's d
Receiving/Attending	3.56 (0.74)	3.72 (0.62)	-2.04	.042*	-0.24
Understanding	3.45 (0.70)	3.61 (0.59)	-2.07	.039*	-0.24
Remembering	3.39 (0.70)	3.52 (0.58)	-1.79	.074	-0.21
Evaluating	3.55 (0.69)	3.62 (0.63)	-1.00	.317	-0.12
Responding	3.55 (0.71)	3.74 (0.64)	-2.40	.017*	-0.28
Overall Listening Process	3.50 (0.63)	3.64 (0.55)	-2.08	.038*	-0.24

4.5 Differences by Age Bracket, First Language, and Academic Performance

Table 5 presents the findings from one-way ANOVA for the remaining three grouping variables. It showed no statistically significant difference regarding listening levels based on age bracket (all p > .47) or family language (all

p > .20). In contrast, academic bracket showed meaningful statistical differences in all four dimensions as well as for the composite score using small to moderate effect sizes (η^2p = .04 to .06).

Table 5. One-Way ANOVA Results for Listening Dimensions by Age Bracket, First Language, and Academic Performance

Dimension	F (Age)	p	F (Language)	p	F (Acad. Perf.)	p	η^2p (Acad. Perf.)
Receiving/Attending	0.66	.517	0.21	.931	5.09	.002**	.047
Understanding	0.70	.497	1.31	.265	5.63	.001**	.052
Remembering	0.75	.475	0.54	.707	6.53	<.001**	.059
Evaluating	0.10	.901	1.43	.223	5.21	.002**	.048
Responding	0.01	.986	1.49	.206	4.47	.004**	.041
Overall Listening Process	0.32	.730	0.99	.413	6.55	<.001**	.060

*Note. df(Age) = 2, 311; df(Language) = 4, 309; df(Academic Performance) = 3, 310. ** p < .01.*

According to Tukey's HSD post-hoc analysis for the overall listening process by academic performance level, students from the 90-100 category (M = 3.79) performed better than students in the 85-89 category (M = 3.51, p = .001), students from the 80-85 range (M = 3.51, p = .010), and students from the below-80s category (M = 3.28, p = .024). All other pair-wise comparisons failed to yield significance, including that between the 80-85 and 85-89 groups (p = .999) and comparisons involving below-80s group and the two bottom brackets, (p > .56 for both cases). The overall trend that characterizes the situation, i.e. the top-performing group being distinguished among the rest, has been identified when comparing all the dimensions mentioned above.

4.6 Relationships Among the Listening Dimensions and with Academic Performance

The data provided in Table 6 show that there is a strong positive correlation between the five listening dimensions, with correlation coefficients ranging from .68 to .82 and p-values lower than .001. This implies that students who performed well on one dimension also performed well on other dimensions of listening. The overall high alpha mentioned earlier suggests that the instrument measures a generic listening competence, in addition to providing data on five independent dimensions of listening.

Table 6. Intercorrelation Matrix Among the Five Listening Dimensions (Pearson r)

Dimension	1	2	3	4	5
1. Receiving/Attending	—				
2. Understanding	.81	—			
3. Remembering	.73	.75	—		
4. Evaluating	.68	.75	.76	—	
5. Responding	.73	.74	.75	.82	—

Note. All correlations significant at p < .001.

The Spearman correlations between the listening dimensions and the level of academic performance were positive and statistically significant but were of a small value: Receiving/Attending, ϱ = .15, p = .010; Understanding, ϱ = .19, p = .001; Remembering, ϱ = .25, p < .001; Evaluating, ϱ = .19, p = .001; Responding, ϱ = .19, p = .001; Overall listening process, ϱ = .21, p < .001. Remembering had the strongest relationship with academic performance among the dimensions.

4.7 Predicting Academic Performance from the Listening Dimensions

A multiple linear regression analysis aimed to identify whether all five dimensions of listening, when taken simultaneously, could give rise to an effect on learning (which was converted into a numerical figure). The general model was significant but explained a little variance (R^2 = 0.06, adjusted R^2 = 0.04, F (5, 308) = 3.89, p = 0.002). Despite that, it appears that none of the dimensions on their own could demonstrate a significant impact on learning at the .05 level. In contrast, other dimensions are controlled for (see Table 7), including Remembering, which had the biggest coefficient, b = 1.46. Testing five predictors led to the conclusion that multicollinearity is present between the listening dimensions, since they explain 46%-67% of their variance among one another (r^2 = $.68^2$ - $.82^2$). Therefore, the model cannot tell which predictor contributes to learning.

Table 7. Multiple Linear Regression Predicting Academic Performance from the Five Listening Dimensions

Predictor	b	SE	t	p
(Constant)	80.51	1.82	44.15	<.001
Receiving/Attending	-0.37	0.81	-0.46	.647
Understanding	0.87	0.90	0.97	.335
Remembering	1.46	0.83	1.75	.081
Evaluating	0.00	0.88	0.00	.998
Responding	0.19	0.85	0.22	.826

Note. R^2 = .06, adjusted R^2 = .04, F(5, 308) = 3.89, p = .002. Dependent variable: academic performance, recoded to bracket midpoint (below 80 = 75; 80–85 = 82.5; 85–89 = 87; 90–100 = 95).

5. Discussion

In line with the initial prediction of this research, the role of listening in the opinion of the respondents from BSHM was valued as High, instead of Very High, at every step of the model proposed by DeVito (2000). The fact that this value is below the highest possible category is, in itself, meaningful: the results imply that students correctly identify listening behavior as something positive, even if they do not execute it completely automatically. The lowest rated component, namely Remembering, is consistent with the general principle found in the literature on listening that states that this component is the weakest stage of the listening process since it is reliant on the successful performance of the first two stages (DeVito, 2000); if a student has been distracted or misinterpreted what was said, he/she will not be able to remember the message at this moment. The fact that this component correlates highly with academic success in our sample (ϱ = .25) proves its importance in practice; anything that hampers students' ability to remember what they heard in class can also hinder listening in the workplace.

The minor yet steady women's edge in Receiving/Attending, Comprehending, and Responding resounds a more substantial but inconsistent trend in the literature of gender and listening; indeed, in the works of some authors there is a small female advantage in the tasks involving receptive language while other researchers found no difference in the results after controlling for other factors (Villadiego et al., 2023). Since the corresponding effect sizes were altogether small ($|d| \leq 0.28$), the present findings need to be treated as the tendency relevant at the population level rather than an argument for rendering instruction varying by sex in practical terms; thus, it can be said that even in a mixed class that would be analyzed here the male and female students would exhibit considerable similarity in terms of listening skills.

Overall, the absence of meaningful age or language group differences is a positive discovery for program development. The results indicate that for this population, listening skills (as defined in this context) do not simply depend on age or language background; hence, it is reasonable to conclude that listening programs can be applied equally to learners of different age and linguistic backgrounds. However, caution should be exercised in interpreting this finding since the groups differ significantly in size when it comes to first language (there are 212 speakers

of Filipino/Tagalog, while there are only 17 other local dialect speakers), which makes it more difficult to identify small but significant differences that might exist in some of the others.

The results regarding academic performance came out as the most reliable evidence. It was revealed that every dimension of listening, according to the academic performance level, was significantly different. In each case, it was confirmed that students in the highest category had the highest score. In contrast, those in the other two groups scored lower, with relatively low/medium statistical significance. This proves that the data obtained in this study is consistent with the previous studies of active listening effectiveness among students (Eggenberger, 2021), and the literature related to the relationship between better attention at the classroom and fewer distractions from the devices that led to lower academic performance (such as studies by Agostini & Petrucco, 2023; Pew Research Center, 2024; Rutgers University, 2026), including those seen in the Receiving/Attending subscale (such as questions about device distraction). At the same time, the regression analysis results indicate the need to be careful with the interpretation of the results. Although the regression model used in the study was statistically significant, it explained only 6% of the variance in academic performance, and none of the listening dimensions used in this study affected it independently of other dimensions.

The highest degree of correlation among the five factors is the most feasible explanation. Instead of suggesting that there are five independent predictors, the results support the notion that there is a strong general listening factor related to the weaker indicator of academic achievement. In addition to academic performance, numerous other factors affecting grades, including study habits, past performance, course complexity, and socioeconomic background, are not assessed by the questionnaire. According to Taber's recommendations in the matter of interpreting very high alpha-coefficients, α = .98 is again regarded here as proof of reliability. A re-analytical procedure would clarify whether the data are better represented in a five-factor model or the bi-factorial one (general listening plus specific factors).

It is important to keep in mind the modest 6% variance explained according to the regression results in the greater empirical literature regarding the determinants of academic performance, where individual psychosocial or skill measures, such as listening, also result in a naturally low share of variance, as they are considered together with stronger, more predictive measures like prior grade point average, study time, and class attendance, all of which were not accounted for in this study. Considering the results, they might not be used as null results; on the contrary, the findings show that listening is statistically significant and strongly associated with academic performance in each possible type of analysis, and, at the same time, it should be emphasized that listening cannot be a full explanation for higher academic results for some students over others in BSHM.

6. Theoretical Contribution

The research builds upon DeVito's (2000) 5-stage model of listening, an important concept in general communications education, and applies it to the field of hospitality management education outside North America. It also tests the stage structure against the HURIER model proposed by Brownell (1994) – a model that hospitality management experts specially developed for the specific context of hospitality and restaurant management education. The marked similarities across the five stages found in the Philippine BSHM sample constitute an important theoretical finding in and of themselves – they indicate that the relatively age-old distinctions between stages may be less pronounced among novice hospitality studies students than the model supposes.

There are other theoretical implications regarding the assessment of listening. Based on the correlations' findings, the five stages of DeVito might be viewed as forming a single general factor for a novice hospitality student population. In this case, while the five-stage breakdown will serve primarily as a diagnostic and pedagogical tool — establishing, as results indicate, that Remembering stage is one of the weaker stages worthy of particular attention — much information can be obtained from having a composite score, which allows for achieving great insight regarding the students' listening skills and does not need to rely on separate scores of sub-scales in the course of such statistical analyses as the regression analysis conducted in this research.

7. Practical and Industry Implications

For those teaching hospitality, the most evident

idea is that listening requires a relevant training technique that is systematic rather than ignored in general communication courses. As remembering is the least developed dimension and is most closely linked with academic achievement, methods focusing on retention should be the best approach to helping students learn. Retention involves techniques such as summarizing and taking notes, which are relevant for communicating in the workplace and mastering various skills, such as repeating guest requests and knowing standard operating procedures. As the study found that several points of Receiving/Attending have to do with the problem of the usage of devices and phones that are known for their negative influence on learning achievements, it would be wise to suggest educating students on the issue of the appropriate use of devices in the classroom and when having a conversation with guests.

For industry partners and internship coordinators, it can be inferred from the finding that listening actively increases customer satisfaction and service recovery after a service breakdown (Min et al., 2021) that there may be a rational basis for providing training in listening (not just customer service), especially for workers involved with recovery from service failures. Also, since the research does not indicate that listening abilities vary by age or first language group, industry training based on these findings may not need to consider trainees' demographic variables, which will ease the task of designing training programs for the HR and training divisions of hotels and restaurants.

8. Limitations and Future Research

Several limitations were part of these findings. The sample was taken from a single institution under convenience sampling, thus making it challenging to generalize these findings to other BSHM populations. All of the listening data analyzed is self-reported, thus allowing the possibility of social-desirability bias to influence the results and making it impossible to directly measure listening proficiency (for example, how well a person recalls a specific message verbatim). The findings are a general average on four levels rather than an actual GPA, which makes for less precise measurement overall; more accurate results could be obtained if more sophisticated measures were applied to this analysis.

The cross-sectional design prevents making cause-effect conclusions regarding the relationship between listening and academic performance. In addition, given a strong correlation among five subscales, future research should employ exploratory or confirmatory factor analysis to determine whether a five-factor, bifactor, or one-factor model fits the data best before using this measurement tool for important decision-making purposes. In the future, it would be useful to repeat the study in other institutions, to use performance rather than a self-reported measure of listening, to apply a continuous academic performance variable, and to employ a longitudinal design capable of testing the effect of targeted listening instruction on academic and/or working performance over time. One more opportunity is to combine quantitative information gained in this research with qualitative methods such as focus groups and/or reflective journals that can provide information about particular classroom, home, and part-time work experiences Filipino students associate with listening.

9. Conclusion

In this study, students pursuing a Bachelor of Science in Hospitality Management exhibited high listening abilities, as measured by DeVito's (2000) five-stage model. Of those five stages, remembering was noted as the weakest stage yet had the highest association with academic success. The findings indicated that respondents' sex had a small impact on three out of the five listening categories. At the same time, age and first language did not significantly influence listening, thus requiring uniform training in all five areas of listening for students studying in the BSHM programs. The results indicated a strong correlation between listening and academic success across the listening categories. However, the minimal value of variance explained shows that listening acts more as one skill than five, which is also why listening does not guarantee academic success. As listening is also connected to customer satisfaction and service recovery according to hospitality studies, the authors therefore suggest that listening should be taught as an independent competency and not developed automatically along with other communication skills.

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Assessment-First in Early Childhood Science Education: An Exploratory Practice of an Integrated "Intelligent Assessment-Intelligent Teaching-Intelligent Learning" Closed-Loop Model in a Kindergarten Junior Class

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Abstract

China's current reform of educational evaluation has drawn renewed attention to a persistent problem in early childhood science education: teaching, learning, and assessment have long functioned as separate processes. The signs are ordinary enough: activities planned from experience, inquiry that stays near the surface, judgment reserved for the end. Our study asks whether the order can be reversed—whether assessment, moved to the front, can pull teaching and learning together. The model we propose rests on two bodies of research, one on children's preconceptions and one on deep learning. Intelligent assessment, intelligent teaching, and intelligent learning are joined in a data-driven loop that spirals upward; diagnosis opens the process and keeps informing it. We implemented the model in four steps over two months with 22 children in a junior class (ages 3–4), under the science theme "The Big Tree and Its Friends." Digital tools supported the elicitation interviews, learning analytics, and process documentation throughout. The pre- and post-intervention evidence is encouraging. Recognition of concealed tree structures rose from 22.7% to 88.0%, and the proportion of children able to explain, in scientific terms, what plants need to grow rose from 9.1% to 90.9%, with visible gains in the quality of inquiry as well. These results suggest that moving assessment to the front of instruction can turn evaluation from a terminal verdict into navigational guidance at the very start of learning, while also helping teachers grow into data-informed, research-oriented practitioners and drawing families into closer cooperation with the kindergarten. For grassroots settings, the study offers a workable route for putting evaluation reform into practice.

Keywords: educational assessment, assessment-first, early childhood science education, deep learning, data-driven instruction, formative assessment

1. Introduction

Educational evaluation works as a central steering mechanism in the construction of a high-quality education system. The Overall Plan for

Deepening Educational Evaluation Reform in the New Era (CPC Central Committee and State Council, 2020) laid out a multi-dimensional evaluation framework and carried China's evaluation reform into a stage where dismantling outdated practices and building new ones go hand in hand, with construction given the priority. How a macro-level policy of this kind can be translated into everyday classroom practice—and what evaluation should, in the end, contribute to educational modernization—is where the present study begins.

Science education in the early years is foundational to the cultivation of innovative talent, and the kindergarten years are precisely the window in which dispositions toward scientific inquiry first take shape (National Research Council, 2007). Evaluation practice in preschools, however, still leans heavily on summative, outcome-oriented judgment. This kind of practice overlooks the dynamic character of young children's development and the sheer size of individual differences, and it fits awkwardly with a development-centered orientation. Curriculum evaluation is weakened further by vaguely worded objectives, fragmented content, and thin practical enactment, while evaluation standards and instrument development lag behind. On the front line of practice, these systemic tensions condense into three problems that recur again and again.

The first is a misalignment between instructional design and children's actual learning states. Objectives are often set from adult logic and generic experience, which rarely matches the imaginative, pre-conceptual world of a young child; teaching then proceeds in a one-directional manner, with limited effect. A second difficulty lies in the inquiry itself. Young children observe with the naked eye, and what the naked eye cannot reach—the mechanism behind a phenomenon—usually stays hidden from them. So, their inquiry often stops at describing what lies on the surface, and these fleeting impressions rarely settle into the stable, core experiences we hope children will carry with them. The third difficulty is about timing. Assessment usually arrives at the very end of a lesson, which means that while children are actually inquiring, no feedback reaches them. A judgment made only at the end cannot register the confusion, or the small breakthroughs, that occur along the way. It becomes little more than a stamp on the final product, and teaching, learning, and assessment drift further apart.

These problems pushed us back to a question that is easier to ask than to answer: what if assessment did not wait at the finish line, but stood at the starting point instead? For the frame we drew on deep learning theory, though what we had watched in real kindergarten classrooms shaped the model at least as much. In that model, assessment moves to the front of instruction and stays active there, running as a data-supported, spiraling loop through which intelligent assessment, intelligent teaching, and intelligent learning continually inform one another. If it works, the three strands are reconnected, and frontline teachers gain a model they can make their own.

2. Theoretical Foundations and Framework Construction

2.1 Policy and Theoretical Basis

Two policy documents frame this study: the Overall Plan for Deepening Educational Evaluation Reform in the New Era (CPC Central Committee and State Council, 2020) and the Guidelines for Learning and Development of Children Aged 3–6 (Ministry of Education of the People's Republic of China, 2012). On the theoretical side, we draw on two bodies of work—studies of preconceptions and studies of deep learning. As that literature describes it, deep learning does not proceed in a straight line. It starts from an effort to diagnose and restructure learners' existing ideas, develops through embodied inquiry situated in authentic contexts, and climbs in a spiral rather than along a linear path (Marton & Säljö, 1976; Biggs & Tang, 2011). This picture of learning is precisely what justifies running an integrated assessment loop through the entire instructional cycle.

2.2 Preconceptions: The Logical Starting Point and Diagnostic Basis of Learning

Before formal science instruction ever begins, learners have already built intuitive pictures of the natural world out of everyday experience, spontaneously and without guidance (Vosniadou & Brewer, 1992). A child's mind is no blank slate. These early understandings form the child's own framework for making sense of the world—a framework that resists change, depends heavily on context, and yet, for the child, carries real explanatory power (Carey, 1985).

A preschooler's conviction that a big tree needs to "drink milk" is a typical anthropomorphic

preconception of this kind. Traditional instruction tends either to ignore such ideas or to try to overwrite them directly with scientific concepts, yet decades of conceptual-change research suggest that this accomplishes little: old and new conceptions usually coexist and compete rather than one substituting for the other (Posner, Strike, Hewson, & Gertzog, 1982).

Recognizing and diagnosing children's preconceptions is therefore the logical starting point of science teaching—and the fundamental reason this study places assessment before instruction. Ausubel (1968) put it plainly: the most important single factor influencing learning is what the learner already knows. If the imaginative "theories" already at work in children's minds cannot be accurately identified, any instructional design is shooting in the dark. Front-loaded assessment makes these tacit, highly individualized preconceptions visible, and in doing so tells the teacher exactly where to intervene.

2.3 Deep Learning Theory: The Process and Destination of Learning

Deep learning is not the shallow memorization of knowledge. It denotes the learner's critical engagement with new ideas, the weaving of those ideas into existing cognitive structures, and the transfer of knowledge to novel situations (Marton & Saljo, 1976). In essence, deep learning happens while preconceptions are being challenged, revised, and rebuilt. On the pathway of this process the literature broadly converges: activating prior conceptions, provoking cognitive conflict, constructing scientific concepts, and applying them through transfer.

The critical lever in this cycle is the provocation of cognitive conflict. When children discover through embodied inquiry—handling materials, or watching phenomena that contradict their expectations—that what they previously believed can no longer account for the situation in front of them, genuine conceptual construction becomes possible (Posner et al., 1982). What this means for teaching is fairly direct. The core task is no longer one-way transmission; it is to design authentic situations and inquiry tasks that can provoke productive cognitive conflict, so that children do the meaning-making themselves as they travel from naive ideas toward scientific concepts. Seen this way, assessment also falls into line with learning—exactly as the formative assessment literature has long argued. Evidence of prior understanding is gathered not to certify children, but to steer the teaching that follows (Black & Wiliam, 1998; Wiliam, 2011).

2.4 Framework Construction: The Three-Loop, Four-Step Dynamic Assessment Model

On these foundations we built what we call a "three-loop, four-step" dynamic assessment model aimed at promoting deep learning (see Figure 1). In this model, assessment serves as the engine. It drives teaching and learning forward, and the three together form a data-supported, spiraling closed system—one that puts into practice a simple logic: diagnose preconceptions first, design for cognitive conflict, then support deep construction.

The model runs in four steps.

The first step happens before any teaching at all. With the help of digital tools, we collect children's original understandings of the inquiry topic and turn them into a visual profile of where the class actually stands. Objectives and activities are then set on this evidence rather than on experience alone.

The second step lets the assessment data decide the teaching. Broad objectives are split into targets that build on each other, and the scaffolds differ from child to child—more support for those who had never noticed roots, less for those who already had.

The third step belongs to the children. Tasks mix physical and virtual materials—real bark to touch, macro photographs to examine, root shapes projected on a screen—and call on several senses at once. Children handle the materials, run into problems their current ideas cannot solve, and rebuild their understanding piece by piece.

The fourth step looks at growth rather than outcomes. Process tracking and pre-post comparisons show what has changed in cognition and development, and whatever we learn goes into the next round. The loop closes; the next cycle starts one turn higher.

Pre-course Questionnaire for "The Big Tree and Its Friends"

Question	Picture
Where is the big tree? Where is the grass? Where is the flower? (The children point them out on the picture.)	
"Where are the leaves? Where are the branches? Where are the roots? Where is the trunk?" (The children point them out on the picture.)	
"You're going to walk from the street lamp over there to the big tree. How will you go? (Will you take the stone path or walk across the grass?)"	

Category	Specific Manifestations	No. of Childre
Plant cognition (basic)	Recognize common flowers, grass and trees	12
Plant cognition (advanced)	Recognize several species; begin to notice structure	5
Environmental perception (basic)	Touch and notice textures of stones, bark, etc.	13
Environmental perception (to be refined)	Notice details of texture; expression needs scaffolding	7
Total participants	—	**22**

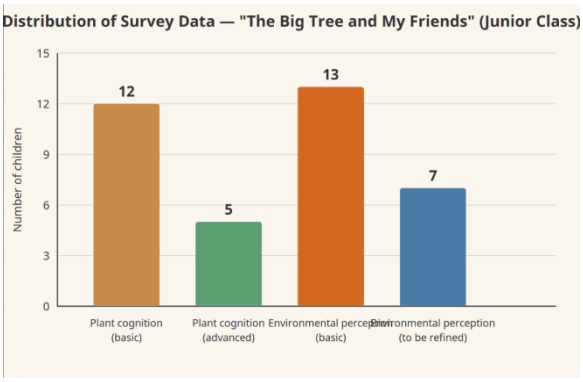


Figure 1. Framework of the three-loop, four-step dynamic assessment model

3. Practical Implementation

The study ran in the junior class (children aged 3–4) of a kindergarten, working with a science theme called "The Big Tree and Its Friends," and the implementation unfolded in phases over two months. Twenty-two children took part, together with their class teacher and one researcher. Figure 2 shows how the four steps played out here; the loop was the same throughout, but the tools changed from stage to stage.

3.1 Phase 1: Pilot Diagnosis—Knowing the Learners Before Teaching Them

Before designing anything, we needed to hear the children out. Each child was taken aside for ten minutes or so with four picture cards—a whole tree, a patch of bark, a tangle of roots, a tree with birds on it—and asked four open questions, among them "What does this tree need to stay alive?" and "Does the tree have friends?" The answers were recorded on a tablet exactly as spoken, transcribed by speech-recognition software, and then read line by line; recurring words such as "milk," "sugar," and "mum" were counted by hand. Reading through the 22 transcripts took less than a week, and it told us three things.

They knew the tree above ground and not below it. 54.5% could name leaves, flowers or fruit, while only 22.7% mentioned roots or the trunk. When asked to draw a tree, most children drew a green cloud on a brown stick. What they left out was precisely what the soil hides, and we started referring to this gap as the "visual blind zone."

Their ideas about how a tree lives came from home. 68.2% said the tree must drink milk, eat sugar, or be fed by its parents; one child put it this way: "Mum gives me milk, so the tree drinks milk too." Only 9.1% said water, and fewer still said sunlight. Animism is expected at this age, but the sheer weight of the milk-and-sugar answer convinced us to confront it head-on rather than hope it would fade.

What they wanted to know was social, not botanical. 45.5% were curious about the tree's "friends" and "family," 31.8% about the look of branches and leaves, and 22.7% about how a tree grows. Not one child asked about roots—which is why, later on, we entered the hidden parts through the "friends" they cared about, the animals living in the bark and around the roots.

These three findings rewrote the objectives. The original aim, "understand trees," was far too loose to teach from, so it was split into three: name the parts of a tree that cannot be seen; find out by experiment what a plant really needs; and notice that the living things around a tree depend on one another.

3.2 Phase 2: Optimized Intervention—Teaching That Follows the Diagnosis

Each of the three aims was then worked on through a mix of real materials and digital support.

For the hidden parts, the children went outside, felt the bark with their hands, and took rubbings

with paper and crayon. Back in the room, the rubbings were photographed on a tablet and the texture pulled up on the screen until the cracks were visible to everyone at once. Roots were harder—nobody can lift a camphor tree—so we washed the soil off a potted seedling and put it under the document camera, where the root hairs showed clearly. Within a week, most children used the word "roots" on their own and pointed to the ground when asked where they were.

The milk-and-sugar belief did not give way so easily. Three seedlings were planted in transparent cups on the windowsill: one watered, one given milk, one left dry. Every two or three days the children photographed their own cup with a tablet and added a mark to a "growth diary" pasted on the wall—a drawing, or a sentence the teacher wrote down for them. By the second week the milk had soured and the dry seedling had drooped, while the watered one had put out new leaves. The point was not to correct them from above; it was to let the cups do the arguing. Three conditions were set up—normal watering with light, water deprivation, and light deprivation. The children cared for the plants themselves, kept observing them, and recorded the growth changes with a documentation application. Comparing the real outcomes side by side, they arrived independently at the conclusion that plant growth requires water and sunlight—an evidence-based explanation taking the place of anthropomorphic fantasy.

At the level of higher-order thinking, the goal was to cultivate ecological awareness. The children watched a science video about woodpeckers and trees and then joined a "tree theater" role-play, taking on the parts of the tree, the pests, and the woodpecker. Acting the relationships out with their bodies, they came to understand biological symbiosis; an abstract ecological notion became concrete experience.

Across the implementation, the teacher's role moved toward that of context designer, inquiry supporter, and observer of learning. One moment from the augmented-reality root observation episode stands out: when the three-dimensional root model appeared, the children gasped audibly. That kind of visual impact and embodied experience is something verbal explanation alone cannot produce—and it is exactly the ground on which deep learning is laid.

3.3 Phase 3: Outcome Evaluation—Seeing What Changed

Data collection ran alongside the teaching for the full two months rather than after it. At the end the children were interviewed once more, using the same questions and the same recording procedure. What the comparison shows is reported in the rest of this section. Recognition of concealed structures such as the roots rose from 22.7% to 88.0%, and the share of children who could state the requirements of plant growth in scientific terms went from 9.1% to 90.9%. The core concepts had largely taken hold, and the animistic interpretations had mostly given way. The quality of the children's inquiry told much the same story. During the process we had collected data on how long the children stayed attentive, how often they interacted, and how they used the tools, and we assembled these into an individual growth portfolio for every child. Leafing through a portfolio, one could actually see how far each child had come—in initiating inquiry on their own, in sharing and working with peers, and in handling the instruments.

The most persuasive evidence of deep learning, however, was qualitative. In the experimental activities, all children (100%) knew that plants must be watered and that unwatered plants would die—and, more tellingly, they took to watering the plants on their own initiative every morning after breakfast. Voluntarily carrying a newly constructed concept into daily routine, with no prompting, suggests that the scientific understanding had begun to consolidate. This is precisely the behavioral signature that distinguishes deep learning from surface recall.

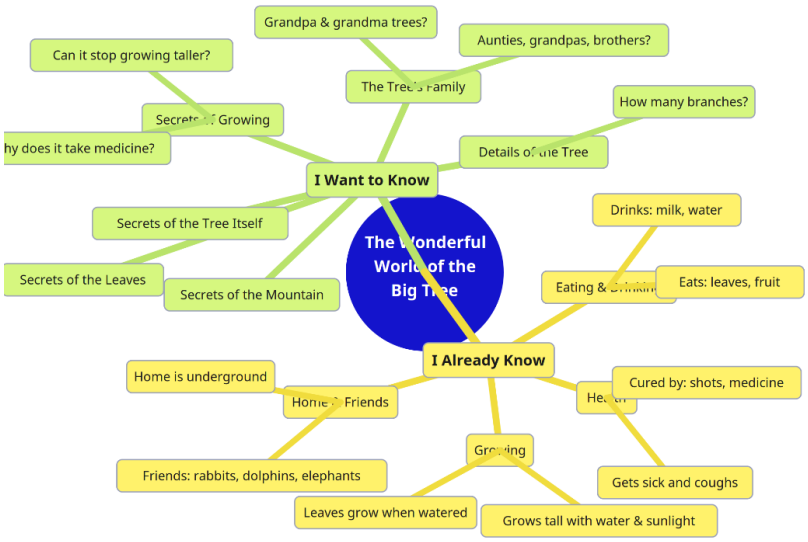


Figure 2. Distribution of digital-intelligence tools across the stages of preschool science education

4. Outcomes and Core Value

The significance of this practice reaches well beyond the optimization of a single science theme. It amounts to a new paradigm for evaluation reform in preschool education, and it redefines the teacher's role in the era of digital intelligence (see Table 1). Three aspects of its value stand out.

Table 1. Comparison of teacher role transformation in the era of digital intelligence

Dimension	Traditional role	Transformed role in the digital-intelligence era
Instructional design	Experience-based planning driven by intuition and generic templates	Evidence-informed design grounded in diagnostic learner profiles
Curricular positioning	Passive executor of prescribed curricula	Research-oriented practitioner and autonomous decision-maker
Assessment practice	Summative judgment delivered after instruction	Continuous, formative diagnosis accompanying the learning process
Allocation of effort	Repetitive, low-efficiency preparation and manual recording	Deep observation of children and high-quality teacher-child interaction
Basis of decisions	Personal experience and tacit intuition	Data-informed, iterative, evidence-based decision cycles

The first is a paradigm shift in assessment—from terminal judgment to navigational guidance at the point of departure. Under the assessment-first model, conventional assessment of learning is converted into assessment for learning and assessment as learning (Black & Wiliam, 1998; Wiliam, 2011). Assessment stops being an appendage of instruction and becomes the core engine that drives instructional adjustment and supports children's learning—which is what the reform requirement that evaluation empower education looks like when it is substantively enacted.

The second is the restructuring of the instructional model into a data-driven, spiraling closed system. By threading data through diagnosis, design, enactment, and reflection, the closed loop repairs the traditional fragmentation of teaching, learning, and assessment. Teachers, meanwhile, are repositioned—no longer passive executors of curriculum but research-oriented practitioners who make decisions on evidence, with their capacities in curriculum design, learning-state diagnosis, and evaluative reflection strengthened through repeated cycles. Just as important, the model rebuilds teachers'

sense of professional worth. Supported by intelligent assessment tools, teachers are relieved of experience-based, low-efficiency preparation and can give their energy to deep observation of children and high-quality teacher-child interaction. Their identity shifts from passive implementer to data-informed agent of educational research and decision-making, and their professional well-being rises accordingly—grassroots support, in effect, for a teacher evaluation system oriented toward educational outcomes.

The third aspect is the deepening of assessment's educational value, which contributes to a home-kindergarten-community collaborative community. Visualized artifacts—AI-generated growth portraits, learning stories, process documentation—effectively dissolve the information barrier between home and kindergarten. Parents can directly apprehend their children's learning trajectories and conceptual transformations, shifting from passive recipients of educational information to informed supporters of learning. In the survey data gathered during this practice, parental understanding of, and satisfaction with, the kindergarten's education exceeded 95%, and a child-development-centered, data-driven, multi-party ecology integrating teaching, learning, assessment, and upbringing has begun to take shape.

5. Conclusions, Limitations, and Future Directions

What does evaluation owe to the building of a strong education system? From the classroom level, our answer is a modest one: assessment earns its place by diagnosing, guiding, and improving—not by screening and certifying. The assessment-first, three-dimensional closed-loop model described in this article was built with the demands of current evaluation reform in mind, and it grew out of problems we kept meeting in preschool science education—inquiry that stayed shallow, teaching planned from experience, assessment that arrived too late. Because the model is assembled from ordinary tools and ordinary classroom routines, other teachers can pick it up and adapt it to their own settings. If it contributes anything, we would put it this way: by changing what assessment does, it changes the shape of instruction. The question a teacher asks at the end of the day is no longer "what did I teach?" but "what did the children learn, and how did they learn it?" That shift, in our view, is one workable way for evaluation reform to genuinely take root in preschool education.

Several limitations should be acknowledged, and they delineate directions for future work. First, technological application needs to move from functional assistance toward intelligent integration. Digital tools did improve the precision of assessment, but a risk of "technology for technology's sake" was also observed, potentially entailing over-documentation and additional teacher burden. Future development should pursue more intelligent assessment systems—for example, predictive analytics that anticipate cognitive difficulties or surges of interest from behavioral data such as tool-use frequency and peer-interaction patterns, and intelligent formative support that automatically captures children's peak moments of inquiry, such as posing original questions or completing successful collaboration, and drafts learning-story texts, freeing teachers for higher-value educational interaction. Second, the present assessment concentrated on observable behaviors and explicit concepts; the evaluation of tacit, higher-order dispositions—scientific spirit, inquiry attitudes, and creative thinking—remained insufficiently deep and awaits further breakthrough. Third, the model was piloted only in the domain of science. Whether, and how, it can be adapted to domains such as art and social development, where evaluation criteria are more plural, requires further empirical testing.

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Developing the Habit of Following After-School Self-Directed Learning Plans Among Upper-Grade Primary School Students

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Abstract

After-school self-directed learning is an important part of consolidating classroom knowledge, developing learning abilities, and establishing effective learning habits during primary education. Upper-grade primary school students gradually develop greater self-awareness and self-management abilities, which provide a foundation for participating in the formulation and management of their own learning plans. However, a gap often remains between making a plan and actually carrying it out. Some students can formulate after-school learning plans with the help of teachers or parents but struggle with setting specific goals, allocating time appropriately, maintaining consistent implementation, persisting when difficulties arise, and evaluating their learning after completing tasks. These problems not only affect the efficiency of after-school learning but also hinder the development of stable self-directed learning habits. Cultivating the habit of following learning plans should not rely solely on external supervision or task requirements. Instead, goal setting, task decomposition, time management, progress monitoring, and reflection should be integrated into a continuous learning process. Through this process, students can gradually develop the ability to plan independently, act according to their plans, make timely adjustments, and evaluate their own performance. Drawing on the developmental characteristics of upper-grade primary school students and existing research on self-directed learning habits, this paper examines the meaning, practical challenges, formative conditions, and development pathways of after-school learning plan implementation habits. It proposes an approach based on student participation, supported by concrete learning plans, teacher guidance, and home-school collaboration, with the aim of providing practical insights into cultivating self-directed learning habits among upper-grade primary school students.

Keywords: upper-grade primary school students, after-school learning, self-directed learning, learning plans, habit development

1. Introduction

As basic education increasingly emphasizes students' self-directed learning abilities, learning approaches are gradually shifting from passive acceptance of teachers' arrangements toward more active student participation in the learning process. Self-directed learning requires students not only to acquire knowledge but also to identify

learning objectives, organize tasks, select appropriate methods, and manage their own learning activities. Good self-directed learning habits enable students to gradually reduce their dependence on teachers and parents and develop a stable sense of initiative and responsibility in learning. Liu (2020) categorizes the development of student self-directed learning into four levels: interest-based engagement, habit formation, ritualization, and the development of personal meaning. This perspective emphasizes that self-directed learning needs to progress from initial participation toward habitual behavior and internal recognition. It also indicates that self-directed learning does not simply mean completing tasks independently; rather, it requires continuous behavioral development until active learning becomes a relatively stable tendency.

Upper-grade primary school is an important stage in the further development of students' learning habits and the gradual transformation of their learning approaches. As learning content expands, subject knowledge becomes more challenging, and learning tasks become increasingly complex, students need to devote more time to after-school review, homework, and knowledge consolidation. Compared with students in lower grades, those in upper primary grades have generally developed a stronger sense of time and greater awareness of self-management. They are increasingly capable of understanding learning objectives and organizing their own learning activities to some extent. Gao (2019), in a study of mathematics self-directed learning habits among upper-grade primary school students, identifies five dimensions of such habits: setting learning objectives, selecting learning content, allocating learning time, choosing learning methods, and evaluating learning outcomes. These dimensions provide a useful framework for understanding the specific components of self-directed learning habits at this educational stage.

After-school learning provides an important context for developing self-directed learning habits. Classroom learning is generally organized around clearly defined teaching arrangements and teacher guidance, whereas after-school learning takes place more frequently in the home environment, where students need to manage homework, review activities, reading tasks, and individual learning needs. Whether students can formulate plans according to their actual circumstances and translate those plans into sustained learning activities directly affects the quality of their after-school learning. Some students can list the tasks they need to complete each day but cannot allocate their time effectively. Others begin studying only after being reminded by their parents and lack the initiative to start learning independently. Some students complete their homework but rarely review their learning process or develop the habit of adjusting their plans. This gap between planning and implementation makes learning plans likely to remain merely formal arrangements.

Existing research on self-directed learning has addressed various aspects, including learning motivation, learning strategies, self-monitoring, family parenting styles, and teacher support. However, further attention needs to be given to how after-school learning plans can be translated into stable patterns of action in the specific context of upper-grade primary education. A learning plan is not simply a checklist of tasks. Its value lies not only in clarifying what students need to complete each day but also in helping them develop the ability to act consistently, allocate time appropriately, and manage their own learning activities. Accordingly, this paper focuses on the development of after-school self-directed learning plan implementation habits among upper-grade primary school students. It examines the common difficulties and underlying causes associated with plan implementation and proposes development pathways involving goal setting, task decomposition, time management, progress monitoring, evaluation and feedback, and home-school collaboration.

2. The Meaning of After-School Self-Directed Learning Plan Implementation Habits Among Upper-Grade Primary School Students

2.1 The Basic Meaning of After-School Self-Directed Learning Plan Implementation Habits

After-school self-directed learning refers to students' active engagement in activities outside classroom instruction based on their learning needs and the requirements provided by teachers. Such activities may include reviewing classroom knowledge, completing homework, undertaking supplementary reading, organizing mistakes in previous exercises, and pursuing other learning activities. Compared with classroom learning, after-school learning

involves a greater degree of independent organization. Students need to select and organize learning activities according to their tasks, individual abilities, and available time. Its self-directed nature does not mean that students must completely separate themselves from teacher and parental guidance. Rather, it involves gradually developing the ability to manage their own learning activities with appropriate support.

An after-school self-directed learning plan refers to an arrangement that students make regarding their learning tasks, the sequence of activities, completion times, and expected outcomes within a given period. Plans may be organized on a daily or weekly basis. They can include both school-assigned tasks and additional activities that students identify according to their own needs, such as reviewing knowledge, reading, and organizing learning materials. Compared with deciding what to study at the last minute, a learning plan helps students understand their tasks in advance, identify priorities, and reduce unnecessary uncertainty during the learning process.

The habit of implementing after-school self-directed learning plans refers to a relatively stable behavioral tendency developed through repeated learning activities. It involves actively following reasonable plans while making adjustments according to actual circumstances. This habit is reflected not only in completing planned tasks on time but also in checking learning arrangements independently, starting activities promptly, allocating time appropriately, seeking solutions when difficulties arise, and reviewing and reflecting on learning outcomes after completing tasks.

It is important to recognize that developing the habit of following learning plans is not equivalent to mechanically obeying every item in a schedule. Students may encounter changes in task difficulty, unexpected activities, or physical discomfort during the learning process. If the original plan is no longer appropriate, students who can independently adjust the sequence of tasks or modify their completion times are also demonstrating self-directed plan implementation. In contrast, even if students complete their daily tasks according to a schedule established by their parents, complete dependence on external reminders does not necessarily indicate that they have developed genuine habits of independent implementation.

Therefore, determining whether students have developed good after-school learning plan implementation habits should not depend solely on how many tasks they complete. Greater attention should be given to whether they demonstrate initiative in planning, the ability to sustain learning activities, and an awareness of when and how to make adjustments.

2.2 The Main Components of After-School Self-Directed Learning Plan Implementation Habits

The habit of implementing after-school self-directed learning plans among upper-grade primary school students mainly consists of four interconnected components: plan formulation, task implementation, process monitoring, and outcome evaluation.

Plan formulation is the starting point of implementation. Students need to understand their current learning tasks, identify what needs to be completed, and arrange activities according to their importance and personal abilities. Planned activities should be sufficiently specific. Rather than writing general objectives such as “study carefully” or “improve academic performance,” students should identify concrete activities. For example, instead of writing “review Chinese,” they can specify “review the vocabulary learned this week and organize the key points from two lessons.” This makes it easier for students to understand exactly what they need to accomplish.

Task implementation refers to the process of translating plans into actual learning activities. Students need to begin studying at the scheduled time, complete tasks in a reasonable order, and minimize distractions unrelated to learning. Implementation habits are reflected not only in whether students start on time but also in whether they can maintain a certain level of concentration and continue making efforts when difficulties arise rather than frequently interrupting their work or giving up immediately.

Process monitoring involves observing and managing the progress of planned learning activities. Students need to understand how much of a task has been completed and determine whether their actual progress is consistent with the original arrangement. When they discover that a task is taking longer than expected or that the learning results are unsatisfactory, they should be able to adjust their learning methods or reorganize subsequent

tasks. Process monitoring enables students to identify problems promptly and prevents their plans from becoming disconnected from actual learning activities.

Outcome evaluation is an important stage after the implementation of a learning plan. Students need to check whether tasks have been completed, determine whether learning objectives have been achieved, and consider which arrangements were effective and which aspects require improvement. Gao (2019) incorporates learning objectives, content, time allocation, learning methods, and evaluation into the analysis of self-directed learning habits, indicating that plan formulation and implementation involve several mutually supportive learning behaviors.

These four components are not independent of one another. Plan formulation establishes the direction of learning, task implementation translates the plan into action, process monitoring helps students address deviations, and outcome evaluation provides experience for subsequent planning. Only when these components form a continuous learning process can plans move beyond written arrangements and help students gradually develop stable implementation habits.

2.3 The Difference Between Learning Plan Implementation Habits and General Learning Habits

General learning habits include various behaviors, such as listening attentively in class, completing written assignments, reading, previewing lessons, reviewing knowledge, and preparing for examinations. Although after-school self-directed learning plan implementation habits are an important part of learning habits, their focus is not limited to any single learning activity. Instead, they concern how students organize and manage different learning activities.

For example, completing homework on time is a specific learning habit. However, arranging homework according to task quantity, difficulty, and available time, and checking progress after completion, reflects the broader habit of implementing learning plans. Similarly, reading extracurricular books every day is a reading habit, whereas independently incorporating reading into a daily learning plan, completing the activity consistently, and recording reading content demonstrate a more developed plan implementation habit.

This distinction indicates that cultivating after-school learning plan implementation habits should not simply require students to complete a particular task on time. Instead, students should be helped to develop the ability to organize learning activities so that different tasks can be incorporated into a relatively stable arrangement. Only when students gradually acquire this management ability can they maintain a certain degree of independence when learning tasks change.

3. The Value of Developing After-School Self-Directed Learning Plan Implementation Habits among Upper-Grade Primary School Students

3.1 Strengthening Students' Awareness of Their Role in Learning

Awareness of one's role as an active learner is an important foundation for participating in learning activities. Some students become accustomed to receiving instructions from teachers and parents throughout their educational experience. Learning content, study times, and even the sequence of activities are determined by others. Although this approach may help ensure that tasks are completed, it can also lead to dependence on external arrangements. When reminders become less frequent, students may not know what to study or how to organize their time.

Formulating and implementing after-school learning plans provides students with opportunities to participate in managing their own learning. They need to identify learning tasks according to their circumstances, determine the sequence of activities, and take responsibility for the results. Through this process, students gradually recognize that learning is not merely about completing tasks assigned by others but also about managing their own learning activities.

Sun (2015), in a study of the factors influencing the development of self-directed learning habits among upper-grade primary school students, examines learning motivation, family parenting styles, and teachers' classroom roles, emphasizing the relationship between learning motivation and the development of self-directed learning habits. This suggests that students' ability to develop active learning behaviors depends not only on external task requirements but also on whether they have an internal willingness to participate in learning. Allowing students to participate in plan formulation can

strengthen their sense of responsibility for learning and reduce their dependence on parental reminders.

3.2 Improving the Continuity of After-School Learning Activities

After-school learning tasks are often dispersed across different subjects, completed at flexible times, and carried out in relatively complex environments. Without reasonable arrangements, students may experience confusion about the sequence of activities, omit certain tasks, or allocate their time unevenly. Some students may complete the activities they enjoy first and leave more difficult tasks until the end, resulting in insufficient time for subsequent work. Others may frequently switch between different tasks and struggle to maintain a stable learning state.

Learning plans help students identify tasks and establish a reasonable sequence before beginning their activities. Once the habit of implementing plans has developed, students no longer need to reconsider what they should do every day. Instead, they can begin learning according to an established arrangement. This stability helps reduce hesitation and procrastination and enables after-school learning to become a more continuous process.

Implementing a plan does not mean requiring students to follow exactly the same schedule every day. Rather, it means helping them develop relatively stable methods of organizing learning activities. When learning tasks change, students should still be able to redistribute their time according to actual circumstances and ensure that important tasks are completed.

3.3 Developing Students' Self-Management Abilities

Upper-grade primary school students are at a stage when self-awareness and self-management abilities are gradually developing. Implementing after-school learning plans requires students to exercise a certain degree of control over their own behavior, including managing study time, reducing irrelevant activities, persisting in completing tasks, and dealing with learning difficulties. These behaviors are not limited to academic activities and may also be transferred to other aspects of daily life.

When formulating plans, students need to recognize their own abilities. During implementation, they must manage their attention and behavior. When reviewing their plans, they need to evaluate their own performance. These activities help students gradually develop the ability to observe and regulate their behavior. Gao (2022), in a study of academic self-efficacy and self-directed learning among upper-grade primary school students, connects goal setting, autonomy in the learning process, and learning strategies, emphasizing the positive role of academic self-efficacy in supporting self-directed learning.

When students successfully complete planned tasks through their own efforts, they are more likely to develop a clear sense of achievement. Such experiences can strengthen their confidence in their learning abilities, encourage them to undertake new tasks, and gradually develop their willingness to manage learning activities independently.

3.4 Supporting the Transition from Primary to Secondary Education

Upper-grade primary school is an important period during which students' learning approaches gradually change. After entering secondary school, students generally encounter changes in the number of subjects, the complexity of learning content, and the amount of after-school work. They need to manage increasingly complicated learning arrangements. Students who have long depended on teachers and parents to organize their learning may experience difficulties adapting to these new requirements.

Developing the habit of implementing after-school learning plans can help students establish basic abilities in time management, task allocation, and self-evaluation in advance. Even when they encounter new learning content, they can use previously acquired planning methods to organize their activities. Wen (2013), from the perspective of lifelong learning, emphasizes the role of good learning habits and self-directed learning abilities in supporting continuous personal development. The development of plan implementation habits during primary education can therefore provide a foundation for students' subsequent transitions in learning approaches.

4. Problems and Causes in the Implementation of After-School Self-Directed Learning Plans Among Upper-Grade Primary School Students

4.1 Dependence on External Arrangements and Insufficient Student Participation

Some students have clear after-school learning arrangements every day, but these plans are

primarily formulated by their parents or teachers. Parents organize learning times according to homework requirements and their own expectations, while students simply complete the assigned tasks one by one. This approach may provide useful support before learning habits have been established. However, when students are not sufficiently involved in formulating plans over an extended period, learning plans can become external management tools.

In such situations, students may know what tasks they need to complete every day but may not understand why the tasks are arranged in a particular way. They may also lack the awareness needed to adjust their plans according to actual circumstances. When learning tasks change or parents are not present, students may wait for reminders, delay starting their work, or become uncertain about how to organize their learning activities.

Dependence on external arrangements is related to insufficient development of students' awareness of self-directed learning. Although upper-grade primary school students have developed a certain degree of independence, they still need guidance in learning experience, time management, and independent judgment. If adults make all the arrangements on their behalf, students have fewer opportunities to gain practical experience in planning. Yang (2017), in a study of teacher support strategies in self-directed learning, emphasizes that self-directed learning does not mean learning entirely without teacher involvement. Instead, teachers need to gradually shift from external controllers to providers of learning support. This approach is equally applicable to after-school learning plans. Teachers and parents should provide necessary guidance without making every decision on behalf of students over the long term.

4.2 Vague Learning Objectives and Insufficiently Actionable Plans

Whether a learning plan can be implemented is closely related to the specificity of its objectives. Some students tend to use general expressions when making plans, such as "review lessons," "complete homework carefully," or "read more extracurricular books." Although these objectives reflect a willingness to learn, they do not clearly define the scope of tasks or the criteria for completion. As a result, students may feel uncertain when carrying out their plans.

For example, "review mathematics" does not indicate which knowledge points need to be reviewed or what methods should be used. After opening the textbook, students may browse through it casually or remain unsure about where to begin. In comparison, a task such as "organize two mathematical concepts that were not fully understood this week and complete the corresponding exercises" provides a much clearer learning direction.

Vague objectives can also make it difficult for students to determine whether a task has been completed. Without specific completion criteria, students may use the amount of time spent studying as a substitute for actual learning outcomes, assuming that sitting at a desk is equivalent to completing a learning task. In reality, learning plans should focus on the specific activities students need to undertake rather than simply specifying the duration of study.

Some students also include too many tasks in their plans, which can undermine implementation. Parents may expect students to complete school homework, additional exercises, reading, and lesson preparation within the same period. Students may consequently continue adding tasks in response to external expectations. When the total workload exceeds their available time and abilities, the plan becomes difficult to implement. Repeatedly facing plans that cannot be completed may gradually weaken students' confidence and even lead them to resist planning altogether.

4.3 Unreasonable Time Allocation and Disruptions to Plan Implementation

Time allocation is an important component of after-school self-directed learning plans. Although upper-grade primary school students have generally developed a basic awareness of time, they may still find it difficult to estimate how long different learning tasks will take. Some students organize their schedules according to ideal conditions without considering task difficulty, changes in concentration, or necessary rest periods. Consequently, deviations frequently occur during implementation.

For example, a student may assume that a particular assignment will take only ten minutes, but the actual completion time may be much longer. As the first task takes longer than expected, subsequent arrangements are also affected. Without the ability to make adjustments, students may rush through their

work, complete tasks carelessly, or abandon some activities.

Distractions in the home environment can also affect plan implementation. Television, mobile phones, family activities, and other forms of entertainment may divert students' attention. Some students have already formulated learning plans but are easily attracted by unrelated activities during study time, making it difficult to maintain continuous engagement.

Unreasonable time allocation is also related to students' limited experience in practical time management. Effective planning requires students to understand their own learning pace and the characteristics of different tasks. Such understanding cannot be acquired solely through adult explanations. It develops gradually through repeated experiences of planning, implementation, and adjustment. Gao's (2019) study of mathematics self-directed learning habits among upper-grade primary school students also identifies the allocation of learning time as an important dimension, highlighting the significance of time management in developing self-directed learning habits.

4.4 Insufficient Consistency in Implementation and Frequent Procrastination or Interruptions

Implementing a learning plan requires persistence. However, the learning behaviors of upper-grade primary school students are still easily influenced by interest, emotions, and external environments. Some students demonstrate strong enthusiasm when they first formulate a plan and carefully record their learning tasks. However, their willingness to follow the plan gradually declines over time.

This may be reflected in several ways. Students may complete tasks successfully at the beginning but gradually begin to omit activities. They may procrastinate when dealing with subjects they dislike, frequently interrupt their work when encountering difficult tasks, or abandon subsequent arrangements entirely after failing to complete a plan on a particular day.

The lack of consistency in plan implementation is related to students' understanding of learning tasks, their interests, and their academic self-efficacy. Students who repeatedly face tasks they cannot complete may begin to believe that their abilities are insufficient, reducing their willingness to continue making efforts. Gao (2022) connects academic self-efficacy with goal setting, learning processes, and learning strategies among upper-grade primary school students, emphasizing that positive perceptions of one's abilities can support continued engagement when learning difficulties arise.

Therefore, cultivating plan implementation habits should not focus exclusively on discipline and persistence. It should also consider whether students can gain successful learning experiences through appropriate task arrangements. If plans consistently exceed students' actual abilities, even strict external supervision may fail to establish stable self-directed behaviors.

4.5 Insufficient Progress Checking and Plan Adjustment

Some students regard plan formulation and task completion as two separate activities. Once they have finished their assignments, they consider the learning process complete and rarely check their actual progress or evaluate whether their arrangements were reasonable. As a result, plan implementation may become a mechanical process of completing and marking tasks.

For example, a student may originally schedule mathematics exercises for a particular period but spend considerably longer than expected on difficult questions. If no adjustments are made, subsequent learning activities may be affected. Other students may complete their planned reading tasks without reviewing the content or checking whether they have understood the main ideas. Their plans may indicate that the tasks have been completed, but the actual learning outcomes may not meet expectations.

Insufficient self-evaluation also affects students' understanding of their learning processes. Students may focus exclusively on whether homework has been completed and whether answers are correct while overlooking factors such as time allocation, learning methods, and attention management. Consequently, recurring problems may remain unnoticed.

Shi and Xu (2022), in their discussion of cultivating self-directed learning habits, emphasize the importance of learning method guidance, diversified evaluation, and home-school communication. This suggests that the development of plan implementation habits should extend beyond task completion. Progress checking and outcome evaluation are also necessary to help students gradually learn how to improve their own learning behaviors.

4.6 Insufficient Coordination Between Family and

School Support

After-school self-directed learning mainly takes place in the home environment, but its tasks and methods are closely connected with school teaching. If teachers and parents have different understandings of self-directed learning, the development of plan implementation habits may be affected.

Some teachers pay greater attention to whether homework is completed on time, whereas parents may focus more on the amount of time spent studying or the completion of additional exercises. Students may consequently face several different learning arrangements, leading to duplicated tasks, time conflicts, and excessive workloads.

Some families also regard supervision as the primary method of cultivating self-directed learning habits. Parents repeatedly ask whether tasks have been completed, remind students to begin studying, or directly check every step of the learning process. Although this approach may improve the likelihood of task completion in the short term, it can also lead students to depend on external supervision. In other families, insufficient attention is paid to after-school learning, leaving students without timely guidance when difficulties arise.

Chen (2014), in a study of self-directed learning among upper-grade primary school students, examines students' learning attitudes, habits, and learning conditions, while also considering differences between teachers' and parents' understandings of self-directed learning. This indicates that the development of plan implementation habits requires a relatively consistent educational approach between schools and families, rather than relying entirely on either party.

5. Conditions for Developing After-School Self-Directed Learning Plan Implementation Habits

5.1 Students Need to Develop Clear Motivation for Self-Directed Learning

The formation of habits requires motivation to engage in particular behaviors. If students regard learning plans merely as additional tasks imposed by their parents, it is difficult for them to develop an independent willingness to implement those plans. In contrast, when students recognize that planning can help address specific learning needs and are willing to use it to solve practical problems, they are more likely to participate actively in planning and implementation.

The motivation for self-directed learning does not necessarily originate from abstract academic objectives. For upper-grade primary school students, practical benefits such as having more time to read books they enjoy after completing homework, preparing for examinations in advance, or reducing the stress associated with approaching deadlines can all serve as meaningful motivations for planning.

Teachers and parents should help students recognize the practical benefits of organizing their learning rather than simply emphasizing the importance of making plans. Zhang, Yan, and Rao (2017), in their discussion of developing independent habits among primary school students through joyful education, emphasize the roles of independent choice and self-management in habit development. Therefore, cultivating plan implementation habits requires preserving opportunities for students to make choices, allowing them to determine learning content, task sequences, and specific methods within reasonable limits.

5.2 Students Need to Master Basic Planning and Implementation Methods

Good implementation habits require practical methods. Even when students are motivated to learn, they may struggle to translate their intentions into action if they do not know how to divide tasks, allocate time, or deal with difficulties.

Planning methods mainly involve identifying tasks, distinguishing priorities, estimating the time required, and organizing the sequence of activities. Task implementation methods include starting promptly, maintaining concentration, reducing distractions, and dealing with learning difficulties appropriately. Process management also requires students to develop the ability to check progress and adjust their plans.

These methods should be taught through specific learning activities rather than abstract explanations alone. For example, teachers can select a common after-school assignment and guide students in analyzing its content, estimating the time required, and discussing reasonable ways to organize different tasks. Repeatedly applying these methods in actual learning situations enables students to gradually develop relatively stable behavioral patterns.

5.3 Students Need to Gain Appropriate Experiences of Success

The development of plan implementation habits is closely related to students' perceptions of their own learning abilities. When students complete a plan and clearly recognize their efforts and progress, they are more likely to develop positive learning experiences.

Successful experiences do not mean that every plan must be completed perfectly the first time or that difficulties should never occur. For students, being able to start a task that they previously tended to postpone, completing a difficult assignment by adjusting their methods, or independently identifying and correcting an unreasonable time arrangement can all represent meaningful progress.

Teachers and parents should establish appropriate learning requirements according to students' actual abilities, enabling them to gradually improve their implementation through continued effort. Excessively demanding goals may lead to frustration, whereas goals that are too easy may provide insufficient challenges. Maintaining an appropriate relationship between task difficulty and students' current abilities helps ensure that plan implementation remains both achievable and developmentally meaningful.

5.4 Students Need a Relatively Stable Learning Environment and Appropriate Support

The after-school learning environment affects the continuity of plan implementation. Students need a relatively fixed learning space, access to necessary learning materials, and minimal interference from activities unrelated to learning. A family does not necessarily need a separate study room, but it should provide basic conditions for a quiet and relatively stable study period.

Teacher and parental support is also essential. Teachers need to help students understand learning tasks and acquire appropriate methods, while parents can assist them in establishing daily learning routines and provide necessary guidance when difficulties arise. The purpose of such support should be to help students gradually develop independent management abilities rather than permanently replacing their own efforts.

6. Pathways for Developing After-School Self-Directed Learning Plan Implementation Habits among Upper-Grade Primary School Students

6.1 Developing Awareness of Independent Planning Based on Students' Actual Needs

The development of plan implementation habits should begin with students' willingness to participate in formulating their own plans. If students do not identify with their plans, even a complete planning schedule provided by teachers and parents may result in superficial completion, arbitrary modifications, or failure to follow the arrangements.

Therefore, cultivating planning awareness requires connecting plan formulation with students' actual learning needs. Teachers can begin with common problems in daily learning and encourage students to consider why certain assignments are repeatedly postponed, why review tasks are frequently forgotten, and why extended study time does not always produce the expected results. Through these specific questions, students can recognize the practical value of planning and understand that making a plan is not intended to increase their workload but to organize learning activities more effectively.

Student participation in plan formulation should gradually increase. For students who have not yet developed planning awareness, teachers can initially provide a basic framework within which students choose the sequence of tasks and specific completion times. As students gain more experience, external arrangements can gradually be reduced, allowing them to formulate daily and weekly plans independently.

Students should also have a certain degree of freedom when making plans. For example, after completing essential homework, they can choose extracurricular reading, supplementary learning, or other educational activities according to their interests. They can also select the order in which different subjects are reviewed within reasonable limits. Such opportunities help students recognize the direct relationship between their plans and their own learning activities, thereby strengthening their willingness to implement those plans.

Teachers should recognize that independent choice does not mean the absence of guidance. When students make clearly unreasonable arrangements, teachers should help them analyze the causes, explain the possible consequences of different choices, and guide them toward more appropriate decisions. Through continuous

participation and adjustment, students can gradually move from accepting plans made by others to formulating their own learning arrangements.

6.2 Translating Learning Objectives into Specific Tasks to Improve Plan Feasibility

Vague learning objectives are an important reason why plans fail to be implemented. Developing plan implementation habits therefore requires helping students learn how to translate broad learning objectives into specific tasks.

In practice, learning objectives can be divided into short-term developmental goals and concrete daily tasks. Developmental goals identify the general direction of learning over a period of time, such as consolidating the mathematics knowledge covered during the week, improving English vocabulary retention, or completing a certain amount of extracurricular reading. Concrete tasks specify what students need to do each day, such as organizing classroom notes, correcting exercises, reading a passage aloud, or reviewing a particular group of vocabulary items.

Teachers can guide students to describe tasks in simple but specific terms, clarifying the learning content, completion requirements, and expected time. For example, the general task "review Chinese" can be revised to "review this week's vocabulary, check words that are easily misspelled, and recall the key points of the lessons." Similarly, "study mathematics" can be divided into "complete the exercises that were not fully understood in class and organize one incorrect answer that requires further review."

Task decomposition should also take students' actual abilities into account. For students with weaker academic foundations or a tendency to procrastinate, larger tasks can be divided into smaller components to reduce the psychological difficulty of getting started. Students who have already developed stronger planning abilities can be given greater opportunities for independent choice and supplementary learning.

The number of tasks included in a plan should not be excessive. Students' after-school time needs to accommodate not only school assignments but also necessary rest, physical activities, and personal interests. If plans are too intensive, students may experience fatigue and resistance during implementation. Zhu (2023), in a discussion of assignment design for guiding students' self-directed learning of physics textbooks, examines the relationship between assignment content and independent learning and emphasizes the importance of optimizing assignment design. This suggests that cultivating plan implementation habits requires attention to the reasonableness of learning tasks rather than simply increasing their number.

6.3 Allocating Time According to Task Characteristics and Developing Stable Study-Starting Habits

Time allocation affects not only learning efficiency but also whether students can begin their activities according to their plans. Upper-grade primary school students need to gradually learn how to organize their learning time according to task difficulty, estimated duration, and personal learning conditions rather than simply distributing all tasks evenly across fixed periods.

Teachers and parents can guide students in arranging their after-school schedules according to their actual daily circumstances. Homework that must be completed on the same day can be given priority. Tasks requiring sustained thinking can be scheduled during periods when students are relatively focused. Activities such as reading and organizing learning materials can be arranged more flexibly according to students' learning conditions.

Time arrangements should include a certain amount of flexibility. Students may underestimate the time required for particular tasks, and difficult questions may require additional thinking. If no buffer time is provided between activities, delays in one task can disrupt the entire schedule. Appropriate rest periods are equally important. Students should not be expected to study continuously for long periods simply to complete every item in their plans.

Developing stable study-starting habits is an important aspect of time management. Students can establish a fixed set of preparatory activities before beginning their work, such as organizing learning materials, checking the day's tasks, and preparing necessary stationery. Repeating these relatively consistent behaviors can gradually establish a clear signal for starting learning activities.

For students who frequently procrastinate, the difficulty of beginning a task can be reduced appropriately. Instead of requiring them to complete an entire set of exercises immediately, teachers and parents can encourage them to

begin with the first question or read a short passage. Once students have started, they may find it easier to enter a focused learning state and continue with subsequent tasks.

Teachers can also guide students in observing their learning conditions at different times of the day. Students can identify which periods are more suitable for tasks requiring concentration and which are more appropriate for reading or organizing information. As students gradually understand their own characteristics, time management can become more individualized and reasonable rather than a mechanical set of requirements.

6.4 Strengthening Learning Method Guidance to Improve Persistence during Plan Implementation

Plan implementation involves more than starting a task on time. It also requires students to use appropriate methods to complete their learning activities. Some students can begin studying as scheduled but lack effective learning strategies. When difficulties arise, they may spend too much time on a single problem, affecting the completion of subsequent tasks.

Teachers should provide guidance according to the characteristics of different learning activities. For memorization tasks, students can be encouraged to use classification, spaced review, and self-questioning. For reading tasks, teachers can guide them to focus on main ideas, keywords, and personal understanding. For mathematics exercises, students can learn to analyze the conditions of a problem, recall relevant knowledge, and check their reasoning after completing the task.

Guidance should also address how students respond to tasks they cannot complete immediately. When encountering a difficult question, students can mark it, review relevant classroom content, or consult appropriate learning materials. If they remain unable to solve the problem after making reasonable efforts, they can seek help from teachers or parents. This approach prevents students from spending excessive time on a single task and reduces the likelihood of abandoning learning activities immediately when difficulties arise.

When interruptions occur during plan implementation, teachers and parents should not simply attribute them to a lack of discipline. Instead, they should help students identify the specific causes. If students frequently stop working because tasks are too difficult, the tasks may need to be divided into smaller components. If mobile phones and entertainment activities repeatedly distract them, the learning environment may need to be improved. If students cannot complete tasks because they lack appropriate methods, further guidance in learning strategies is necessary.

Wu (2022), in a discussion of cultivating self-directed learning abilities in primary school mathematics teaching, addresses learning environments, preparatory learning tasks, teaching methods, and learning habits. This perspective can be extended to after-school learning management. Through appropriate learning method guidance and reasonable task design, students can acquire the practical abilities needed to carry out their plans.

6.5 Establishing Progress Monitoring Mechanisms and Developing the Habit of Checking and Adjusting Plans

During plan implementation, students need to understand their actual learning progress and identify differences between their plans and their real circumstances. Progress monitoring should not become continuous parental inspection. Instead, it should gradually develop into a process through which students independently observe and manage their own learning behavior.

Teachers can encourage students to use simple daily learning records to compare planned tasks with actual completion. These records do not need to be complicated. They can include whether a task was completed, whether it was started on time, how long it actually took, and what difficulties arose. Completed tasks can be marked accordingly, while unfinished tasks should be accompanied by a brief explanation of the reasons and a decision about whether they need to be rescheduled.

Plan adjustments should be based on actual circumstances. If a task takes longer than expected because of its difficulty, students can reorganize subsequent activities. If unexpected events occur during the day, they can adjust the sequence of learning tasks. If a particular task is no longer necessary, it can be modified or replaced under the guidance of teachers.

Teachers should help students distinguish between reasonable adjustments and arbitrary abandonment. Reasonable adjustment involves modifying arrangements according to learning tasks and actual circumstances while making

efforts to ensure that important learning objectives are achieved. Arbitrary abandonment, in contrast, occurs when students stop working simply because they dislike a task or are distracted by unrelated activities. Although the two behaviors may appear similar, they reflect different attitudes toward learning and self-management.

For upper-grade primary school students, progress monitoring can begin with simple self-questioning. During learning activities, students can ask themselves whether they started according to their plans, whether their current progress is consistent with expectations, and whether their learning methods need to be changed. Through these simple checking behaviors, students can gradually develop awareness of their own learning processes.

During the initial stage of development, teachers and parents can participate in checking students' progress. However, they should avoid interrupting learning activities too frequently. As students' self-monitoring abilities improve, external checks can gradually be reduced, allowing students to report their own progress and adjustments independently. Yang (2017) emphasizes the role of teacher support in developing students' self-monitoring abilities and learning strategies. The ultimate purpose of teacher support should be to help students acquire the ability to monitor their learning processes independently.

6.6 Emphasizing Outcome Evaluation and Using Positive Feedback to Reinforce Implementation Habits

Outcome evaluation is an essential component of plan implementation. After completing their daily learning tasks, students need to review whether their plans have been carried out, identify unfinished tasks, and consider whether their original arrangements were appropriate.

Evaluation should not focus exclusively on the number of completed tasks and academic performance. It should also consider specific behaviors during plan implementation. For example, whether students can begin learning independently, whether they complete tasks in a reasonable order, whether they can reduce distractions, whether they actively seek solutions when difficulties arise, and whether they can adjust their plans according to actual circumstances.

When students fail to complete planned tasks, teachers and parents should guide them in analyzing the reasons rather than immediately criticizing them. If a task remains unfinished because the estimated time was inaccurate, students can be helped to reassess the time required for different activities. If progress is slow because students have not mastered appropriate learning methods, teachers and parents can provide necessary guidance. If learning is interrupted by entertainment activities, they can discuss ways to improve the learning environment and organize behavior more effectively.

Positive feedback can strengthen students' identification with their learning plans. After completing planned tasks, students should receive recognition for their efforts. Teachers can acknowledge specific improvements, such as independently formulating plans, starting learning activities on time, completing tasks without direct assistance, and actively adjusting unreasonable arrangements. Compared with praising academic results alone, recognizing specific behaviors helps students become more aware of changes in their implementation habits.

Evaluation methods can also gradually shift from external assessment toward self-evaluation. Teachers can encourage students to review their plan implementation once a week, identify one habit they have successfully developed and one behavior that still needs improvement, and determine specific adjustments for the following period. Through continuous reflection, students can gradually understand that plan evaluation is not intended to determine whether they are sufficiently successful, but rather to make future learning arrangements more effective.

6.7 Providing Differentiated Guidance According to Individual Student Differences

Although upper-grade primary school students are generally at similar developmental stages, they differ in academic foundations, learning interests, family environments, and self-management abilities. Requiring all students to follow exactly the same planning arrangements may result in excessive workloads for some, insufficient challenges for others, and difficulties adapting for those who need additional support.

For students with limited awareness of self-directed learning who frequently rely on parental reminders, the primary focus should be on developing basic study-starting habits. Teachers can help them identify a small number of essential daily tasks and gradually establish fixed

study times and basic implementation routines. Their plans should remain simple, and they should not be required to meet too many expectations at once.

For students who can complete basic learning tasks but have difficulty allocating time appropriately, guidance should focus on estimating task duration, prioritizing activities, and checking progress. Teachers can encourage these students to record the actual time required for different tasks and use their experiences to improve subsequent arrangements.

For students who have already developed relatively strong self-directed learning abilities, greater opportunities for independent choice and reflection can be provided. For example, students can arrange supplementary reading, error correction, and periodic review according to their learning needs and regularly evaluate the effectiveness of their plans. Teachers do not need to specify every task in detail but should focus more on whether students' learning objectives are reasonable and whether their plans are feasible.

The developmental priorities of Grade Five and Grade Six students can also differ. Grade Five students may benefit more from teacher demonstrations and collaborative planning to acquire basic methods, whereas Grade Six students can gradually be expected to formulate weekly plans independently, manage review tasks, and adjust their arrangements when necessary. Tian (2011), in a discussion of self-directed mathematics learning among upper-grade primary school students, examines the roles of schools and families in developing self-directed learning and emphasizes the importance of support from multiple sources.

Differentiated guidance does not mean assigning students to fixed categories. Rather, it requires adjusting the level of support according to their current implementation abilities. Students' self-directed learning abilities change as they gain experience, and teachers should modify their guidance accordingly so that external support can gradually be transformed into students' own management abilities.

7. Implementation Support through Home-School Collaboration

7.1 Integrating Learning Plan Guidance into Daily School Teaching

Schools are important environments for developing students' learning habits. Although teachers cannot directly manage every aspect of students' learning at home, they can help students acquire the skills needed to formulate and implement after-school plans through classroom instruction, assignment design, and daily guidance.

In daily teaching, teachers can guide students in identifying specific after-school review tasks according to the characteristics of different subjects. Chinese language learning can involve reviewing texts, accumulating vocabulary, and completing reading activities. Mathematics learning can focus on organizing knowledge, correcting mistakes, and consolidating exercises. English learning can incorporate vocabulary memorization, text reading, and language practice.

Assignment design should take the reasonableness and different levels of learning tasks into account. Teachers should not rely simply on increasing the amount of homework to improve students' learning engagement. Instead, they should consider whether assignments help students consolidate knowledge, identify learning difficulties, and develop learning abilities. Appropriate optional supplementary tasks can provide students with opportunities to organize their learning activities independently.

Schools can also organize classroom discussions in which students share their experiences of formulating learning plans. For example, students can explain how they organize tasks across different subjects, deal with time conflicts, and solve difficulties by adjusting their learning methods. Through such exchanges, students can learn about different approaches to learning management and gain useful insights from their peers.

Teachers should avoid turning learning plans into another standardized checking task. If schools focus only on whether planning forms are completed correctly or whether students meet daily check-in requirements, students may begin formulating plans merely to satisfy inspection requirements. The primary focus of school guidance should be whether students have genuinely learned to manage their own learning processes rather than whether their planning forms meet formal standards.

7.2 Shifting Family Support from Direct Supervision to Appropriate Assistance

The family is the primary environment for after-

school self-directed learning, and parental approaches can influence students' learning attitudes and behavioral habits. The key to family support is not to organize every learning activity on behalf of students but to provide a stable learning environment and gradually develop their ability to manage their own activities.

Parents can discuss daily learning tasks with their children and help them understand the amount of homework, completion requirements, and available study time. When students formulate plans, parents can offer suggestions but should allow children to decide the sequence of tasks and specific arrangements whenever possible. If a plan is unreasonable, parents should help children identify the problem through discussion rather than immediately rejecting the plan and replacing it with their own arrangements.

The home learning environment should also remain relatively stable. Parents can agree with their children on reasonable study times, reduce distractions from television, mobile phones, and other entertainment activities, and prepare the necessary learning materials. Family members should avoid interrupting students too frequently during study periods so that they can maintain relatively continuous engagement.

When children fail to follow their plans, parents should first understand the specific reasons. If the tasks are too difficult, they can help divide them into smaller components. If time allocation is unreasonable, they can reconsider how long different activities are likely to take. If learning is repeatedly interrupted by distractions, they can discuss ways to improve the environment. Parents should not automatically interpret every failure to complete a plan as an attitude problem, nor should they rely on continuous criticism and punishment to force children to follow their arrangements.

As children's independent abilities improve, parents should gradually reduce direct reminders and allow children to assume greater responsibility for managing their learning. For students who have already developed stable implementation habits, parents can pay greater attention to their overall learning conditions rather than checking every individual task. The value of family education lies in helping students develop learning methods that they can use independently, rather than making them permanently dependent on adult supervision.

7.3 Establishing Communication Mechanisms Between Schools and Families

The development of plan implementation habits involves both school teaching requirements and the home learning environment. Without sufficient communication between schools and families, students may face conflicting expectations. Schools and families should therefore establish relatively consistent developmental goals based on students' actual learning needs.

Teachers can explain the basic requirements of after-school learning plans to parents so that they understand the importance of respecting students' actual abilities and avoiding excessive supplementary tasks. Parents can also provide feedback to teachers about students' learning conditions at home, including which tasks take longer than expected, which learning activities present difficulties, and which stages are most likely to involve procrastination.

Communication should focus on solving specific problems rather than simply comparing students' performance. For students who repeatedly fail to implement their plans, teachers and parents can jointly analyze the underlying difficulties and clarify their respective responsibilities. Teachers are responsible for providing guidance on learning content and methods, parents are responsible for maintaining basic learning conditions and offering necessary support, and students should gradually assume primary responsibility for planning and implementation.

Shi and Xu (2022) connect home-school communication with learning method guidance and evaluation approaches in their discussion of cultivating self-directed learning habits. Cooperation between schools and families can reduce conflicting expectations and create a relatively stable environment in which students can accumulate experience in implementing their learning plans.

7.4 Using Learning Tools Appropriately and Avoiding Formalistic Planning

Learning tools can help students record tasks, organize their time, and monitor their progress. For upper-grade primary school students, simple paper-based schedules, calendars, and task lists are generally sufficient for most daily learning management needs.

A planning form does not need to be complicated. Students can record their daily

learning tasks according to the date and allocate estimated completion times while also recording actual progress. A simple daily record enables students to understand the status of their plans. They can then conduct a weekly review to identify which arrangements were reasonable and which tasks were frequently delayed.

Digital tools can also serve as supplementary resources. For example, students may use simple calendar reminders or electronic task lists to record important learning activities. However, the purpose of using such tools should be to support learning management rather than create additional operations for students. For students whose self-control abilities are not yet fully developed, excessive use of mobile phones and electronic devices may introduce further distractions.

Teachers and parents should not equate the use of planning tools with self-directed learning abilities. A completed planning form does not necessarily indicate that a student can implement plans independently, and the use of digital tools does not automatically mean that effective time management skills have been acquired. Tools can provide recording and reminder functions, but the actual development of habits still depends on students' continued participation in real learning activities.

8. Sustained Development and Evaluation of After-School Self-Directed Learning Plan Implementation Habits

8.1 Promoting Habit Formation Through a Gradual Development Process

Developing plan implementation habits requires a transition from external guidance to independent action. Students should not be expected to complete all behavioral changes within a short period. The requirements should gradually increase according to their actual circumstances.

During the initial stage, teachers and parents can focus on helping students establish basic planning awareness. Students need to understand what learning tasks they have each day, make simple time arrangements under adult guidance, and gradually establish fixed study-starting behaviors. At this stage, plans should remain simple, and implementation requirements should not be excessive. The main objective is to help students gain experience in completing tasks consistently.

During the adaptation stage, students should be given more opportunities to formulate plans independently. Teachers can gradually reduce restrictions on the specific sequence of learning activities, allowing students to organize tasks according to their own circumstances and conduct simple checks after completion. When students make unreasonable arrangements, they should be encouraged to analyze the causes and make adjustments rather than having adults reorganize the entire plan for them.

During the consolidation stage, students should gradually become capable of formulating daily or weekly plans independently, monitoring task progress, and adjusting arrangements according to actual circumstances. Teachers and parents can then shift their roles toward observation, feedback, and necessary guidance. Students should not only be able to complete familiar learning tasks but also apply previously acquired methods to reorganize their activities when learning content or time arrangements change.

This gradual process is consistent with the developmental approach to self-directed learning, which progresses from external behavioral participation toward habitual behavior and internal recognition (Liu, 2020). The key to habit formation is not how many plans students complete within a short period but whether they can maintain active planning and consistent implementation over time.

8.2 Establishing Multiple Evaluation Methods that Focus on the Implementation Process

The evaluation of after-school self-directed learning plan implementation habits should avoid relying exclusively on academic performance or the number of completed tasks. Students' academic results are influenced by their prior knowledge, task difficulty, and other factors and therefore cannot fully reflect the development of their plan implementation habits.

Evaluation can focus on several aspects. In terms of plan formulation, attention should be given to whether students can establish learning objectives according to their actual circumstances and whether their task arrangements are specific and reasonable. In terms of implementation, evaluation should consider whether students can begin learning independently and demonstrate a certain degree of persistence. Regarding process monitoring, attention should be given to whether students can identify problems in their learning

progress and make timely adjustments. In terms of reflection, evaluation should examine whether students can analyze their implementation results and recognize the strengths and weaknesses of their learning behaviors.

The evaluation process can also involve different participants. Student self-evaluation helps them understand their own implementation performance, teacher evaluation provides guidance from the perspectives of learning tasks and methods, and parental evaluation reflects students' actual learning behaviors in the home environment. Different participants should communicate around relatively consistent developmental objectives to avoid focusing exclusively on different outcome indicators.

Evaluation methods do not need to be complicated. Students can use simple daily records and weekly reviews to understand their progress and obtain suggestions through teachers' observations and appropriate parental feedback. Existing improvements should be acknowledged promptly, while recurring problems should be examined to identify their specific causes and determine appropriate adjustments for the next stage.

Pei (2016), in a discussion of strategies for improving students' self-directed learning efficacy, emphasizes the importance of harmonious teacher-student relationships and effective learning strategies. This indicates that evaluation should provide support and guidance, helping students develop a better understanding of their learning behaviors rather than creating excessive pressure through evaluation results.

8.3 Preventing Plan Implementation from Becoming Mechanical Check-In Behavior

During the development process, planning forms, task lists, and completion records can provide useful support. However, excessive reliance on these tools may also create problems. If teachers and parents focus too heavily on the number of check-ins, the completeness of planning forms, and the quantity of daily tasks completed, students may begin treating the completion records as their primary objectives while neglecting actual learning outcomes.

For example, students may complete tasks quickly merely to mark them as finished on their planning forms without carefully understanding the learning content. Others may record tasks as completed to avoid parental criticism even though they have not actually followed their plans. Although such behaviors may satisfy formal requirements, they do not genuinely promote the development of self-directed learning habits.

Therefore, evaluation of plan implementation should focus on actual changes in learning behavior. Whether students can formulate arrangements independently, select appropriate methods according to learning tasks, make adjustments when difficulties arise, and gradually reduce their dependence on adult reminders are all important indicators of habit development.

Teachers and parents should also preserve a certain degree of flexibility for students. Learning plans are tools for organizing learning activities rather than fixed rules that restrict students' behavior. Students should be allowed to make reasonable adjustments according to actual circumstances and arrange rest and recreational activities after completing essential tasks. Only when students understand the purpose of planning and can use plans flexibly according to their own needs can plan implementation habits become genuinely integrated into daily learning.

9. Conclusion

Upper-grade primary school is an important stage in the development of students' self-directed learning awareness and self-management abilities. Cultivating the habit of implementing after-school self-directed learning plans can contribute to improving learning behaviors, strengthening students' awareness of their role in learning, and supporting the transformation of learning approaches. After-school learning plans should not only clarify learning objectives and task arrangements but also incorporate actual implementation, process monitoring, and outcome evaluation. Only when students can translate plans into sustained action and actively identify and address problems during learning can they gradually develop stable plan implementation habits.

In practice, after-school self-directed learning plan implementation may be affected by insufficient student participation, vague learning objectives, unreasonable time allocation, weak implementation consistency, inadequate process monitoring, and insufficient coordination between family and school support. These problems are related to students' limited experience in self-management, insufficient

mastery of learning methods, inappropriate forms of external supervision, and inadequate support from the learning environment. Cultivating plan implementation habits should not rely solely on increasing tasks or strengthening supervision. Instead, attention should be given to the relationship between students' independent awareness, practical abilities, and learning environments.

The development process should be based on students' active participation in plan formulation. Learning objectives should be translated into specific tasks, students should be helped to establish reasonable time arrangements and stable study-starting behaviors, and learning method guidance should be provided to strengthen their ability to complete tasks. Teachers and parents should also guide students in monitoring their progress, adjusting plans, and reflecting on outcomes so that they can gradually acquire the ability to manage their own learning activities. On this basis, home-school collaboration, differentiated guidance, and process-oriented evaluation can provide sustained support for habit development.

The habit of implementing after-school self-directed learning plans does not simply mean requiring students to complete a fixed number of tasks every day. Rather, it involves helping students gradually develop the ability to plan actively, act consistently, make timely adjustments, and evaluate their own learning. As these behaviors are repeatedly practiced in daily learning activities, students can gradually reduce their dependence on external reminders and develop more stable self-directed learning awareness and behavioral abilities, thereby establishing a foundation for subsequent learning and continuous personal development.

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Classroom Order Management Strategies During Transitions Between Teaching Activities in Primary Schools

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Abstract

Transitions between teaching activities are an essential part of primary school classroom instruction. They involve adjustments to teaching arrangements and changes in students' learning tasks and participation patterns. Since primary school students are still developing their attention spans, self-control, and behavioral habits, transitions may be accompanied by distractions, disruptions, inefficient activity coordination, and unnecessary loss of instructional time. These issues can affect the continuity of classroom instruction and reduce the effectiveness of teaching activities. Effective classroom order management does not simply require students to remain quiet. Rather, it involves guiding students through different learning tasks by establishing appropriate procedures, clear transition signals, consistent classroom rules, and constructive teacher-student interactions. This paper examines classroom order management during transitions between teaching activities in primary schools. It discusses common problems and their underlying causes and proposes strategies involving instructional planning, transition rules, student behavior guidance, classroom time allocation, and teacher emotional regulation. The discussion aims to provide practical guidance for organizing classroom activities effectively and maintaining a positive learning environment.

Keywords: primary education, classroom management, transitions between teaching activities, classroom order, instructional organization

1. Introduction

Classroom instruction generally consists of several interconnected teaching activities, including lesson preparation, knowledge presentation, question-based discussions, collaborative learning, student presentations, and lesson summaries. Each activity has different organizational requirements and learning objectives. Teachers therefore need to adjust classroom arrangements according to instructional goals and students' learning conditions, enabling students to move smoothly from one activity to another. Although transitions between teaching activities may occupy only a relatively short period, they directly influence the continuity and effectiveness of classroom instruction. When transitions are poorly organized, students may struggle to understand new requirements, resulting in unnecessary conversations,

movement around the classroom, distractions, or limited participation.

Primary school students are generally active and easily distracted, while their self-regulation abilities are still developing. Compared with older students, they often require more specific behavioral guidance when classroom activities change. For example, when moving from teacher-led instruction to group discussion, students need to adjust their learning approaches, organize their materials, arrange their seating, and understand their new responsibilities. If teachers fail to prepare these arrangements in advance, classroom order may become difficult to maintain.

Existing research on primary school classroom management has addressed classroom routines, learning environments, student behavioral problems, instructional time management, and teachers' management competencies. Chen and Zhang (2019) identify the establishment of classroom routines, the creation of a positive learning environment, appropriate responses to student behavioral problems, and reflection on classroom activities as important components of primary school teachers' classroom management competencies. These perspectives provide a foundation for understanding order management during transitions. However, transitions have distinctive procedural characteristics. Maintaining classroom order therefore requires more than general disciplinary expectations; management strategies must be incorporated into specific teaching activities. Accordingly, this paper examines classroom order management from the perspective of transitions between teaching activities in primary schools.

2. The Meaning of Teaching Activity Transitions and Classroom Order Management

2.1 The Meaning of Transitions Between Teaching Activities

Transitions between teaching activities in primary school classrooms refer to the process through which teachers adjust learning tasks, organizational arrangements, instructional materials, and patterns of interaction according to teaching objectives and classroom progress. Common examples include moving from teacher-led instruction to individual practice, from individual learning to group collaboration, from classroom discussion to student presentations, and from knowledge acquisition to lesson summarization.

A transition does not simply involve changing the instructional content. It also requires adjustments to students' learning behaviors and classroom organization. For example, during group work, students need to understand the discussion topic, determine their respective responsibilities, and communicate according to the task requirements. When the discussion ends, they must stop interacting, organize their materials, and redirect their attention toward the presentation activity. These behaviors require appropriate guidance from teachers.

Therefore, transitions between teaching activities involve three interconnected dimensions: task transitions, behavioral transitions, and organizational transitions. Task transitions concern changes in learning content and objectives. Behavioral transitions involve adjustments to students' learning activities and participation patterns. Organizational transitions refer to changes in seating arrangements, learning materials, and interaction formats. Together, these dimensions constitute the basic process of classroom activity transitions.

2.2 Basic Requirements for Classroom Order Management During Transitions

Classroom order management during transitions refers to the process through which teachers organize and regulate student behavior, instructional time, and the learning environment to facilitate movement between different teaching activities. Its purpose is not to restrict students' normal participation but to help them understand their current responsibilities, recognize transition requirements, and participate appropriately in subsequent activities.

Yu (2010) identifies classroom routine management, classroom environment management, classroom activity management, and classroom behavioral problem management as important dimensions of primary school teachers' classroom management competencies. These dimensions are also relevant to the management of activity transitions. Teachers need to ensure that students follow established rules while also considering whether activities are appropriately arranged, whether the environment supports the new learning task, and whether emerging behavioral problems can be addressed promptly.

Effective transition management should demonstrate clarity, continuity, and

appropriateness. Clarity requires teachers to communicate specific expectations and avoid ambiguous instructions. Continuity requires sufficient connections between consecutive activities to reduce unnecessary waiting. Appropriateness means that teachers should adopt different management approaches according to the nature of the activities and the developmental characteristics of students, rather than treating every transition as an occasion for disciplinary intervention.

3. Common Classroom Order Problems During Transitions

3.1 Unclear Transition Instructions

In some classrooms, transitions depend primarily on teachers giving temporary verbal instructions, such as asking students to begin a discussion, take out their exercise books, or stop their current activities. When teachers provide only general instructions without explaining specific procedures or completion times, students may interpret the requirements differently. Some may move quickly into the next activity, while others remain engaged in the previous task.

For example, when teachers ask students to participate in group discussions without clarifying the discussion topic, speaking arrangements, or expected outcomes, students may interpret the activity as unrestricted conversation. Consequently, classroom noise may increase, and some students may move away from the intended learning task. Such situations are not necessarily caused by students' lack of discipline. They may also result from insufficiently specific transition instructions.

3.2 Insufficient Coordination Between Teaching Activities

Different teaching activities are interconnected. When teachers fail to establish appropriate connections between consecutive stages, students may experience interruptions in their learning process. For example, after explaining new knowledge, a teacher may immediately ask students to complete individual exercises without explaining how the exercises relate to the preceding content. Students may then become uncertain about the purpose of the task and repeatedly ask for clarification.

Some classrooms also experience excessive activity changes. Teachers may arrange discussions, games, presentations, and exercises consecutively in an attempt to make lessons more engaging, without allowing students sufficient time to prepare and adjust. Although the teaching formats appear varied, students may not have enough time to understand and adapt to each new task. As a result, instructional efficiency may decline rather than improve.

3.3 Insufficient Management of Student Behavior During Transitions

Behavioral problems during primary school classroom transitions commonly include unnecessary conversations, leaving seats without permission, playing with learning materials, losing concentration, and failing to stop previous activities promptly. In particular, after group discussions, classroom games, and student presentations, students may remain highly excited and require some time to return to a more focused learning state.

Wang (2021), in a narrative study of the development of classroom management competencies among novice primary school teachers, discusses classroom rules, student behavioral problems, and teacher-student interactions as important aspects of classroom management. This perspective highlights the importance of teachers' ability to recognize and respond appropriately to student behavior. If teachers only criticize students after classroom order has deteriorated, without establishing preventive transition procedures, classroom management may remain largely reactive.

3.4 Inappropriate Allocation of Transition Time

Classroom instructional time is limited, and each teaching activity requires an appropriate amount of time. When transitions are not adequately prepared, students may spend excessive time finding learning materials, adjusting their seating arrangements, or waiting for instructions. This reduces the time available for actual learning.

In her study of classroom management competencies among novice primary school English teachers, Wu (2021) identifies classroom time management as an important dimension of teachers' management abilities. The study also discusses problems such as unreasonable time allocation across teaching activities and excessive instructional time being consumed by maintaining classroom order. These issues indicate that transitions involve not only behavioral management but also the effective allocation of instructional time. Teachers who focus exclusively on completing individual activities while overlooking the time required to

connect them may struggle to maintain the overall continuity of classroom instruction.

4. Strategies for Managing Classroom Order During Teaching Activity Transitions

4.1 Planning Teaching Activities in Advance to Reduce Uncertainty

Classroom order management should begin during the instructional planning stage rather than only after disruptions occur. When preparing lessons, teachers should determine the sequence of teaching activities according to instructional objectives and clarify the learning goals, organizational arrangements, and transition requirements of each stage. For activities involving seating changes, learning materials, or group collaboration, teachers should plan the necessary procedures in advance to avoid excessive last-minute arrangements.

For example, in a primary school Chinese language lesson, a teacher may organize activities into several stages: text explanation, individual thinking, group discussion, and student presentations. Before group discussion begins, the teacher can introduce the discussion question and explain the expected outcomes and time limit. Students can then enter the next activity without repeatedly asking for clarification.

Instructional planning should also emphasize connections between consecutive activities. Teachers can use questions or learning outcomes from the preceding stage to introduce the next activity, helping students understand why the transition is necessary. For instance, after explaining a text, a teacher may raise a question related to its content and invite students to discuss it in groups. In this way, transitions become natural extensions of the learning process rather than disconnected activities.

4.2 Establishing Clear and Consistent Classroom Transition Rules

Classroom rules help students develop stable expectations regarding their behavior. Teachers can establish basic procedures for different transitions, including stopping the current activity, organizing learning materials, listening to instructions, adjusting seating arrangements, and beginning the next task.

These rules should not be overly complicated. Instead, they should be expressed in language that students can easily understand and remember. For example, teachers may agree with students that when a particular signal is given, they should stop discussing, face the teacher, organize their desks, and wait for further instructions. Through repeated use of the same procedures, students gradually become familiar with transition expectations, reducing the need for repeated reminders.

Chen and Zhang (2019) emphasize the importance of classroom routines in primary school classroom management. In the context of teaching activity transitions, classroom routines should extend beyond general requirements concerning classroom discipline and homework. They should also cover the procedures connecting different learning activities. Teachers can integrate transition rules into everyday instruction so that students gradually develop the habit of following them voluntarily rather than treating them as temporary disciplinary requirements.

4.3 Using Clear Transition Signals to Guide Behavioral Adjustments

For primary school students, verbal reminders alone may not always produce consistent results. Teachers can use fixed verbal expressions, gestures, countdowns, or simple visual cues according to the characteristics of classroom activities. These signals can help students recognize when they need to adjust their learning behaviors.

For example, before a group discussion ends, teachers can provide a time reminder so that students know the activity is about to finish. Once the discussion is over, teachers can use an agreed gesture or short verbal signal to remind students to stop talking, organize their materials, and face the front of the classroom. Compared with repeatedly raising their voices or criticizing students, consistent transition signals are more likely to establish clear behavioral expectations.

Different activities may require different signals, but their basic use should remain consistent. Teachers should avoid changing signals too frequently because students may need to repeatedly learn new procedures, increasing the difficulty of transitions. For younger students, teachers can incorporate pictures, gestures, and demonstrations. For older primary school students, external reminders can gradually be reduced to encourage greater independence in managing their learning activities.

4.4 Encouraging Student Participation and Developing Self-Management Awareness

Classroom order management should not depend entirely on teachers' instructions. Students are also active participants in classroom activities and can undertake certain organizational responsibilities under teacher guidance. For example, during group work, group leaders may remind members to organize materials and summarize discussion results. After classroom presentations, students can follow agreed procedures to collect and return learning materials.

Student participation in classroom management helps them understand the practical value of classroom rules and gradually develop self-management abilities. However, responsibilities should be appropriate to students' ages and capabilities. Teachers should not transfer the responsibility for maintaining the discipline of the entire class to a small number of students.

Teachers should also reinforce positive behavior through constructive feedback. When students complete transitions according to established procedures, teachers can provide specific encouragement by recognizing a group's efficient preparation, orderly organization of materials, or ability to stop discussions at the appropriate time. Compared with general instructions to follow classroom rules, feedback directed at specific behaviors helps students understand which actions should be maintained.

4.5 Allocating Transition Time Reasonably to Improve Instructional Efficiency

Teachers should incorporate the time required for transitions into the overall lesson plan rather than focusing exclusively on knowledge presentation and learning activities while overlooking the time needed for preparation, organization, and coordination.

Before an activity begins, teachers can prepare the textbooks, teaching aids, and learning materials required for the following stage. For group activities involving seating changes, seating arrangements can be clarified before the lesson to reduce unnecessary movement. When an activity does not require changes to the classroom layout, teachers can make use of existing seating arrangements to avoid unnecessary movement.

Time allocation should also reflect the complexity of each activity. Simple tasks may require relatively short transitions, whereas activities involving material organization, group rearrangement, or presentation preparation require additional time. Teachers should avoid constantly rushing students merely to keep up with the lesson schedule. At the same time, excessively long periods without meaningful tasks should be minimized. Appropriate time allocation allows students to complete necessary preparations while maintaining the continuity of classroom instruction.

4.6 Managing Teacher Emotions and Creating a Positive Transition Environment

Teachers' emotional states influence their classroom management approaches and may also affect students' classroom behavior. When transitions become disorganized, teachers who immediately express impatience, anger, or frustration may create additional emotional tension, making classroom order even more difficult to maintain.

Zheng (2021), in a study of primary school teachers' classroom emotional management, discusses teachers' self-regulation, classroom atmosphere management, and instructional evaluation as relevant aspects of emotional management. This perspective suggests that transitions require attention not only to student behavior but also to emotional interactions between teachers and students.

Teachers should maintain a calm tone and respond appropriately to occasional behavioral problems during transitions. When a small number of students fail to complete a transition promptly, individual reminders may be more effective than criticizing the entire class. Teachers should also acknowledge students' positive cooperation. A stable and supportive classroom atmosphere can reduce resistance to transition instructions and gradually integrate order management into normal teaching activities.

5. Differentiated Management Across Different Types of Teaching Activity Transitions

5.1 From Teacher-Led Instruction to Independent Learning

This transition involves students moving from a listening role to active thinking and independent task completion. Before ending an explanation, teachers should clarify the specific learning task, completion requirements, and time allocation. They should also ensure that students understand which textbooks or learning materials are needed. For younger students, teachers can demonstrate the required procedures, while older students can be

encouraged to organize their learning independently according to the task requirements.

5.2 From Individual Learning to Group Collaboration

The transition from individual learning to group collaboration usually involves increased interaction among students and may lead to unnecessary movement and conversations. Teachers should clarify group membership, discussion tasks, activity duration, and expected outcomes in advance. This reduces the time students spend reorganizing themselves after entering their groups. Teachers can guide groups that are easily distracted through classroom observation and appropriate questions without frequently interrupting the entire class.

5.3 From Group Collaboration to Student Presentations

The key challenge in this transition is helping students end their discussions and redirect their attention toward presenting and listening. Teachers can provide advance reminders that the discussion is about to finish and ask each group to select its presentation content and representative. During presentations, other students should be given specific listening tasks, such as recording important ideas or considering questions raised by the presentation. This helps prevent presentations from becoming activities in which only a few students participate while others engage in unrelated conversations.

5.4 From Classroom Activities to Lesson Summarization

Lesson summarization requires students to move away from specific learning activities and return to broader understanding and reflection. Teachers can use blackboard notes, keywords, or guiding questions to organize the learning outcomes generated by previous activities. This helps students review the main content of the lesson and understand the connections between different teaching stages. The summarization stage should not introduce too many new tasks. Instead, it should help students consolidate what they have learned and bring the instructional process to a coherent conclusion.

6. Continuous Improvement of Teachers' Classroom Order Management Competencies

The ability to manage classroom order during teaching activity transitions develops gradually through everyday teaching practice. Teachers need to understand basic classroom management methods and adjust their approaches according to students' developmental characteristics, classroom conditions, and instructional content.

Wang (2021), in examining the development of classroom management competencies among novice primary school teachers, emphasizes the role of practical exploration, individual reflection, and support from others in professional development. This suggests that teachers should not rely exclusively on fixed management practices. Instead, they should pay attention to how different teaching activities are implemented. After each lesson, teachers can reflect on whether transitions were smooth, whether students understood the instructions, which stages involved excessive waiting, and whether management approaches affected students' willingness to participate.

Schools can also provide opportunities for teachers to learn from one another through classroom observations, teaching demonstrations, and professional exchanges. Teachers may develop different effective approaches to organizing activities and maintaining classroom order. Sharing specific classroom cases can help teachers identify weaknesses in their own management practices.

Novice teachers, in particular, should avoid relying excessively on criticism and disciplinary instructions. The purpose of classroom management is to ensure that students can participate effectively in learning activities, rather than keeping them in a constant state of passive obedience. Teachers should integrate rule guidance, instructional planning, and student participation so that classroom order gradually develops from students' understanding and acceptance of classroom expectations.

7. Conclusion

Transitions between teaching activities are an important process connecting different stages of primary school instruction. Their organization directly influences instructional continuity and the effective use of learning time. Because primary school students are still developing their self-management abilities, transitions may involve unclear instructions, delayed behavioral adjustments, insufficient coordination between teaching activities, and inappropriate time allocation. These problems are associated not only with students' developmental characteristics but also with teachers' instructional planning and classroom

organization.

Improving classroom order management during transitions requires teachers to incorporate management strategies into specific teaching activities. Teachers should plan activity sequences in advance, establish clear and consistent transition rules, use appropriate signals to guide behavioral adjustments, and develop students' self-management awareness through participation and positive feedback. Reasonable time allocation, stable emotional regulation, and continuous instructional reflection are also important for improving classroom management.

Classroom order should not be regarded as a means of restricting student participation. Rather, it is a necessary condition for supporting effective learning. By integrating order management with instructional activity design, teachers can reduce unnecessary waiting and disciplinary interventions, establish natural connections between different teaching stages, and ultimately improve the organizational efficiency of primary school classroom instruction.

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Awareness of Generative AI Limitations and Students' Intention to Use ChatGPT: A Moderated Mediation Analysis

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Abstract

This research examined the importance of understanding generative artificial intelligence (GenAI) limitations in predicting college students' likelihood of using ChatGPT, based on a modified Technology Acceptance Model. It treated awareness, perceived usefulness, and perceived anxiety about skills deterioration related to GenAI as independent variables, with intention to use ChatGPT as the dependent variable. The first-stage moderated mediation model was applied to analyze participants' responses, with cooperation from 931 college students from different fields of study at a private higher education institution in the Philippines. The findings revealed that the awareness of GenAI limitations exerted a positive impact on the intention of college students to use ChatGPT, in particular, both its direct positive effect ($c' = 0.169$, $p < .001$) and an indirect effect through the mediation of perceived usefulness. Conditional process analysis confirmed that skill-erosion concern moderated the relationship between awareness and perceived usefulness (moderated mediation index = -0.075, 95% CI [-0.107, -0.046]). Although perceived usefulness remained a significant mediator of the relationship between awareness and intention, the indirect effect diminished as skill-erosion concern increased, dropping from 0.233 for students with low-little concern to 0.105 for students with great concern. The collinearity analysis confirmed that the predictors were empirically distinguishable. The findings show that beliefs about risks regulate the technology acceptance process, and that AI-literacy training can be pursued alongside measured caution about dependency rather than treating these goals as alternatives.

Keywords: generative artificial intelligence, ChatGPT, Technology Acceptance Model, behavioral intention, moderated mediation, higher education

1. Introduction

The release of ChatGPT at the end of 2022 sparked one of the biggest technological shifts in higher education. Generative artificial intelligence (GenAI) technologies have reached a point where students actively use them to draft, brainstorm, revise, or study. This has prompted multiple studies to understand how students perceive and assess GenAI technologies (Chan & Hu, 2023; Ravšelj et al., 2025; Strzelecki, 2024). The findings show that students have a mixed attitude towards GenAI; on the one hand,

students highlight the ability of this technology to save time, receive personalized feedback, and simplify complex tasks, while, on the other hand, they worry that regular use of GenAI may affect the development of critical thinking, collaboration, and problem-solving skills in students (Golding et al., 2025; Khlaif et al., 2025; Nadim & Di Fuccio, 2025; Zhai et al., 2024). However, research has not sufficiently examined the psychological mechanisms that shape users' intentions to use this technology based on their awareness of its drawbacks.

The Technology Acceptance Model (TAM) explains this conversion process simply: usefulness is perceived, and this perception shapes behavioral intention (Davis, 1989). Applying TAM to generative AI in the educational realm nowadays has shown that usefulness is still one of the key indicators of how inclined people are to use it (Almogren et al., 2024; Damiano et al., 2024; Jia & Tu, 2024; Yu et al., 2024), which has not turned out to be impeded by the fact that GenAI has one difference from transactional technologies for which TAM was created, which is the risk concerning the user's intellectual capacities. Namely, students not only evaluate the convenience of the tool but also consider possible losses in terms of skills, too much dependence, and fewer opportunities for an independent learning process (Khlaif et al., 2025; Walter, 2024). Thus, the risk associated with GenAI shows that the process described in TAM cannot be fully relevant for each student, since the level of concern students have with regard to the losses in skills might influence it, which is in line with the research on the impact of perceived risk on the process of accepting technology developed in different realms (Wijaya et al., 2024).

This research addresses this gap by evaluating a moderated mediation framework in which perceived usefulness mediates the relationship between college students' knowledge of generative AI limitations and their behavioral intention to use ChatGPT, while students' apprehension about skill loss and dependence moderates this initial connection. The research fits within a trend in educational technology that emphasizes empirical studies exploring the link between technology and actual educational practices.

The aims of this study can be summarized in three key points: (a) to identify the link between a college student's knowledge about generative AI limitations and how willing they are to use ChatGPT; (b) to find out whether a student's understanding of the usefulness of generative AI will be a mediating factor in this case; and (c) to check if the strength of the awareness/usefulness link changes for students depending on their anxiety that the use of generative AI can hurt their development of skills. By achieving these objectives, this study used quantitative research to provide a well-substantiated answer to the question of the role of beliefs about the risks in the technology acceptance process.

2. Review of Related Literature

2.1 Generative AI Adoption in Higher Education

Surveys conducted since the launch of GenAI have produced a consistent finding: students have both positive and negative impressions of generative AI. In a survey of 399 university students in Hong Kong, Chan and Hu (2023) concluded that students viewed GenAI positively for facilitating the learning process but were wary of its accuracy, ethics, and potential negative consequences for learning. Ngo (2023) found that Vietnamese students liked GenAI for saving time and clarifying difficult information but also noted that its main drawback was its inability to verify data reliability. Ravšelj et al. (2025) surveyed more than 23,000 students from 109 countries and found that students used ChatGPT primarily for brainstorming ideas and summarizing texts but were not satisfied with its usefulness for developing critical thinking and rated it lower than in the classroom. Petricini et al. (2023) and Golding et al. (2025) emphasized that most students think using GenAI to prepare assignments constitutes academic dishonesty, yet they still do it, reinforcing the gap between perceived usefulness and perceived risk. Baek et al. (2023) and Dai et al. (2023) noted that students are willing to adopt the technology reluctantly, while Yang (2024) emphasizes that students want more institutional guidelines rather than a ban on the tool. Similar findings appear in research conducted outside Asia. Romero-Rodríguez et al. (2023) studied 400 Spanish university students and found that perceived usefulness of ChatGPT for complex cognitive tasks strongly correlates with acceptance. Strzelecki (2024) studied 534 Polish students and found that habit and performance expectancy predict both intentions to use the tool and its effective use. Bouteraa et al. (2024) mentioned that students' beliefs about academic integrity influence the spread of ChatGPT in higher education, highlighting the

connection between evaluative and ethical judgments and their use of the technology for academic purposes. Hon (2026) studied the impact on learning outcomes in Microsoft Teams and concluded that outcomes depend on use, not merely on exposure to the tool.

2.2 The Technology Acceptance Model and Perceived Usefulness

The Technology Acceptance Model (TAM) remains the most important theory explaining why users accept or reject technology (Davis, 1989). Perceived usefulness of the technology, defined as the extent of belief that the technology would help one perform better at tasks, has always proved to be more significant than perceived ease of use in predicting the use of technology in different types of applications, from e-government to finance and banking (Wijaya et al., 2024). Damiano et al. (2024) applied TAM and Diffusion of Innovation theory to analyze GenAI use in education settings and concluded that users' perceptions of ChatGPT's accuracy and usefulness influence their decision-making. Nevertheless, they highlighted that users cannot distinguish accurate from inaccurate information and therefore have no real ability to judge information quality. Jia and Tu (2024) studied 637 college students and argued that AI abilities do not directly influence learning outcomes; instead, learning outcomes depend on students' motivation and efficacy beliefs. More recent investigations confirm the central role of usefulness while also complicating it. Almogren et al. (2024) determined perceived usefulness and ease of use to be important predictors of attitudes towards ChatGPT for 458 subjects, while Yu et al. (2024) used the method of structural equation modeling with 328 college students and found that efficiency influenced perceived usefulness and, through this, intention to continue using it. Foroughi et al. (2024) made an important modification by showing that information accuracy negatively moderated the relationships between ChatGPT usage and its determinants, suggesting that judgments about output quality drive acceptance.

2.3 Awareness of AI Limitations and Critical AI Literacy

A related area of research has proposed that understanding the limits, biases, and failings of technology is not simply an attitude toward using technology but a whole new concept. Walter (2024) claimed that AI literacy—defined as well-informed awareness of both the capabilities and limitations of AI systems—is a necessary condition for the productive use of these systems and for keeping critical thinking alive in AI-supported education. Hwang et al. (2023) examined a digital literacy scale for college students and found that the ability to critically assess outputs produced by AI is one of the best predictors of students' perceptions of the technology's usability and ease of use, which shows that it is possible for critical awareness to support the evaluation of usefulness. Consequently, the literature suggests that knowledge of generative AI's limitations should be treated as an important belief within an acceptance model, rather than as an idea that contradicts or completely denies the technology's usefulness. This interpretation is supported by Heard et al. (2024), who found that AI literacy predicted students' willingness to use ChatGPT indirectly through perceptions of its usefulness, supporting the view that awareness knowledge is one of the beliefs that promote technology use.

2.4 Over-Reliance, Skill Erosion, and Risk as a Moderating Concern

Numerous advertising studies note a particular story about generative AI: excessive exposure could harm users' skills and abilities. Khlaif et al. (2025) conducted interviews and held focus groups with 46 teachers and concluded that having constant access to AI leads to skill atrophy, procrastination, and social fragmentation. Nadim and Di Fuccio (2025), through a systematic analysis of existing studies, reached the same conclusion, arguing that although generative AI offers many benefits, it also raises key issues across numerous spheres. Perceived risk has been studied in technology acceptance research. According to Wijaya et al. (2024), the impact of perceived risk on acceptance depends on the action taken. The authors' findings guided us to consider anxiety about skill erosion as a moderator rather than a competing precursor of behavioral intention. Data collected provide positive evidence. Zhai et al. (2024) reviewed the literature on AI dialogue systems and concluded that excessive dependency leads to deficiencies in problem-solving, analysis, and critical thinking skills. Moore and Gerlich (2025) performed a mixed-methods study with the aim of exploring the relations between the extent of AI use and critical thinking level in participants.

2.5 Mediation and Moderation in Technology-Acceptance Research

Conditional process analysis is the standard method for investigating how psychological processes operate (Hayes & Rockwood, 2017). In the first stage of the moderated mediation model, the focus is not limited to determining whether an indirect impact exists. The goal shifts to determining whether another variable affects this indirect impact. Researchers use the moderated mediation approach in various areas to examine how factors affect phenomena such as the adoption of fintech solutions and e-wallets (Wijaya et al., 2024). This method can also be applied to studying generative AI adoption. Nevertheless, researchers rarely use the moderated mediation model when investigating the relationship between technology use and students' knowledge and skills. This study aims to bridge this gap. This study uses the regression-based estimation framework provided by Hayes and Rockwood (2017). As Foroughi et al. (2024) note, moderators of adoption pathways can provide better analytical insight than assuming each belief is an additional direct predictor.

3. Theoretical Framework

This research uses the principles of TAM, developed by Davis (1989), which holds that external beliefs about a system affect perceived usefulness and perceived ease of use, which in turn shape a person's behavioral intention to use the system. TAM includes several highly influential components, and perceived usefulness remains the primary predictor of behavioral intention in the technology sphere (Wijaya et al., 2024). In this investigation, the authors elaborate on TAM in several ways, which aligns with recent studies in the sphere of generative AI. First, as stated in Hwang et al. (2023) and Walter (2024), generative AI awareness limitation as a risk-aversion belief is considered an external belief that contributes to the successful realization of the system's usefulness. Second, the research model views perceived risk, seen as skill-erosion and over-reliance concerns, as a moderator of the belief-formation phase in TAM, building on evidence showing that perceived risk affects the technology adoption process rather than acting as an independent predictor (Wijaya et al., 2024). In Hayes & Rockwood's (2017) conditional process model, this yields a first-stage moderated mediation model in which the extent to which awareness of AI limitations affects behavioral intention through perceived usefulness depends on students' perceived degree of skill-erosion concern.

4. Conceptual Framework

Figure 1 illustrates the conceptual framework utilized in this study. It is suggested that the awareness of the limitations of Generative AI (X) plays a role in predicting the intention to use ChatGPT (Y), both in a direct manner (c') and in an indirect manner via the perceived usefulness of such technology (M). Furthermore, it is proposed that the first-stage relationship between the awareness of the limitations of Generative AI and the perception of its usefulness (a) is moderated by the perceived fear of skill erosion (W). Consequently, the strength of this relationship will decrease as fear increases. In keeping with this specification, all three belief sets mentioned — awareness of restrictions, perceived usefulness, and concern over skill erosion — refer to generative AI as a concept, while the outcome variable refers specifically to the intention to use ChatGPT — the most common tool among the respondents. This distinction will be preserved in the entire manuscript.

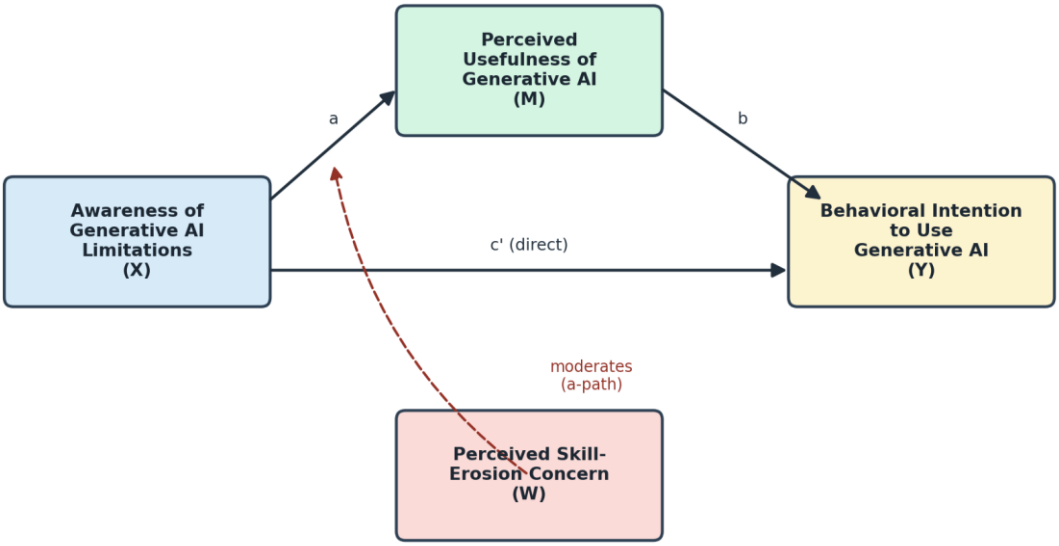


Figure 1. Conceptual framework depicting the first-stage moderated mediation model

5. Statement of the Problem

This study generally aimed to examine the mediating role of perceived usefulness and the moderating role of skill-erosion concern in the relationship between college students' awareness of generative AI limitations and their behavioral intention to use ChatGPT. Specifically, it sought to answer the following questions:

1) What are the respondents' demographics in terms of gender, year of study, and field of study?
2) What are the levels of awareness regarding (a) limitations of generative AI, (b) usefulness of generative AI among college students, (c) their intention to use ChatGPT, and (d) their concern regarding the decline in their skills?
3) Is there a significant direct link between the awareness of limitations of generative AI and the intention to use ChatGPT?
4) Is perceived usefulness of generative AI a significant mediating factor between awareness of limitations of generative AI and intention to use ChatGPT?
5) Is perceived concern of decline in skills a significant moderating factor between awareness of limitations of generative AI and perceived usefulness of generative AI?
6) Does the indirect effect of awareness of generative AI limitations on intention to use ChatGPT through perceived usefulness depend on the level of perceived skill erosion concern?

6. Hypotheses

Correspondingly, the following hypotheses, stated in null form, were tested at the .05 level of significance:

1) H_0: The understanding of limitations associated with generative artificial intelligence has no major influence on the intention to use ChatGPT.
2) H_0: The perceived usefulness does not act as a significant mediator between the awareness of generative limitations and intention to use ChatGPT.
3) H_0: The concern regarding loss of ability does not act as a significant moderator between awareness of generative AI limitations and perceived usefulness.
4) H_0: The indirect effect of awareness of generative AI limitations on intention to use ChatGPT through perceived usefulness will remain almost unaffected by the level of concern about loss of ability.

7. Methodology

7.1 Research Design

This research used a quantitative, non-experimental design, including descriptive-correlational methods and regression-based conditional process analysis. More specifically,

the study used a moderated mediation model, considering both the theoretical and statistical aspects described by Hayes and Rockwood (2017). The moderated mediation approach was chosen because the research assignments required not only examining whether the variables are correlated but also investigating the process underlying that correlation.

7.2 Respondents and Sampling Procedure

Participants in this study included 931 college students with varying degree programs, education levels, and genders from Northeastern College, a private institution not affiliated with any religious organization, located in Santiago City, Isabela, in the Cagayan Valley area of the Philippines. The students were enrolled in various disciplines including education, criminology, information technology, hospitality management, engineering, business, and liberal arts. To recruit respondents, the researchers distributed a survey to intact classes across degree programs such as Criminology, Information Technology, Hospitality Management, Elementary and Secondary Education, Geodetic Engineering, Political Science, Business Administration, and other related courses. This study used convenience sampling. Participation was voluntary and open to all enrolled students with experience using generative AI technologies, including ChatGPT. Table 1 shows the demographic profile of the respondents.

7.3 Research Instrument

The research involved administering structured questionnaires that had two sections. The first section covered demographic factors, while the remaining four sections consisted of Likert items assessing four respondent attributes. The first attribute assessed was that of awareness of the limitations of generative AI. This subscale included seven items assessing respondents' awareness of inaccuracy, contextual relevance, computational bias, statistical over-reliance, and limited emotional intelligence in generative AI. The second attribute was the perceived usefulness of generative AI, and this subscale consisted of six items measuring respondents' beliefs about improving their digital skills, generative AI's time-saving capabilities, the provision of meaningful insights, the provision of customized feedback, and its role as a support tool.

A subscale called Behavioral Intention to Use ChatGPT examined participants' readiness to use ChatGPT in their educational endeavors, including their motivation to learn how to use it. Perceived Skill-Erosion concern was another subscale comprising four questions that evaluated agreement with notions such as the idea that using generative AI lowers the importance of education, prevents social participation, limits the number of transferable skills acquired, and creates dependency among learners. The survey also included some open-ended questions to provide qualitative descriptions, but as a quantitative study, it focused primarily on closed-ended questions. To estimate scale reliability, calculations were conducted based on respondents' answers (see Table 2).

7.4 Data Gathering Procedure

The survey was conducted online with college students currently enrolled in the participating programs, through class representatives and instructors. Before completing the survey, respondents received an informed consent statement explaining the study's purpose, the voluntary nature of participation, and the plan to maintain confidentiality. Only completed responses with valid Likert-scale entries were included in the analysis, resulting in an analytical sample of 931 respondents.

7.5 Ethical Considerations

The research followed standard research ethics for studies involving human participants. Participants were free to participate and were informed of their right to withdraw at any time at no cost. The data were anonymized, and the analysis used only the program classification and demographic variables. The study complies with Republic Act No. 10173 of the Philippines, popularly referred to as the Data Privacy Act of 2012.

7.6 Statistical Treatment

Descriptive statistics (mean and standard deviation) provided information on the levels of each construct, while Cronbach's alpha tested internal consistency. Scale scores were obtained by averaging scores derived from their constituent items. The Pearson correlation test identified relationships between item pairs. For the actual analysis, the researcher followed Hayes's (2021) conditional process analysis to estimate the first stage of the moderated mediation process model. Specifically, (a) the first-stage regression predicted perceived

usefulness as a dependent variable on generative AI limitation awareness, worries about decline of skills, and their interaction term while controlling for the frequency of generative AI usage, sex, and year level; (b) the second-stage regression examined how to predict behavioral intention as the dependent variable from perceived usefulness and awareness of limitations in generative AI while controlling for the same covariates; and (c) the total effect analysis examined behavioral intention based on awareness of limitations and covariates.

The researcher calculated conditional indirect effects at three levels of skill erosion: low (-1 standard deviation), average (mean), and high (+1 standard deviation). To calculate the index of moderated mediation, the researcher multiplied the interaction coefficient by the Stage 2 path coefficient. Because the distribution of both indirect and conditional effects is generally not normal, the researcher used nonparametric percentile bootstrap confidence intervals with 5000 bootstrap samples; a significant effect is defined as one whose 95% bootstrap confidence interval does not include zero. The assumptions behind ordinary least squares estimation were investigated before hypothesis testing began. The researchers checked homoscedasticity and linearity using graphs of standardized predicted values against standardized residuals; evaluated residual normality with normal probability plots, along with skewness and kurtosis; checked residual independence with Durbin-Watson; and assessed multicollinearity using tolerance and VIF values. Because all variables were measured with a single self-report tool, used VIF < 3.3, the most conservative criterion for full collinearity; VIF checks redundancies among predictors and also indicates possible common method variance (Kock, 2015). Inference on indirect and moderating effects was based on percentile bootstrapping rather than assuming normality of the coefficient distribution, to ensure robustness to slight deviations from the assumption (Hayes & Rockwood, 2017).

8. Results

Table 1. Demographic Profile of Respondents

Demographic Variable	Category	f	%
Sex	Male	473	50.8
	Female	458	49.2
Year Level	First Year	267	28.7
	Second Year	272	29.2
	Third Year	282	30.3
	Fourth Year	110	11.8
Academic Program	BS Criminology	279	30.0
	BS Information Technology	162	17.4
	BS Hospitality Management	141	15.1
	Bachelor of Elementary Education	72	7.7
	BSEd English	66	7.1
	BSEd Filipino	63	6.8
	BS Geodetic Engineering	51	5.5
	BSEd Mathematics	33	3.5
	BSEd Science	30	3.2
	AB Political Science	15	1.6
	Other programs (< 1% each)	18	1.9
Total		**931**	**100.0**

Note. Programs with fewer than 1% of respondents each (BS Business Administration, BS Management Accounting, AB Mass Communication, Midwifery-related programs, and single-case program-title variants) were collapsed into "Other programs."

Table 2. Descriptive Statistics and Internal Consistency Reliability of Study Constructs

Construct	Items	M	SD	Cronbach's α	Descriptive Level
Awareness of Generative AI Limitations (X)	7	3.31	0.94	.934	Moderate
Perceived Usefulness of Generative AI (M)	6	3.17	0.89	.930	Moderate
Behavioral Intention to Use ChatGPT (Y)	2	3.09	0.94	.799	Moderate
Perceived Skill-Erosion Concern (W)	4	3.04	0.86	.854	Moderate
Generative AI Usage Frequency (covariate)	1	3.08	1.09	—	Moderate

Note. Scale range = 1.00-5.00; descriptive levels: 1.00-2.33 = Low, 2.34-3.67 = Moderate, 3.68-5.00 = High. All alpha coefficients exceeded the .70 acceptability threshold, with the two-item Behavioral Intention scale in the acceptable range and the remaining scales in the excellent range.

Table 3. Pearson Correlations Among Study Variables

Variable	1	2	3	4	5
1. Usage Frequency	—				
2. Awareness of Limitations (X)	.462**	—			
3. Perceived Usefulness (M)	.553**	.649**	—		
4. Behavioral Intention (Y)	.502**	.625**	.804**	—	
5. Skill-Erosion Concern (W)	.442**	.654**	.675**	.583**	—

***p < .001 (two-tailed), N = 931.*

According to the data provided in Table 2, the participants demonstrated moderate awareness about the limitations of generative AI (M = 3.31, SD = 0.94), its usefulness (M = 3.17, SD = 0.89), the intention to implement generative AI (M = 3.09, SD = 0.94), and the skill erosion worry (M = 3.04, SD = 0.86). These moderate positions indicate that, across all aspects mentioned, students held neutral but slightly positive views. Further, Table 3 shows correlations among the constructs ($p < .001$). These findings show that perceived usefulness and behavioral intention are closely related, consistent with TAM predictions. These correlations support the model but should not be taken as proof of its validity, since bivariate correlations cannot confirm a model's theory. Moreover, the research also revealed that concern about skills erosion is positively correlated with limitation awareness (r = .654) and perceived usefulness (r = .675). Thus, students are concerned about the negative effects of GenAI, but they also recognize its advantages.

Given the notable bivariate relationships in Table 3, the uniqueness of the variables and the possibility of multicollinearity were investigated before interpreting the regression models. The collinearity measures for the Stage 1 independent variables were acceptable: limitations awareness (tolerance = .535, VIF = 1.87), concern about skill erosion (tolerance = .547, VIF = 1.83), and frequency of generative AI usage (tolerance = .752, VIF = 1.33). All measures were below the conservative multicollinearity threshold of 3.3, as suggested by Kock and Ned (1AD), and below the usual threshold of 10, indicating that neither predictor redundancy nor excessive common method bias could explain the findings.

The largest link in the matrix is between perceived usefulness and behavioral intention (r = .804), meaning about 65% of the variance is shared, leaving roughly 1/3 of the variance in intention unexplained by usefulness. These two concepts are also theoretically distinct in the TAM framework, where usefulness refers to an evaluative belief about the outcome of an action, and intention is viewed as motivational readiness to act (Davis, 1989; Strzelecki, 2024). Nevertheless, this correlation raises the question of whether the two scales are fully independent, a limitation of the current measurement model. The residual diagnostics for both stage models were also checked: the plots of standardized residuals against the standardized predicted values showed no systematic funneling or

curvature, and normal probability plots of the residuals followed the diagonal.

Table 4. Stage 1 Regression: Perceived Usefulness Regressed on Awareness of Limitations, Skill-Erosion Concern, and Their Interaction (Moderated a-Path)

Predictor	b	SE	t	p	95% CI [LL, UL]
Constant	3.305	0.028	115.99	< .001	—
Awareness of Limitations (X)	0.241	0.028	8.68	< .001	[0.166, 0.319]
Skill-Erosion Concern (W)	0.396	0.029	13.50	< .001	—
X × W (interaction)	-0.106	0.018	-5.78	< .001	[-0.148, -0.067]
Usage Frequency (covariate)	0.195	0.020	9.81	< .001	—
Sex (Female = 1) (covariate)	-0.168	0.038	-4.46	< .001	—
Year Level (covariate)	0.023	0.019	1.21	.225	—

Note. Outcome variable: Perceived Usefulness of Generative AI. $R^2 = .601$, $F(6, 924) = 231.80$, $p < .001$. Predictors and interaction term were mean-centered. 95% CI computed from 5,000 bootstrap resamples; CI reported for focal terms.

Table 4 displays the results of Stage 1 of the moderated a-path regression analysis. The model was significant, $R^2 = .601$, $F (6, 924) = 231.80$, $p < .001$, meaning that the limitations of generative AI concerns about skill erosion, as well as their combination and control variables, accounted for nearly 60.1% of the variance in its utility perception. According to the results, the limitations of generative AI were a significant predictor of its utility perception (b = 0.241, p < .001, 95% CI [0.166, 0.319]), which confirms the proposition stating that better understanding of the limitations of what generative AI can and cannot do goes hand in hand with better understanding of its utility. Importantly, the interaction between awareness of limitations and skill-erosion concern was significant and negative (b = -0.106, p < .001, 95% CI [-0.148, -0.067]), suggesting that concern about potential skill erosion moderated the relationship.

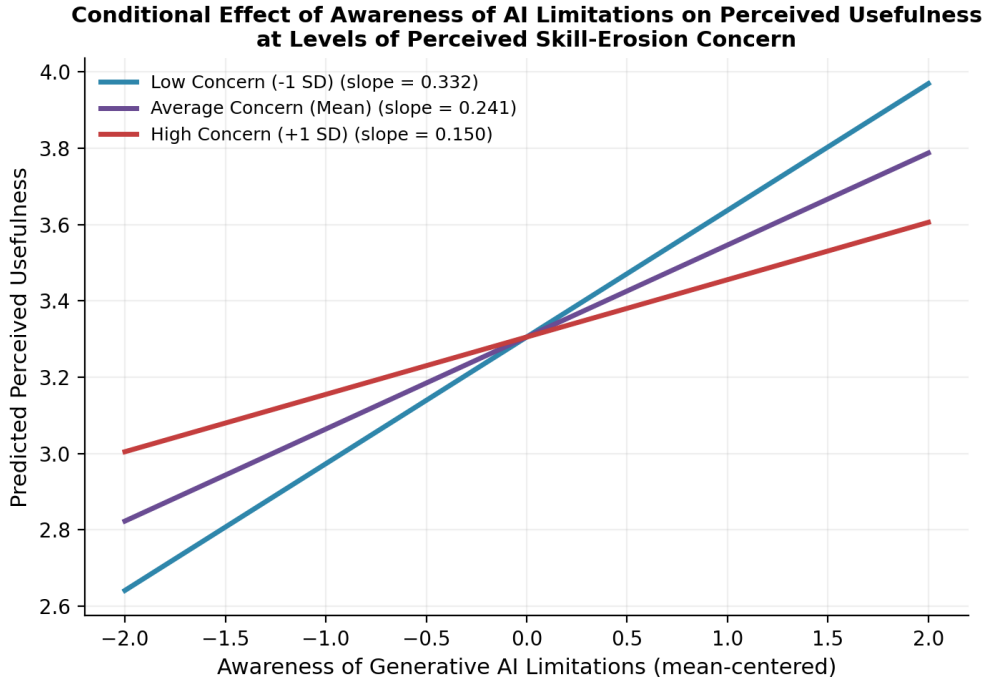


Figure 2. Conditional effect of awareness of generative AI limitations on perceived usefulness at low, average, and high levels of perceived skill-erosion concern

Figure 2 shows that the positive relationship between awareness of limitations and perceived usefulness had the highest 'simple slope' for low skill-erosion concern students (simple slope = 0.332), and the lowest for great concern students (simple slope = 0.150), with average concern students positioned in the middle (simple slope = 0.241). The observations show that awareness of the limitations posed by generative AI continues to drive perceived usefulness across student groups, but with much greater weight among students with low concern about skill erosion from technology use.

Table 5. Stage 2 (b and c′ Paths) and Total Effect (c Path) Regression Results

Predictor	b	SE	t	p	95% CI [LL, UL]
Stage 2 Model: DV = Behavioral Intention (Y)					
Constant	3.090	0.025	122.15	< .001	—
Perceived Usefulness (M) → Y (b path)	0.701	0.029	24.49	< .001	[0.620, 0.778]
Awareness of Limitations (X) → Y (c′ direct path)	0.169	0.026	6.63	< .001	[0.098, 0.241]
Usage Frequency (covariate)	0.050	0.020	2.48	.013	—
Sex (covariate)	0.005	0.036	0.13	.898	—
Year Level (covariate)	-0.016	0.018	-0.87	.383	—
Total Effect Model: DV = Behavioral Intention (Y)					
Constant	3.144	0.032	97.25	< .001	—
Awareness of Limitations (X) → Y (total effect c)	0.506	0.028	18.33	< .001	[0.452, 0.560]
Usage Frequency (covariate)	0.237	0.024	9.96	< .001	—
Sex (covariate)	-0.106	0.046	-2.29	.022	—
Year Level (covariate)	-0.011	0.023	-0.46	.645	—

Note. Stage 2 model R2 = .667, F(5, 925) = 370.94, p < .001. Total effect model R2 = .452, F(4, 926) = 190.59, p < .001. 95% CI computed from 5,000 bootstrap resamples for focal paths.

Based on the data in Table 5, the results support the mediation hypothesis. The model on total effect indicated the existence of a very important and statistically significant effect of variable awareness on behavioral intention (c = 0.506, p < .001, 95% CI [0.452, 0.560]), thus leading to rejection of the null hypothesis (H01) and approval of a meaningful association of variables under investigation. In the Stage 2 Model, which included usefulness alongside awareness, usefulness proved to be a strong predictor of behavioral intention (b = 0.701, p < .001, 95% CI [0.620, 0.778]). Based on the obtained results, it can be observed that a significant direct effect of awareness on behavioral intention was noted, but it was considerably diminished (c′ = 0.169, p < .001, 95% CI [0.098, 0.241]). This pattern is typical of partial mediation, where the direct path is reduced but does not disappear completely with the mediator.

Table 6. Conditional Indirect Effects of Awareness of Limitations on Behavioral Intention Through Perceived Usefulness, at Levels of Skill-Erosion Concern

Level of Skill-Erosion Concern (W)	Conditional a-path	Conditional Indirect Effect (a×b)	95% Bootstrap CI [LL, UL]
Low Concern (-1 SD)	0.332	0.233	[0.172, 0.298]
Average Concern (Mean)	0.241	0.169	[0.114, 0.230]

High Concern (+1 SD)	0.150	0.105	[0.043, 0.173]
Index of Moderated Mediation	—	**-0.075**	**[-0.107, -0.046]**

Note. Indirect effects and the index of moderated mediation were estimated using 5,000 percentile bootstrap resamples. An effect is considered statistically significant at α = .05 when the 95% confidence interval does not include 0. Conditional a-paths were determined at the mean of concern about skill erosion and at ±1 SD (SD = 0.86) from Stage 1 coefficients provided in Table 4 using a = 0.241 + (-0.106 x W). Each conditional indirect effect constitutes the multiplication of the respective conditional a-path and b-path from Stage 2 (b = 0.701). The moderated mediation index is calculated by multiplying the interaction coefficient by the b-path coefficient. All numbers were computed from unrounded coefficients; thus, they may differ slightly from products calculated using rounded figures. We report only percentile bootstrapped confidence intervals; bootstrapped standard errors were not reported.

Table 6 presents findings related to the study's main hypotheses regarding mediation and moderated mediation. The indirect impact of knowledge of generative AI limitations on behavioral intention through perceived usefulness was significantly positive across skill-erosion worry levels, as none of the bootstrap confidence ranges contained zero. In addition, the findings allow us to reject H02 and state that perceived usefulness significantly mediates the relationship between awareness of limitations and behavioral intention, accounting for approximately one-third of the total effect (indirect effect at the mean = 0.169 relative to a total effect of 0.506, or 33.4%). The more crucial factor here is the variance of the existing indirect effect. For example, it was more than double for students with low skill-erosion worries (0.233) compared with those with high skill-erosion worries (0.105). The index of moderated mediation, which reveals whether the conditional pattern is statistically trustworthy, is significant and negative (index = -0.075, 95% CI [-0.107, -0.046]). Therefore, zero is not in this range, and H04 cannot be accepted.

9. Discussion

This research examined whether perceived usefulness mediates the link between college students' knowledge of the limitations of generative AI and their intention to use ChatGPT, and whether concern about skill spoilage moderates this path. Three research findings require attention.

First, the knowledge of the limitations of generative AI was positively correlated, not negatively, with perceived usefulness and behavioral intention. This result runs contrary to the intuitive expectation that awareness of technology's disadvantages would reduce willingness to use it. Instead, the findings align with the body of knowledge on AI literacy, which states that critical awareness of technology's strengths and shortcomings involves acquiring the competency to use it intelligently (Heard et al., 2024; Hwang et al., 2023; Walter, 2024). Students who are aware that generative AI can produce incorrect, biased, and irrelevant outcomes seem to draw better conclusions about technology's usefulness than those who are unaware.

Secondly, perceived usefulness had a very large and significant mediating effect on the connection between limitation awareness and behavioral intention, confirming the idea put forward by the Technology Acceptance Model that beliefs regarding usefulness are the main channel through which external beliefs impact the intention to adopt (Damiano et al., 2024; Davis, 1989). The existence of a significant but smaller direct effect suggests that limitation awareness affects behavioral intention through a number of other ways, such as normative beliefs about professional preparedness or peer expectations, and the idea is supported by the statement that "students need to learn to use generative AI well for their future careers" present in the intention statement.

Third, the most innovative angle of this study is the significant moderation of the awareness-to-usefulness impact by students' skill erosion fears. With students demonstrating low levels of these concerns, awareness translated into perceived usefulness to a very strong degree (simple slope = 0.332). In contrast, for students with great concerns, the translation into usefulness was much smaller (simple slope = 0.150), although it never ceased to exist. This finding is a refinement of the previous discoveries about the co-existence of the fears of over-dependence and skills decay, alongside an ongoing use of GenAI (Khlaif et al., 2025; Moore & Gerlich, 2025; Ravšelj et al., 2025;

Zhai et al., 2024) and implies that the student's feelings of skill erosion do not act as a simple switch, but rather as a dial that interacts with the efficiency of the awareness translation into the perception of usefulness.

This shows that the findings agree with studies on the role of perceived risk in technology acceptance literature (Wijaya et al., 2024). The implication for teachers and universities is that the promotion of AI literacy and the creation of non-paralyzing concern about excessive reliance are not opposing tasks; the evidence suggests that it is possible and even beneficial to make students believe that GenAI is useful while being sufficiently concerned about its disadvantages to avoid excessive reliance, which can be noticed in the lower indirect influence of high-risk students.

10. Conclusion

This study investigated the influence of awareness of generative AI limitations on behavioral intention to use ChatGPT among college students and whether this process works through perceived utility and is moderated by students' concern about diminishing skills. The analysis of the data, collected from 931 students and using a moderated mediation design, showed that awareness positively influenced both perceived utility and intention to use the tool, perceived utility mediated approximately one-third of the relationship between awareness and intention to use the tool, and the correlation was significantly weaker for students who were more concerned about their skills. Thus, the research disconfirmed all four hypotheses. The results expand the Technology Acceptance Model by showing that beliefs about risks associated with technology use do not simply influence the adoption process through positive and negative effects; benefits were achieved through awareness of utility-channel creation.

11. Recommendations

Based on the results, the following recommendations are provided.

1) Higher education institutions should develop and include focused AI-literacy courses in their curricula. Study results show that understanding the limitations of generative AI supports positive attitudes toward technology and its use.
2) Awareness of the costs of generative AI should be cultivated further by instructors and instructional designers. Although awareness does not prevent people from thinking positively about using generative AI, it tempers their views on its effectiveness.
3) Course design should include independent thinking tasks alongside generative AI. For example, tasks that involve finding unreliable information generated by AI, evaluating AI outputs, or using AI output as a foundation for independent work.
4) Authorities planning generative AI policies must keep in mind students' conflicting attitudes toward this technology; while some students may use generative AI tools without understanding their limitations, others may understand these tools well and be concerned about their risks.
5) Future researchers can apply the moderated mediation model analyzed in this research in different institutional contexts and consider moderators such as instructors' guidance or institutional AI policy clarity, or they may design longitudinal studies to evaluate how generative AI functionality and institutional policies evolve over time.

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