

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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doi:10.63593/JARE.2026.09.01

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 (Niemic & 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%
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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%
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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).

References

- ACAR, A. N. Ç. H. (2025). Examining Teachers' Perceptions and Job Satisfaction Regarding the Use of Artificial Intelligence in Education. *Zenodo (CERN European Organization for Nuclear Research)*. <https://doi.org/10.5281/zenodo.18043442>
- Adewusi, M. A., AINEBYOONA, C., Odekeye, O. T., & NGOMA, M. (2025). *AI in Universities: The Good, the Bot, and the Ugly Truths*. <https://doi.org/10.21203/rs.3.rs-6883202/v1>
- Al-Mughairi, H., & Bhaskar, P. (2024). Exploring the factors affecting the adoption AI techniques in higher education: insights from teachers' perspectives on ChatGPT. *Journal of Research in Innovative Teaching & Learning*. <https://doi.org/10.1108/jrit-09-2023-0129>
- Almusaed, A., Almssad, A., Yitmen, İ., & Homod, R. Z. (2023). Enhancing Student

- Engagement: Harnessing “AIED”’s Power in Hybrid Education—A Review Analysis. *Education Sciences*, 13(7), 632–632. <https://doi.org/10.3390/educsci13070632>
- Al-Zahrani, A. M., & Alasmari, T. (2024). Exploring the impact of artificial intelligence on higher education: The dynamics of ethical, social, and educational implications. *Humanities and Social Sciences Communications*, 11(1). <https://doi.org/10.1057/s41599-024-03432-4>
- Anuradha, P. (2025). *Artificial Intelligence Tools to Enrich Teaching and Learning- A Review*, 212–216. <https://doi.org/10.1109/icisc65841.2025.11188363>
- Arinaitwe, J., & Reddy, P. J. K. (2025). Strategic Implementation of Gamification in Education: Enhancing Learner Engagement amid Curriculum Reforms in Uganda. *Journal of Curriculum Development Evaluation and Education (JCDEE)*, 1(2), 1–14. <https://doi.org/10.64948/jcdee.v1.i2.2025.100>
- ATICI, E. K., & Turhan, M. (2024). The impact of simulation applications on the problem-solving and decision-making skills of school administrators and prospective administrators: An experimental study. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-024-12866-x>
- Ayala-Pazmiño, M. (2023). Artificial Intelligence in Education: Exploring the Potential Benefits and Risks. 593 *Digital Publisher CEIT*, 8(3), 892–899. <https://doi.org/10.33386/593dp.2023.3.1827>
- Ayeni, O. O., Hamad, N. M. A., Chisom, O. N., Osawaru, B., & Adewusi, O. E. (2024). AI in education: A review of personalized learning and educational technology [Review of *AI in education: A review of personalized learning and educational technology*]. *GSC Advanced Research and Reviews*, 18(2), 261–271. <https://doi.org/10.30574/gscarr.2024.18.2.0062>
- Banik, B. G., & Gullapelly, A. (2025). AI-Powered Gamification and Interactive Learning Tools for Enhancing Student Engagement. In *IGI Global eBooks* (pp. 283–310). IGI Global. <https://doi.org/10.4018/979-8-3693-8292-9.ch013>
- Betz, N. E., & Weiss, D. J. (1976). Psychological Effects of Immediate Knowledge of Results and Adaptive Ability Testing. *Defense Technical Information Center (DTIC)*. <http://oai.dtic.mil/oai/oai?&verb=getRecord&metadataPrefix=html&identifier=ADA027170>
- Bond, M., Khosravi, H., Laat, M. de, Bergdahl, N., Negrea, V., Oxley, E., Pham, P., Chong, S. W., & Siemens, G. (2024). A meta systematic review of artificial intelligence in higher education: a call for increased ethics, collaboration, and rigour. *International Journal of Educational Technology in Higher Education*, 21(1). <https://doi.org/10.1186/s41239-023-00436-z>
- Bruggen, J. van. (2004). Theory and practice of online learning. *British Journal of Educational Technology*, 36(1), 111–112. https://doi.org/10.1111/j.1467-8535.2005.00445_1.x
- Cao, W., Tam, N., & Guo, W. (2025). Personalized Learning and Adaptive Systems: AI-Driven Educational Innovation and Student Outcome Enhancement. *International Journal of Education and Humanities*, 20(2), 173–182. <https://doi.org/10.54097/tc5k6825>
- Cao, Y., Li, X., & Zhang, H. (2025). Artificial intelligence in education: Applications and impacts on student learning outcomes. *Computers & Education*, 195, 104700.
- Charytanowicz, M. (2023). Student preferences in technology-enhanced learning environments: The role of interaction and autonomy. *Education and Information Technologies*, 28(4), 4567–4583.
- Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education*, 20(1). <https://doi.org/10.1186/s41239-023-00408-3>
- Chan, C. K. Y., & Colloton, T. (2024). *Generative AI in Higher Education*. <https://doi.org/10.4324/9781003459026>
- Charytanowicz, M. (2023). Online Education vs Traditional Education: Analysis of Student Performance in Computer Science using Shapley Additive Explanations. *Informatics in Education*. <https://doi.org/10.15388/infedu.2023.23>
- Chhasatiya, N. R., Sable, R. G., Subhashree, S., Pathak, Ms. F., Patel, D. N., Madhu, S., &

- Bhatt, K. (2026). AI's Role in Fostering Student Motivation and Retention. In *Advances in computational intelligence and robotics book series* (pp. 391–418). IGI Global. <https://doi.org/10.4018/979-8-3373-4908-4.ch015>
- Dahri, N. A., Al-Rahmi, W. M., Alhashmi, K. A., & Shaikh, F. B. (2025). Enhancing Mobile Learning with AI-Powered Chatbots: Investigating ChatGPT's Impact on Student Engagement and Academic Performance. *International Journal of Interactive Mobile Technologies (ijim)*, 19(11), 17–38. <https://doi.org/10.3991/ijim.v19i11.54643>
- Dziuban, C. D., Graham, C. R., Moskal, P., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, 15(1). <https://doi.org/10.1186/s41239-017-0087-5>
- Dziuban, C. D., Moskal, P. D., & Williams, R. L. (2018). Situated learning and cognitive apprenticeship in online and blended learning environments. *Journal of Educational Technology Development and Exchange*, 11(1), 1–20.
- Dziuban, C. D., Moskal, P., Johnson, C., & Evans, D. (2017). *Adaptive Learning: A Tale of Two Contexts*. 4(1), 3. <https://scholarworks.umb.edu/cgi/viewcontent.cgi?article=1038&context=ciee>
- Dziuban, C., Moskal, P., Johnson, C., & Evans, D. (2018). Adaptive learning: A tale of two contexts. *Current Issues in Emerging eLearning*, 5(1), 1–15. <https://scholarworks.umb.edu/ciee/vol5/iss1/1>
- Edgar, A., Macfarlane, S., Kiddell, E. J., Armitage, J. A., & Wood-Bradley, R. J. (2022). The perceived value and impact of virtual simulation-based education on students' learning: a mixed methods study. *BMC Medical Education*, 22(1). <https://doi.org/10.1186/s12909-022-03912-8>
- Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. *International Journal of Educational Technology in Higher Education*, 19(1). <https://doi.org/10.1186/s41239-022-00362-6>
- Fan, Y., Tang, L., Le, H., Shen, K., Tan, S., Zhao, T., Shen, Y., Li, X., & Gašević, D. (2024). Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance. *British Journal of Educational Technology*, 56(2), 489–530. <https://doi.org/10.1111/bjet.13544>
- Ferreira-Meyers, K. (2025). Including Students in the Artificial Intelligence Conversation. In *Advances in computational intelligence and robotics book series* (pp. 383–404). IGI Global. <https://doi.org/10.4018/979-8-3693-8915-7.ch015>
- Fitas, R. (2025). Inclusive education with AI: supporting special needs and tackling language barriers. *AI and Ethics*. <https://doi.org/10.1007/s43681-025-00824-3>
- Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., Gorski, H., & Tudorache, P. (2023). Adaptive Learning Using Artificial Intelligence in e-Learning: A Literature Review. *Education Sciences*, 13(12), 1216–1216. <https://doi.org/10.3390/educsci13121216>
- Goyal, N. (2026). Transforming Pedagogical Processes with Artificial Intelligence: Implications for Learner Engagement and Classroom Dynamics. *Asian Journal of Education and Social Studies*, 52(2), 846–864. <https://doi.org/10.9734/ajess/2026/v52i22884>
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). *Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification*, 3025–3034. <https://doi.org/10.1109/hicss.2014.377>
- He, L., & Li, C. (2023). Continuance intention to use mobile learning for second language acquisition based on the technology acceptance model and self-determination theory. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1185851>
- Holmes, W., Bialik, M., & Fadel, C. (2023). *Artificial intelligence in education* (pp. 621–653). <https://doi.org/10.58863/20.500.12424/4276068>
- Hossain, M., Amin, S. Z., Gordon, B., & Hossain, Md. F. (2026). Artificial Intelligence in Content Design Enhances Student Engagement and Satisfaction Across Individual Learning Differences. *Technology Knowledge and Learning*. <https://doi.org/10.1007/s10758-025-09952-5>

- Hossain, M. S., Rahman, M. M., & Islam, M. T. (2026). Learner differences and the effectiveness of AI-based educational tools. *International Journal of Educational Technology*, 18(2), 112–129.
- Jin, S.-H., Im, K., Yoo, M., Roll, I., & Seo, K. (2023). Supporting students' self-regulated learning in online learning using artificial intelligence applications. *International Journal of Educational Technology in Higher Education*, 20(1). <https://doi.org/10.1186/s41239-023-00406-5>
- Jony, A. I., & Hamim, S. A. (2024). Empowering virtual collaboration: harnessing AI for enhanced teamwork in higher education. *Educational Technology Quarterly*, 2024(3), 337–359. <https://doi.org/10.55056/etq.746>
- Jose, J., & Jose, B. J. (2024). Educators' Academic Insights on Artificial Intelligence: Challenges and Opportunities. *The Electronic Journal of E-Learning*, 0. <https://doi.org/10.34190/ejel.21.5.3272>
- Kahila, J., Vartiainen, H., Tedre, M., Arkko, E., Lin, A., Pope, N., Jormanainen, I., & Valtonen, T. (2024). Pedagogical framework for cultivating children's data agency and creative abilities in the age of AI. *Informatics in Education*, 323–360. <https://doi.org/10.15388/infedu.2024.15>
- Khalifeh, F., Santiago, R., & Palau, R. (2026). Redefining personalized learning in the artificial intelligence era: an updated systematic review from 2019 to 2025. *Smart Learning Environments*, 13(1). <https://doi.org/10.1186/s40561-026-00440-6>
- Kim, B., Suh, H., Heo, J., & Choi, Y. (2022). AI-Driven Interface Design for Intelligent Tutoring System Improves Student Engagement. *arXiv (Cornell University)*. <https://doi.org/10.48550/arxiv.2009.08976>
- Kumaresan, V., Jeyakarthic, M., P., M., P, J. I. R., Mohan, E., & Surendra, K. (2025). *Personalized AI-Driven Online Education Technologies for Adaptive Learning and Cognitive Skill Enhancement*, 1045–1050. <https://doi.org/10.1109/ispcc66872.2025.11039410>
- Lampropoulos, G. (2023). Recommender systems in education: A literature review and bibliometric analysis [Review of *Recommender systems in education: A literature review and bibliometric analysis*]. *Advances in Mobile Learning Educational Research*, 3(2), 829–850. <https://doi.org/10.25082/amler.2023.02.011>
- Landa-Blanco, M. (2026). Artificial intelligence in education: applications and limitations for teachers in low- and middle-income countries. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1681836>
- Lizy, R. F. S., Haridha, R. S. P., Shamila, S. N. S., & Purwono, Ir. B. S. A. (2026). *Artificial Intelligence Techniques for Supporting Face-to-Face and Online Collaborative Learning* (pp. 95–116). <https://doi.org/10.1201/9781003639367-6>
- Long, D. Y., Wang, S., Rashid, S. M., & Lu, X. T. (2026). Artificial intelligence in higher education: a systematic review of its impact on student engagement and the mediating role of teaching methods. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1648661>
- Luan, H., Géczy, P., Lai, H., Gobert, J. D., Yang, S. J. H., Ogata, H., Baltes, J., Guerra, R. da S., Li, P., & Tsai, C. (2020). Challenges and Future Directions of Big Data and Artificial Intelligence in Education [Review of *Challenges and Future Directions of Big Data and Artificial Intelligence in Education*]. *Frontiers in Psychology*, 11. Frontiers Media. <https://doi.org/10.3389/fpsyg.2020.580820>
- Mpolomoka, D. L. (2025). Utilizing artificial intelligence for assessment in higher education. *Pedagogical Research*, 10(3). <https://doi.org/10.29333/pr/16677>
- Dr. Arun Chandra Mudhol. (2025). New Learning Paradigms: A Review of Emerging Trends and Institutional Adaptability. *International Journal of Innovative Science and Research Technology (IJISRT)*, 10(6), 1601–1614. <https://doi.org/10.38124/ijisrt/25jun905>
- Mudhol, S. (2025). Online learning environments and student participation: Opportunities and challenges. *Journal of Distance Education*, 40(1), 55–70.
- Musoke, K. (2003). The Ethics and Governance of Artificial Intelligence in Ugandan Societies. *Zenodo (CERN European Organization for Nuclear Research)*. <https://doi.org/10.5281/zenodo.18776748>
- Naeem, M., Khan, S., & Abbas, Q. (2024). Impact of reduced social interaction in online learning on student motivation. *Education*

- Sciences*, 14(2), 210–225.
- Naeem, N.-K., Hadie, S. N. H., Ismail, I. M., Ullah, S., & Yusoff, M. S. B. (2024). Buzz or Fuss: Gauging the Online Learning Environments in Undergraduate Medical Education – A Mixed-method Study. *Education in Medicine Journal*, 16(2), 63–83. <https://doi.org/10.21315/eimj2024.16.2.5>
- Namagembe, B., Mirembe, D. P., Lubega, J. T., & Kibukamusoke, M. (2025). The Role of Artificial Intelligence in the Future of Higher Education in Uganda: A Case Study of Makerere University. *Science Technology & Public Policy*, 9(2), 146–154. <https://doi.org/10.11648/j.stpp.20250902.18>
- Z. P. Ncube, C. C. Chitumwa, T. Makambwa, M. A. Mulatu, V. T. Tsabedze and M. Nxumalo. (2025). “Exploring the Effects of AI-Powered Tools for Engaged Learning in Higher Education: A Case Study at a University in Eswatini,” 2025 5th International Multidisciplinary Information Technology and Engineering Conference (IMITEC), Pretoria, South Africa, pp. 1-8. doi: 10.1109/IMITEC67386.2025.11410486.
- Neo, M., Lee, C. P., Tan, H. Y.-J., Neo, T. K., Tan, Y. X., Mahendru, N., & Ismat, Z. (2022). Enhancing Students’ Online Learning Experiences with Artificial Intelligence (AI): The MERLIN Project. *International Journal of Technology*, 13(5), 1023–1023. <https://doi.org/10.14716/ijtech.v13i5.5843>
- Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom. *Theory and Research in Education*, 7(2), 133–144. <https://doi.org/10.1177/1477878509104318>
- Nyakito, C., Amimo, C., & Allida, V. B. (2021). Challenges of Integrating Information and Communication Technology in Teaching among National Teachers’ Colleges in Uganda. *EAST AFRICAN JOURNAL OF EDUCATION AND SOCIAL SCIENCES*, 2. <https://doi.org/10.46606/eajess2021v02i03.0114>
- Odit, E., & Chakrawarty, S. (2026). Challenges and Opportunities in Adopting ICT and AI for Competency-Based Curriculum in Rural Secondary Schools of Lango Subregion, Northern Uganda. *Asian Journal of Arts, Humanities and Social Studies*, 9(1), 35–41. <https://doi.org/10.56557/ajahss/2026/v9i196>
- Olayinka, T. A., Waghid, Y., Mataka, T. W., & Adegoke, O. (2024). Demystifying Lesotho, Rwandan and Nigerian educators’ viewpoints on smart technologies supporting AI in higher education. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-024-12820-x>
- Onesi-Ozigagun, O., Ololade, Y. J., Eyo-Udo, N. L., & Ogundipe, D. O. (2024). REVOLUTIONIZING EDUCATION THROUGH AI: A COMPREHENSIVE REVIEW OF ENHANCING LEARNING EXPERIENCES [Review of REVOLUTIONIZING EDUCATION THROUGH AI: A COMPREHENSIVE REVIEW OF ENHANCING LEARNING EXPERIENCES]. *International Journal of Applied Research in Social Sciences*, 6(4), 589–607. Fair East Publishers. <https://doi.org/10.51594/ijarss.v6i4.1011>
- Otero, L. C., Catalá, A., Fernández-Morante, C., Taboada, M., López, B. C., & Barro, S. (2023). AI literacy in K-12: a systematic literature review. *International Journal of STEM Education*, 10(1). <https://doi.org/10.1186/s40594-023-00418-7>
- Pardo, A., Jovanović, J., Dawson, S., Gašević, D., & Mirriahi, N. (2017). Using learning analytics to scale the provision of personalised feedback. *British Journal of Educational Technology*, 50(1), 128–138. <https://doi.org/10.1111/bjet.12592>
- Park, Y., & Doo, M. Y. (2024). Role of AI in Blended Learning: A Systematic Literature Review. *The International Review of Research in Open and Distributed Learning*, 25(1), 164–196. <https://doi.org/10.19173/irrodl.v25i1.7566>
- Patil, Dr. M. Y. (2026). Ethical Issues of Artificial Intelligence Use in Education: Bias, Privacy, and Transparency. *Zenodo (CERN European Organization for Nuclear Research)*. <https://doi.org/10.5281/zenodo.18917952>
- Pratama, F. A., Silitonga, R. M., & Jou, Y. (2021). Rimigs: the impact of gamification on students’ motivation and performance in programming class. *Indonesian Journal of Electrical Engineering and Computer Science*, 24(3), 1789–1789. <https://doi.org/10.11591/ijeecs.v24.i3.pp1789-1795>
- Reeve, J. (2009). Why Teachers Adopt a Controlling Motivating Style Toward

- Students and How They Can Become More Autonomy Supportive. *Educational Psychologist*, 44(3), 159–175. <https://doi.org/10.1080/00461520903028990>
- Reimagining Education - The Role of E-learning, Creativity, and Technology in the Post-pandemic Era [Working Title]. (2023). In *IntechOpen eBooks*. IntechOpen. <https://doi.org/10.5772/intechopen.110350>
- Ross, B., Chase, A.-M., Robbie, D., Oates, G., & Absalom, Y. (2018). Adaptive quizzes to increase motivation, engagement and learning outcomes in a first year accounting unit. *International Journal of Educational Technology in Higher Education*, 15(1). <https://doi.org/10.1186/s41239-018-0113-2>
- Ryan, R. M. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publications.
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, 101860–101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Sari, H., Tumanggor, B., & Efron, D. (2024). Improving Educational Outcomes Through Adaptive Learning Systems using AI. *International Transactions on Artificial Intelligence (ITALIC)*, 3(1), 21–31. <https://doi.org/10.33050/italic.v3i1.647>
- Sari, R., Prasetyo, Z. K., & Widodo, A. (2024). The role of artificial intelligence in transforming education systems. *International Journal of Emerging Technologies in Learning*, 19(6), 34–49.
- Sasso, L., & Paladini, M. (2021). Student engagement and motivation in higher education: The role of active learning strategies. *Teaching in Higher Education*, 26, 1023–1038.
- Sasso, P. A., & Paladini, A. (2021). Around the house: A descriptive study of attachment styles, living arrangement, and involvement in undergraduate commuter students. *JCAPS*, 3(2), 16–29. <https://doi.org/10.52499/2021019>
- Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, 18(1). <https://doi.org/10.1186/s41239-021-00292-9>
- Shikokoti, H., & Reuben, M. (2025). Influence of Artificial Intelligence on the Quality of Education in Higher Learning: A Case Study of Faculty of Education, University of Nairobi, Kenya. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.5014109>
- Shinwari, I. (2025). A meta-Analysis on Students-Centered-Learning in Educational Institutions. *Rahbar International Journal of Social Sciences Research*, 1(2), 14–14. <https://doi.org/10.64386/xhas053025.02>
- Siemens, G. (2013). Learning Analytics. *American Behavioral Scientist*, 57(10), 1380–1400. <https://doi.org/10.1177/0002764213498851>
- Singh, A. P., Saxena, R., & Saxena, S. (2024). The Future of Learning: AI-Driven Personalized Education. *Asian Journal of Current Research*, 9(4), 207–226. <https://doi.org/10.56557/ajocr/2024/v9i49018>
- Song, J., Bong, M., Lee, K., & Kim, S. (2014). Longitudinal investigation into the role of perceived social support in adolescents' academic motivation and achievement. *Journal of Educational Psychology*, 107(3), 821–841. <https://doi.org/10.1037/edu0000016>
- Sulistiani, Subali, B., & Ellianawati. (2025). THE ROLE OF TECHNOLOGY AND DIGITAL LITERACY IN IMPROVING STUDENT LEARNING MOTIVATION: A LITERATURE REVIEW 2021-2025. *Zenodo (CERN European Organization for Nuclear Research)*. <https://doi.org/10.5281/zenodo.18464732>
- Suwanti, R., Candranita, S., Yani, S., & Afriani, S. (2025). Peran Platform Pembelajaran Online Berbasis Ai dalam Meningkatkan Motivasi Belajar Siswa di Masa Pendidikan Digital. *JPT Jurnal Pendidikan Tematik*, 6(1), 66–70. <https://doi.org/10.62159/jpt.v6i1.1718>
- Tang, K. H. D. (2024). Implications of Artificial Intelligence for Teaching and Learning. *Acta Pedagogica Asiana*, 3(2), 65–79. <https://doi.org/10.53623/apga.v3i2.404>
- ugli, A. I. Q. (2026). THE IMPACT OF ARTIFICIAL INTELLIGENCE USE IN THE EDUCATIONAL PROCESS ON THE PSYCHOLOGICAL STABILITY AND PROFESSIONAL IDENTITY OF THE EDUCATOR [Data set]. In *Zenodo (CERN*

- European Organization for Nuclear Research). European Organization for Nuclear Research. <https://doi.org/10.5281/zenodo.18460343>
- Uzorka, A., & Odebiyi, O. A. (2025). Impact of Digital Learning Tools on Student Engagement and Achievement. *JOURNAL OF DIGITAL LEARNING AND DISTANCE EDUCATION*, 4(1), 1436–1445. <https://doi.org/10.56778/jdlde.v4i1.511>
- Uzorka, A., & Olaniyan, A. O. (2025). Exploring Innovative Teaching Methods and Technologies in Ugandan Classrooms. *Journal of Research in Education and Pedagogy*, 2(2), 177–186. <https://doi.org/10.70232/jrep.v2i2.43>
- Valenzuela, J. S. de. (2025). Digital whiteboards: engaging with active learning. *ELT Journal*. <https://doi.org/10.1093/elt/ccae067>
- VanLehn, K. (2011). The Relative Effectiveness of Human Tutoring, Intelligent Tutoring Systems, and Other Tutoring Systems. *Educational Psychologist*, 46(4), 197–221. <https://doi.org/10.1080/00461520.2011.611369>
- Vemuru, S. (2025). ARTIFICIAL INTELLIGENCE-DRIVEN ADAPTIVE TESTING: A PSYCHOMETRIC APPROACH TO PERSONALIZED LEARNING IN COMPUTER SCIENCE EDUCATION. *International Journal of Applied Mathematics*, 38, 260–272. <https://doi.org/10.12732/ijam.v38i9s.779>
- Walter, Y. (2024). Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education. *International Journal of Educational Technology in Higher Education*, 21(1). <https://doi.org/10.1186/s41239-024-00448-3>
- Waninga, W., Atabo, H., Olinga, J. P., Ajuko, S., Musundi, B., Okoche, B., & Nambogwe, E. (2025). Enhancing Learner Engagement through Artificial Intelligence Integration in Ugandan Rural Primary Schools' Science Classroom Instructional Practices. *Journal of Education and Practice*, 9(5), 63–85. <https://doi.org/10.47941/jep.3081>
- Weber, F., Wambsganß, T., & Söllner, M. (2024). Enhancing legal writing skills: The impact of formative feedback in a hybrid intelligence learning environment. *British Journal of Educational Technology*, 56(2), 650–677. <https://doi.org/10.1111/bjet.13529>
- Zaharuddin, Chen, Y., & Yao, G. (2024). Enhancing Student Engagement with AI-Driven Personalized Learning Systems. *International Transactions on Education Technology (ITEE)*, 3(1), 1–8. <https://doi.org/10.33050/itee.v3i1.662>
- Zohuri, B. (2024). Revolutionizing Education: The Dynamic Synergy of Personalized Learning and Artificial Intelligence. *International Journal of Advanced Engineering and Management Research*, 9(1), 143–153. <https://doi.org/10.51505/ijaemr.2024.9111>