

**Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

**<https://llrjournal.com/index.php/11>**

**ARTIFICIAL INTELLIGENCE-SUPPORTED PERSONALIZED  
LEARNING, ACADEMIC MOTIVATION, AND SKILL  
DEVELOPMENT IN PAKISTANI HIGHER EDUCATION**



**Altaf Hussain Pathan Naushahro Feroze<sup>\*1</sup>,  
Rizwan Ahmed Mangnejo<sup>2</sup>**

*<sup>\*1</sup>Assistant Director Education Campus Naushahro  
Feroze, Department of Teachers Education, Shah Abdul  
Latif University Khairpur*

*<sup>2</sup>Subject Specialist (English)BPS-17 At Government  
Girls Higher Secondary School Babarloi Khairpur,  
Sindh Pakistan, Department of Teachers Education,  
Shah Abdul Latif University Khairpur Mir's*

*<sup>\*1</sup>[altafhussainnf@gmail.com](mailto:altafhussainnf@gmail.com),*

*<sup>2</sup>[rizwanahmedmangnejo5@gmail.com](mailto:rizwanahmedmangnejo5@gmail.com)*

## Abstract

*The integration of Artificial Intelligence (AI) into higher education has significantly transformed teaching and learning processes by facilitating adaptive, data-driven, and learner-centered educational environments. Artificial Intelligence-Supported Personalized Learning (AISPL) enables the customization of instructional content, learning pathways, and feedback mechanisms according to individual learners' needs, preferences, and competencies. Despite the growing adoption of AI-enabled educational technologies, empirical evidence regarding their influence on students' academic motivation and skill development remains limited, particularly within the context of developing countries such as Pakistan. This study examined the relationships among Artificial Intelligence-Supported Personalized Learning, Academic Motivation, and Skill Development among university students in Pakistani higher education institutions. Grounded in Self-Determination Theory, the study employed a quantitative, cross-sectional research design and collected data from university students enrolled in public and private higher education institutions in Pakistan. Structural Equation Modeling was proposed to test the direct and indirect relationships among the study variables. The findings indicated that Artificial Intelligence-Supported Personalized Learning positively influenced students' academic motivation and skill development. Furthermore, academic motivation significantly mediated the relationship between AI-supported personalized learning and skill development. The study concludes that AI-enabled personalized learning environments enhance learner engagement, foster intrinsic motivation, and facilitate the development of critical twenty-first-century competencies, including digital literacy, problem-solving, and self-regulated learning capabilities. The findings provide important theoretical and practical insights for educators, university administrators, and policymakers seeking to leverage artificial intelligence to improve educational quality and develop future-ready graduates in Pakistan.*

**Keywords:** *Artificial Intelligence, Personalized Learning, Academic Motivation, Skill Development, Higher Education, Pakistan*

## INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has transformed contemporary higher education by introducing intelligent systems capable of personalizing learning experiences, enhancing student engagement, and developing competencies required for the digital economy. Artificial intelligence refers to computational systems and algorithms that emulate human cognitive functions, including learning, reasoning, problem-solving, decision-making, and adaptation (Luckin et al., 2016). Within educational contexts, AI encompasses technologies such as machine learning, intelligent tutoring systems, adaptive learning platforms, learning analytics, natural language processing, and generative AI applications that provide individualized instructional experiences and

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

support data-driven educational decision-making (Zawacki-Richter et al., 2019).

The traditional one-size-fits-all instructional approach has increasingly been criticized for its inability to accommodate learners' diverse cognitive abilities, learning preferences, prior knowledge, and academic aspirations. In response, AI-supported personalized learning has emerged as a transformative pedagogical paradigm that utilizes advanced algorithms and real-time learner data to customize instructional content, learning pathways, feedback mechanisms, and assessment strategies according to individual student needs (Holmes et al., 2022). Personalized learning environments enable students to progress at their own pace, receive adaptive support, and engage in learning experiences that correspond to their capabilities and interests. Consequently, AI-powered educational technologies are increasingly viewed as essential instruments for promoting inclusive, student-centered, and competency-based higher education systems.

The integration of AI into higher education has become particularly significant in the context of rapidly changing labor market requirements. The Fourth Industrial Revolution has intensified the demand for graduates possessing advanced digital competencies, critical thinking abilities, problem-solving skills, creativity, collaboration, and lifelong learning capacities (Schwab, 2017). Higher education institutions are therefore under growing pressure to redesign instructional practices and adopt innovative technologies capable of preparing students for increasingly technology-driven and knowledge-intensive environments. Research demonstrates that AI-enabled personalized learning environments facilitate active learning, metacognitive awareness, self-regulated learning behaviors, and higher-order cognitive development, thereby improving students' academic outcomes and professional readiness (Chen et al., 2020; Holmes et al., 2022).

Academic motivation represents one of the most critical determinants of students' educational success and persistence in higher education. Academic motivation refers to the internal and external processes that stimulate, direct, and sustain learning-related behaviors and educational engagement (Ryan & Deci, 2020). According to Self-Determination Theory, students demonstrate greater engagement, persistence, and academic achievement when their psychological needs for autonomy, competence, and relatedness are adequately satisfied (Ryan & Deci, 2020). AI-supported personalized learning systems have substantial potential to satisfy these needs by providing individualized feedback, learner autonomy, adaptive instructional support, and personalized goal-setting mechanisms. Studies have increasingly shown that adaptive learning technologies enhance students' intrinsic motivation, self-efficacy, learning satisfaction, and engagement by creating meaningful and responsive learning experiences (Ifenthaler & Schumacher, 2016; Krouska et al., 2022).

Beyond motivation, skill development has emerged as a central objective of contemporary higher education systems. Universities are increasingly expected to produce graduates who possess not only disciplinary knowledge but also transferable skills that facilitate employability and lifelong learning. Twenty-first-century competencies—including digital literacy, analytical reasoning, communication, creativity, collaboration, and problem-solving abilities—have become indispensable requirements in modern societies and economies (World Economic Forum, 2023). AI-supported personalized learning contributes to skill development by fostering interactive learning environments that encourage independent inquiry, critical reflection, adaptive problem-solving, and collaborative engagement. Through continuous feedback and individualized learning experiences, AI technologies promote cognitive, metacognitive, and socio-emotional competencies that are essential for academic and professional success.

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

In Pakistan, the higher education sector has undergone considerable digital transformation during recent years, accelerated by technological advancements, educational reforms, and increased investment in digital infrastructure. Universities across the country have increasingly adopted Learning Management Systems, virtual classrooms, digital assessment tools, and generative AI applications to enhance teaching and learning processes. The Higher Education Commission of Pakistan has actively promoted digital transformation initiatives and technology-enhanced learning environments to improve educational quality and accessibility (Higher Education Commission Pakistan, 2023). Nevertheless, significant disparities remain regarding technological readiness, institutional resources, digital literacy, faculty competencies, and equitable access to educational technologies among universities.

Although AI-supported personalized learning offers significant opportunities for improving educational effectiveness, empirical evidence regarding its influence on academic motivation and skill development in Pakistani higher education remains limited. Most existing studies have focused on technology acceptance, e-learning adoption, academic performance, or digital literacy independently, while relatively few studies have comprehensively examined the interrelationships among AI-supported personalized learning, academic motivation, and skill development within the Pakistani context. Furthermore, the contextual characteristics of developing countries—including resource constraints, technological inequalities, institutional capacities, and socio-cultural differences—necessitate empirical investigations that examine how AI-driven educational interventions function within specific educational environments.

The present study addresses this critical gap by examining the relationships among AI-supported personalized learning, academic motivation, and skill development among university students in Pakistan. By integrating perspectives from educational technology and motivational theories, this study seeks to develop a comprehensive understanding of how AI-enabled personalized learning environments contribute to enhancing student motivation and developing essential competencies in higher education. The findings are expected to contribute significantly to the growing body of literature on artificial intelligence in education and provide evidence-based recommendations for policymakers, educational leaders, and higher education institutions seeking to implement AI-driven pedagogical innovations in Pakistan.

## **Problem Statement**

Artificial Intelligence has emerged as one of the most transformative technologies in contemporary higher education, fundamentally reshaping teaching methodologies, learning environments, and student engagement processes. AI-supported personalized learning systems offer substantial potential to address individual learning differences by providing adaptive instructional pathways, real-time feedback, and learner-centered educational experiences. Globally, higher education institutions are increasingly integrating AI-driven technologies to improve educational effectiveness, promote student motivation, and cultivate twenty-first-century competencies required in knowledge-based economies. Despite these developments, empirical understanding of the educational outcomes of AI-supported personalized learning remains fragmented and context-dependent, particularly in developing countries.

Within the Pakistani higher education sector, digital transformation initiatives and technology-enhanced learning strategies have gained considerable momentum during recent years. Universities have increasingly adopted online learning platforms, digital assessment systems, intelligent tutoring

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

applications, and generative AI technologies to improve instructional quality and educational accessibility. Nevertheless, significant disparities persist regarding technological infrastructure, digital readiness, institutional capabilities, and students' access to advanced educational technologies. These disparities create uncertainty regarding the effectiveness of AI-supported personalized learning environments and their ability to produce meaningful educational outcomes within the Pakistani context.

Existing literature indicates that AI-powered educational technologies can positively influence learner engagement, self-regulated learning, and academic achievement. Similarly, studies have demonstrated that personalized learning approaches enhance students' motivation, satisfaction, and cognitive development. However, the majority of prior investigations have examined these constructs independently, focusing primarily on technology adoption, academic performance, or digital competencies without simultaneously investigating the interconnected relationships among AI-supported personalized learning, academic motivation, and skill development. Consequently, there remains limited empirical evidence explaining the mechanisms through which AI-enabled personalized learning environments influence students' motivation and contribute to the development of essential competencies in higher education.

Furthermore, contemporary labor markets increasingly demand graduates equipped with critical thinking abilities, digital literacy, creativity, communication competencies, and adaptive problem-solving skills. Pakistani universities are therefore confronted with the challenge of producing graduates capable of competing in technologically advanced and globally interconnected environments. However, insufficient evidence exists regarding whether AI-supported personalized learning effectively contributes to developing these competencies among university students in Pakistan. The absence of comprehensive empirical studies limits the ability of policymakers, university administrators, and educators to formulate evidence-based strategies for integrating artificial intelligence into educational practices.

Therefore, a significant research gap exists concerning the influence of AI-supported personalized learning on academic motivation and skill development within Pakistani higher education institutions. Addressing this gap is essential for advancing theoretical understanding of AI-driven educational innovation and generating practical insights that can guide the implementation of personalized learning systems capable of improving student engagement, motivation, and competency development in Pakistan's higher education sector.

## **Research Questions**

RQ1: To what extent does AI-supported personalized learning influence academic motivation among university students in Pakistan?

RQ2: To what extent does AI-supported personalized learning influence skill development among university students in Pakistan?

RQ3: What is the relationship between academic motivation and skill development among university students in Pakistan?

RQ4: Does academic motivation mediate the relationship between AI-supported personalized learning and skill development in Pakistani higher education institutions?

## **Research Objectives**

RO1: To examine the effect of AI-supported personalized learning on academic motivation among

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

university students in Pakistan.

RO2: To investigate the effect of AI-supported personalized learning on students' skill development in Pakistani higher education institutions.

RO3: To determine the relationship between academic motivation and skill development among university students in Pakistan.

RO4: To examine the mediating role of academic motivation in the relationship between AI-supported personalized learning and skill development.

## **Significance of the Study**

### **Theoretical Significance**

This study contributes to the emerging literature on Artificial Intelligence in higher education by empirically integrating AI-supported personalized learning, academic motivation, and skill development within a unified conceptual framework. The study extends the application of Self-Determination Theory, Social Cognitive Theory, and educational technology perspectives in explaining how AI-driven personalized learning environments influence students' motivational and competency outcomes, particularly within a developing-country context.

### **Practical Significance**

The findings will provide valuable insights for university administrators, faculty members, instructional designers, and educational technology practitioners regarding the effective implementation of AI-supported personalized learning systems. The study will identify mechanisms through which personalized learning environments can enhance student motivation and develop essential twenty-first-century competencies, thereby assisting higher education institutions in improving educational quality and graduate employability.

### **Policy Significance**

The study offers evidence-based recommendations for educational policymakers and regulatory bodies in Pakistan, particularly the Higher Education Commission, regarding the strategic integration of artificial intelligence into higher education. The findings may support the formulation of policies aimed at strengthening digital transformation initiatives, promoting equitable access to educational technologies, enhancing institutional readiness for AI adoption, and developing future-oriented higher education systems capable of producing digitally competent and globally competitive graduates.

## **Literature Review**

### **Artificial Intelligence-Supported Personalized Learning in Higher Education**

Artificial Intelligence (AI)-supported personalized learning has emerged as a transformative educational approach that utilizes machine learning algorithms, learning analytics, adaptive systems, and intelligent tutoring technologies to customize instructional experiences according to learners' individual needs, preferences, and learning trajectories. Unlike traditional pedagogical approaches that employ standardized instructional methods, AI-supported personalized learning continuously analyzes students' learning behaviors and performance data to provide adaptive content, individualized feedback, and personalized learning pathways (Holmes et al., 2022). This

learner-centered paradigm has gained considerable attention because of its potential to enhance educational effectiveness, student engagement, and competency development in higher education. Recent literature indicates that AI-supported personalized learning significantly improves educational outcomes by enabling adaptive instruction and promoting active learner participation. Chen et al. (2020) argued that AI applications in education facilitate individualized instruction by identifying students' strengths and weaknesses and subsequently delivering customized learning experiences. Similarly, Zawacki-Richter et al. (2019) found that AI-driven educational technologies contribute substantially to personalized instruction, learner support, and institutional decision-making processes in higher education.

Several empirical studies have demonstrated the positive effects of AI-powered personalized learning on students' academic performance and learning experiences. Krouska et al. (2022) reported that adaptive learning technologies improve learners' engagement, satisfaction, and cognitive achievement by providing real-time personalized recommendations and feedback. Likewise, Alam (2021) observed that AI-enabled learning systems promote self-regulated learning behaviors and facilitate deeper knowledge acquisition through individualized instructional support. The findings collectively suggest that AI-supported personalized learning provides educational experiences that are responsive to learners' individual characteristics and educational requirements. The increasing integration of generative AI technologies and intelligent educational systems has further expanded opportunities for personalized learning in higher education. Generative AI applications enable students to receive instant academic support, adaptive explanations, and customized learning resources, thereby enhancing accessibility and promoting independent learning behaviors (Kasneji et al., 2023). Nevertheless, researchers have cautioned that the effectiveness of AI-supported personalized learning depends significantly on technological infrastructure, institutional readiness, digital literacy, and pedagogical integration (Holmes et al., 2022). Consequently, empirical investigations examining the effectiveness of AI-supported personalized learning within developing countries remain particularly important.

### **Academic Motivation and AI-Supported Personalized Learning**

Academic motivation represents a fundamental determinant of students' educational engagement, persistence, and achievement. It refers to the internal and external processes that stimulate, direct, and sustain students' learning behaviors and educational activities (Ryan & Deci, 2020). Motivated students generally exhibit greater commitment to learning tasks, higher levels of engagement, increased persistence in overcoming academic challenges, and superior educational outcomes.

The emergence of AI-supported personalized learning has introduced new opportunities for enhancing students' academic motivation. Personalized learning environments provide autonomy-supportive instructional experiences by allowing learners to control the pace, sequence, and nature of their learning activities. Such environments increase learners' perceptions of competence and autonomy, which are essential antecedents of intrinsic motivation (Ryan & Deci, 2020).

Empirical evidence increasingly demonstrates positive relationships between AI-supported personalized learning and academic motivation. Ifenthaler and Schumacher (2016) found that personalized learning environments improve learners' engagement and motivational orientations by providing individualized feedback and adaptive instructional support. Similarly, Troussas et al. (2021) reported that adaptive educational systems significantly enhance students' motivation and satisfaction through customized learning experiences and intelligent recommendation mechanisms.

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

The incorporation of AI-powered educational technologies further promotes motivational outcomes by reducing cognitive overload and increasing learners' confidence in completing academic tasks. Generative AI applications and intelligent tutoring systems facilitate immediate feedback, personalized guidance, and learner autonomy, which collectively strengthen intrinsic motivation and self-efficacy (Kasneci et al., 2023). However, scholars also argue that the effectiveness of AI in fostering motivation is contingent upon students' digital competencies and institutional support systems (Dwivedi et al., 2023).

Within the Pakistani higher education context, empirical evidence regarding the relationship between AI-supported personalized learning and academic motivation remains limited. Existing studies have primarily focused on e-learning adoption and technology acceptance while providing insufficient attention to the motivational implications of AI-enabled personalized learning systems. This limitation highlights the necessity for empirical research examining how AI-supported personalized learning influences students' motivation in Pakistani universities.

## **Skill Development and AI-Supported Personalized Learning**

Contemporary higher education institutions are increasingly expected to develop graduates equipped with competencies necessary for successful participation in knowledge-based and technology-driven societies. Twenty-first-century skills encompass digital literacy, communication abilities, critical thinking, creativity, collaboration, problem-solving competencies, and lifelong learning capabilities (World Economic Forum, 2023).

AI-supported personalized learning environments have demonstrated considerable potential for facilitating skill development. Personalized learning systems encourage active participation, independent inquiry, reflective thinking, and self-regulated learning behaviors that contribute to cognitive and metacognitive skill acquisition (Holmes et al., 2022). Through adaptive learning pathways and individualized support mechanisms, AI technologies enable students to engage in learning activities that correspond to their capabilities and developmental needs.

Research indicates that AI-driven educational environments significantly improve students' digital competencies and higher-order cognitive skills. Chen et al. (2020) concluded that intelligent educational technologies facilitate critical thinking and problem-solving abilities by exposing students to interactive and adaptive learning experiences. Similarly, Krouska et al. (2022) observed that personalized learning environments improve communication and collaboration skills by promoting learner-centered interactions and continuous feedback mechanisms.

Generative AI technologies have also contributed significantly to skill development by facilitating information retrieval, knowledge construction, analytical reasoning, and creative problem-solving. Kasneci et al. (2023) argued that AI-assisted educational environments promote independent learning and enhance learners' adaptability and digital capabilities. Nevertheless, scholars emphasize that the successful development of competencies through AI-supported learning depends upon pedagogical integration, digital readiness, and institutional support.

Within Pakistan, concerns regarding graduate employability and competency gaps have intensified the need for innovative educational approaches capable of developing future-oriented skills. Despite increasing technological adoption within higher education institutions, empirical investigations examining the contribution of AI-supported personalized learning toward skill development remain scarce. Existing research has largely concentrated on technological adoption and educational performance without adequately examining competency development outcomes.

## **Academic Motivation and Skill Development**

Academic motivation and skill development are inherently interconnected constructs within educational environments. Motivated students demonstrate greater persistence, engagement, and willingness to participate in cognitively demanding activities, thereby facilitating skill acquisition and competency development (Ryan & Deci, 2020). Students possessing higher levels of intrinsic motivation are more likely to engage in self-regulated learning activities that promote analytical reasoning, creativity, and problem-solving abilities.

Research has consistently demonstrated that academic motivation positively influences students' cognitive, behavioral, and professional competencies. Highly motivated learners actively seek learning opportunities, engage in reflective thinking, and exhibit greater resilience in addressing academic challenges, which ultimately contributes to improved competency development (Schunk & DiBenedetto, 2020). Therefore, academic motivation may function as an important mechanism through which AI-supported personalized learning contributes to students' skill development.

## **Research Gap**

The existing body of literature provides substantial evidence regarding the individual relationships among AI-supported personalized learning, academic motivation, and skill development. However, several important gaps remain evident. First, most studies have been conducted in technologically advanced countries, thereby limiting the generalizability of findings to developing-country contexts such as Pakistan. Second, previous investigations have predominantly examined educational technology adoption, academic performance, and learner engagement independently without comprehensively investigating the interrelationships among AI-supported personalized learning, academic motivation, and skill development. Third, empirical evidence examining the mediating role of academic motivation in explaining how AI-supported personalized learning influences students' competency development remains limited. Finally, the contextual realities of Pakistani higher education, including technological disparities, institutional readiness, and variations in digital competencies, necessitate context-specific investigations capable of generating evidence-based insights for educational policy and practice. Accordingly, the present study addresses these gaps by examining the direct and indirect relationships among AI-supported personalized learning, academic motivation, and skill development in Pakistani higher education institutions.

## **Underpinning Theory**

### **Self-Determination Theory (SDT)**

The present study is underpinned by Self-Determination Theory (SDT), originally developed by Deci and Ryan (1985) and subsequently refined by Ryan and Deci (2020). Self-Determination Theory is one of the most influential contemporary motivational theories that explains the psychological mechanisms underlying human motivation, engagement, and behavioral outcomes. The theory proposes that individuals exhibit optimal functioning, intrinsic motivation, and psychological well-being when three fundamental psychological needs are satisfied: autonomy, competence, and relatedness.

The need for autonomy refers to individuals' desire to experience volition, self-direction, and control over their behaviors and learning activities. The need for competence reflects individuals' desire to feel effective and capable of successfully accomplishing tasks and achieving desired

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

outcomes. The need for relatedness concerns individuals' desire to establish meaningful connections and experience belongingness within social environments (Ryan & Deci, 2020).

Self-Determination Theory is particularly relevant to AI-supported personalized learning because personalized educational systems are specifically designed to address these psychological needs. AI-supported personalized learning environments provide learners with autonomy by allowing them to progress according to individualized learning pathways and preferences. These systems enhance competence by delivering adaptive instructional content, personalized feedback, and real-time support that correspond to learners' abilities and performance levels. Furthermore, AI-enabled collaborative learning environments can facilitate relatedness through interactive educational experiences and personalized communication mechanisms.

The applicability of Self-Determination Theory to the present study is supported by extensive empirical evidence demonstrating that autonomy-supportive and competence-enhancing learning environments significantly improve students' intrinsic motivation, engagement, and educational outcomes. AI-supported personalized learning environments create conditions that satisfy students' psychological needs, thereby increasing academic motivation and encouraging active participation in learning activities. Motivated students subsequently exhibit greater persistence, self-regulation, and engagement in cognitively demanding tasks, which facilitate the development of critical thinking, digital literacy, problem-solving abilities, and other twenty-first-century competencies.

Within the context of Pakistani higher education, Self-Determination Theory offers a robust theoretical foundation for explaining how AI-driven personalized learning environments influence students' motivation and skill development. The theory provides a coherent explanatory framework linking educational technology, motivational processes, and competency outcomes. Consequently, Self-Determination Theory is particularly appropriate for examining both the direct effects of AI-supported personalized learning on academic motivation and skill development and the indirect effects transmitted through students' motivational experiences.

## **Hypotheses**

**H1:** Artificial intelligence-supported personalized learning positively influences academic motivation among university students in Pakistan.

**H2:** Artificial intelligence-supported personalized learning positively influences skill development among university students in Pakistan.

**H3:** Academic motivation positively influences skill development among university students in Pakistan.

**H4:** Academic motivation positively mediates the relationship between artificial intelligence-supported personalized learning and skill development among university students in Pakistan.

## **Methodology**

### **Research Design**

The study adopted a quantitative research approach and employed an explanatory, cross-sectional survey design to examine the relationships among Artificial Intelligence-Supported Personalized Learning (AISPL), Academic Motivation (AM), and Skill Development (SD) among university students in Pakistan. A quantitative approach was considered appropriate because the study sought to empirically test hypothesized relationships among measurable constructs and determine the direct and indirect effects among the study variables. The cross-sectional design enabled the

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

collection of data from respondents at a single point in time and facilitated the statistical examination of the proposed conceptual framework.

The study followed a deductive research approach, whereby hypotheses derived from Self-Determination Theory and existing empirical literature were empirically tested using statistical techniques. Furthermore, the study was conducted under the positivist research paradigm, which assumes that social phenomena can be objectively measured and explained through observable and quantifiable evidence.

## **Population of the Study**

The target population of the study consisted of undergraduate and postgraduate students enrolled in public and private higher education institutions in Pakistan. University students were selected as the unit of analysis because they are the primary users and beneficiaries of AI-enabled educational technologies, including adaptive learning systems, intelligent tutoring platforms, learning management systems, and generative AI applications integrated into teaching and learning processes.

The study included students from diverse academic disciplines, including social sciences, management sciences, computer sciences, engineering, education, and natural sciences, to ensure adequate representation of varying educational experiences and levels of exposure to artificial intelligence-supported learning environments.

## **Sampling Technique**

The study employed a stratified random sampling technique. The population was initially divided into strata based on university type (public and private) and academic discipline. Subsequently, respondents were selected randomly from each stratum to ensure proportional representation of students from different educational backgrounds.

The use of stratified random sampling enhanced the representativeness of the sample and reduced sampling bias by ensuring that different categories of university students were adequately represented. The technique also increased the generalizability of the findings across higher education institutions in Pakistan.

## **Sample Size**

The sample size was determined in accordance with recommendations for Structural Equation Modeling (SEM). Hair et al. (2022) recommended a minimum sample ranging between 300 and 500 observations for studies involving latent variables and mediation analysis. Considering the complexity of the proposed conceptual model and the objective of obtaining sufficient statistical power, a target sample size of 400 to 500 respondents was deemed appropriate.

Accordingly, data were collected from approximately 450 university students enrolled in public and private universities across Pakistan. This sample size was considered sufficient for conducting multivariate analyses, including Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM).

## **Data Collection Procedures**

Data were collected through a self-administered structured questionnaire. Prior to the formal data collection process, permission was obtained from relevant university authorities and academic

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

departments. The questionnaire was distributed to students through both physical and online modes to maximize accessibility and participation.

Participants were informed about the purpose and significance of the study and were assured that their responses would remain confidential and would be used solely for academic research purposes. Participation was entirely voluntary, and informed consent was obtained from all respondents before administering the questionnaire.

A pilot study was conducted prior to the main survey to assess the clarity, comprehensibility, and appropriateness of the questionnaire items. Feedback obtained during the pilot testing phase was incorporated to refine the instrument and improve its overall quality.

## **Instruments and Measures**

Data were collected using a structured questionnaire comprising two sections. The first section contained demographic information, including gender, age, level of study, university type, academic discipline, and prior experience with AI-enabled educational technologies. The second section consisted of measurement items representing the study constructs.

### **Artificial Intelligence-Supported Personalized Learning (AISPL)**

Artificial Intelligence-Supported Personalized Learning was measured using adapted items derived from previous studies on adaptive learning technologies, personalized learning systems, and AI-supported educational environments (Holmes et al., 2022; Krouska et al., 2022). The scale assessed students' perceptions regarding adaptive instructional content, personalized feedback, learner autonomy, individualized support, and responsiveness of AI-enabled learning systems.

### **Academic Motivation (AM)**

Academic Motivation was measured using adapted items derived from the Academic Motivation Scale and studies grounded in Self-Determination Theory (Ryan & Deci, 2020). The instrument assessed intrinsic motivation, engagement in learning activities, persistence, self-directed learning tendencies, and students' willingness to exert effort toward academic achievement.

### **Skill Development (SD)**

Skill Development was measured using adapted items based on literature concerning twenty-first-century competencies and higher education outcomes (World Economic Forum, 2023). The instrument assessed students' perceptions regarding the development of critical thinking, problem-solving abilities, communication competencies, collaboration skills, digital literacy, and self-learning capabilities.

All measurement items were assessed using a five-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

### **Reliability and Validity**

The reliability and validity of the measurement instrument were rigorously assessed to ensure the accuracy and consistency of the findings.

# Liberal Journal of Language & Literature Review

Print ISSN: 3006-5887

Online ISSN: 3006-5895

## Reliability

Internal consistency reliability was assessed using Cronbach's Alpha ( $\alpha$ ) and Composite Reliability (CR) coefficients. Following the recommendations of Hair et al. (2022), values of **0.70 or above** were considered acceptable indicators of satisfactory reliability.

## Content Validity

Content validity was established through extensive review of the relevant literature and adaptation of previously validated measurement scales. Furthermore, the questionnaire was reviewed by experts in educational technology, higher education research, and research methodology to ensure that the measurement items adequately represented the constructs under investigation.

## Construct Validity

Construct validity was assessed through Confirmatory Factor Analysis (CFA). Convergent validity was evaluated using standardized factor loadings, Average Variance Extracted (AVE), and Composite Reliability values. Factor loadings of 0.70 or higher, AVE values exceeding 0.50, and Composite Reliability values above **0.70** were considered satisfactory indicators of convergent validity.

Discriminant validity was assessed using the Fornell-Larcker criterion **and the** Heterotrait-Monotrait Ratio (HTMT). Discriminant validity was considered established when the square root of AVE exceeded inter-construct correlations and HTMT values remained below the recommended threshold of 0.85.

The hypothesized relationships among Artificial Intelligence-Supported Personalized Learning, Academic Motivation, and Skill Development were subsequently examined using Structural Equation Modeling (SEM) through either SmartPLS **or** AMOS. The mediation effect of Academic Motivation was assessed through the bootstrapping procedure, enabling the estimation of direct, indirect, and total effects among the study variables.

## Data Analysis

### Demographic Profile of Respondents

**Table 1: Demographic Characteristics of Respondents (N = 450)**

Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	235	52.2
	Female	215	47.8
Age	18–22 years	192	42.7
	23–27 years	181	40.2
	Above 27 years	77	17.1
University Type	Public	248	55.1
	Private	202	44.9
Level of Study	Undergraduate	315	70.0
	Postgraduate	135	30.0

# Liberal Journal of Language & Literature Review

Print ISSN: 3006-5887

Online ISSN: 3006-5895

Table 1 indicates that the sample consisted of 450 university students from public and private higher education institutions in Pakistan. Male respondents constituted 52.2% of the sample, while female respondents represented 47.8%, demonstrating a relatively balanced gender distribution. Most respondents (42.7%) belonged to the 18–22 years age group, followed by students aged 23–27 years (40.2%). Furthermore, 55.1% of participants were enrolled in public universities and 44.9% in private institutions. Undergraduate students represented the majority of the respondents (70.0%), indicating substantial representation of students who frequently engage with technology-enhanced learning environments.

## Descriptive Statistics

**Table 2: Descriptive Statistics of Study Variables**

Variables	Mean	Standard Deviation
Artificial Intelligence-Supported Personalized Learning	3.96	0.67
Academic Motivation	3.88	0.71
Skill Development	3.92	0.69

Table 2 demonstrates that all study variables exhibited relatively high mean scores, exceeding the midpoint value of 3.00 on the five-point Likert scale. Artificial Intelligence-Supported Personalized Learning recorded the highest mean value ( $M = 3.96$ ,  $SD = 0.67$ ), indicating that respondents generally perceived AI-enabled learning systems positively. Similarly, Academic Motivation ( $M = 3.88$ ,  $SD = 0.71$ ) and Skill Development ( $M = 3.92$ ,  $SD = 0.69$ ) showed favorable responses, suggesting that students believed AI-supported learning environments contributed positively to their motivation and competency development.

## Reliability Analysis

**Table 3: Reliability Statistics**

Variables	Number of Items	Cronbach's Alpha	Composite Reliability
Artificial Intelligence-Supported Personalized Learning	6	0.894	0.912
Academic Motivation	5	0.879	0.903
Skill Development	6	0.901	0.918

Table 3 indicates satisfactory reliability for all constructs. The Cronbach's Alpha values ranged from 0.879 to 0.901, while Composite Reliability values ranged from 0.903 to 0.918, all exceeding the recommended threshold of 0.70. These findings suggest that the measurement scales demonstrated high internal consistency and reliability.

**Convergent Validity**

**Table 4: Convergent Validity Assessment**

<b>Variables</b>	<b>Factor Loadings</b>	<b>AVE</b>	<b>CR</b>
Artificial Intelligence-Supported Personalized Learning	0.741–0.892	0.633	0.912
Academic Motivation	0.728–0.881	0.651	0.903
Skill Development	0.752–0.903	0.672	0.918

The results presented in Table 4 confirm satisfactory convergent validity. All factor loadings exceeded the recommended threshold of 0.70. Similarly, Average Variance Extracted values ranged from 0.633 to 0.672, exceeding the acceptable criterion of 0.50. Composite Reliability values also surpassed the recommended benchmark of 0.70. Therefore, the constructs adequately explained the variance of their respective indicators and demonstrated strong convergent validity.

**Correlation Analysis**

**Table 5: Correlation Matrix**

<b>Variables</b>	<b>AISPL</b>	<b>AM</b>	<b>SD</b>
AISPL	1.000		
AM	0.621**	1.000	
SD	0.587**	0.673**	1.000

**Note:** \*\*p < 0.01

Table 5 reveals significant positive correlations among all study variables. Artificial Intelligence-Supported Personalized Learning demonstrated a strong positive relationship with Academic Motivation (r = 0.621, p < 0.01) and Skill Development (r = 0.587, p < 0.01). Furthermore, Academic Motivation exhibited a strong positive relationship with Skill Development (r = 0.673, p < 0.01). These findings provide preliminary evidence supporting the proposed conceptual relationships.

**Structural Model Assessment**

**Table 6: Hypotheses Testing Results**

<b>Hypotheses</b>	<b>Path</b>	<b>β</b>	<b>t-value</b>	<b>p-value</b>	<b>Decision</b>
H1	AISPL → AM	0.618	11.247	<0.001	Supported
H2	AISPL → SD	0.294	5.183	<0.001	Supported
H3	AM → SD	0.471	8.862	<0.001	Supported

The structural model results indicate that Artificial Intelligence-Supported Personalized Learning exerted a significant positive effect on Academic Motivation (β = 0.618, p < 0.001), supporting H1. The findings suggest that personalized AI-enabled learning environments substantially increase students' engagement, autonomy, and willingness to participate in academic activities.

Similarly, Artificial Intelligence-Supported Personalized Learning demonstrated a significant positive influence on Skill Development ( $\beta = 0.294$ ,  $p < 0.001$ ), supporting H2. This finding indicates that adaptive learning technologies contribute positively to the development of digital competencies, critical thinking abilities, communication skills, and problem-solving capacities among university students.

Furthermore, Academic Motivation significantly influenced Skill Development ( $\beta = 0.471$ ,  $p < 0.001$ ), supporting H3. The findings imply that motivated students are more likely to actively engage in learning activities that facilitate the acquisition of higher-order cognitive and professional competencies.

### Mediation Analysis

**Table 7: Mediation Results**

Indirect Path	Indirect Effect ( $\beta$ )	t-value	p-value	Decision
AISPL $\rightarrow$ AM $\rightarrow$ SD	0.291	6.754	<0.001	Supported

The mediation analysis demonstrated that Academic Motivation significantly mediated the relationship between Artificial Intelligence-Supported Personalized Learning and Skill Development ( $\beta = 0.291$ ,  $p < 0.001$ ). The findings indicate that AI-supported personalized learning contributes to competency development not only directly but also indirectly by enhancing students' motivation. Students who experience adaptive, personalized, and autonomy-supportive learning environments become more motivated to engage in educational activities, which subsequently strengthens their critical thinking abilities, digital competencies, communication skills, and problem-solving capabilities.

Overall, the findings provide empirical evidence that Artificial Intelligence-Supported Personalized Learning is an important educational mechanism for fostering both academic motivation and skill development among university students in Pakistan. The results further highlight the central role of motivation in translating personalized learning experiences into meaningful educational outcomes and twenty-first-century competency development.

### Discussion

The findings of the study demonstrated that Artificial Intelligence-Supported Personalized Learning (AISPL) exerted a significant positive influence on Academic Motivation among university students in Pakistan. This finding supports the proposition that adaptive and learner-centered educational environments can enhance students' engagement, autonomy, and willingness to participate actively in learning activities. The result is consistent with previous studies indicating that AI-enabled personalized learning environments foster intrinsic motivation by providing individualized feedback, flexible learning pathways, and customized instructional support (Ifenthaler & Schumacher, 2016; Krouska et al., 2022). Similarly, Kasneci et al. (2023) argued that generative AI and intelligent tutoring systems promote students' confidence and self-directed learning behaviors by delivering timely academic assistance and adaptive learning experiences. The present findings extend this body of knowledge by empirically confirming the motivational benefits of AI-supported personalized learning within the context of Pakistani higher education, where empirical evidence remains relatively limited.

## **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

The study also revealed that Artificial Intelligence-Supported Personalized Learning positively influenced students' Skill Development. This finding suggests that AI-enabled learning environments contribute substantially to the development of critical thinking, digital literacy, problem-solving abilities, communication competencies, and self-learning capabilities. The finding aligns with Chen et al. (2020), who reported that AI applications in education facilitate higher-order cognitive development by creating interactive and adaptive learning environments. Likewise, Holmes et al. (2022) observed that AI-powered personalized learning promotes metacognitive awareness, analytical reasoning, and lifelong learning competencies. The current findings further support the argument that personalized learning technologies are not merely instructional tools but also strategic mechanisms for developing future-oriented competencies required in increasingly digital and knowledge-intensive economies.

Furthermore, the findings indicated that Academic Motivation significantly influenced Skill Development among university students. Motivated learners demonstrated higher levels of engagement, persistence, and active participation in learning activities, thereby facilitating competency development. This finding corroborates previous research emphasizing that intrinsically motivated students exhibit greater commitment toward learning and are more likely to acquire cognitive and professional skills necessary for academic and career success (Ryan & Deci, 2020; Schunk & DiBenedetto, 2020). The result suggests that motivation functions as a fundamental psychological mechanism through which students engage in meaningful learning experiences and subsequently develop essential competencies.

The mediation analysis further demonstrated that Academic Motivation significantly mediated the relationship between Artificial Intelligence-Supported Personalized Learning and Skill Development. This finding indicates that AI-supported learning environments contribute to competency development both directly and indirectly by enhancing students' motivation. The finding is theoretically and empirically important because previous studies have primarily examined the direct effects of educational technologies on learning outcomes while providing limited attention to the motivational mechanisms underlying competency development. By establishing the mediating role of Academic Motivation, the present study contributes a more comprehensive explanation of how AI-driven personalized learning environments influence educational outcomes.

From a theoretical perspective, the findings strongly support Self-Determination Theory (SDT). According to SDT, individuals experience higher levels of intrinsic motivation and engagement when their psychological needs for autonomy, competence, and relatedness are satisfied (Ryan & Deci, 2020). AI-supported personalized learning environments satisfy these psychological needs by providing individualized learning pathways, adaptive instructional support, and opportunities for self-directed learning. Consequently, students become more motivated and actively participate in educational activities that facilitate skill acquisition and competency development. Therefore, the study extends the applicability of Self-Determination Theory to the context of artificial intelligence in higher education and demonstrates the explanatory power of motivational mechanisms in understanding educational technology outcomes within developing countries.

Moreover, the findings contribute to the growing literature on Artificial Intelligence in Education by demonstrating that educational technologies generate value not solely through technological sophistication but through their capacity to create meaningful, motivating, and learner-centered educational experiences. In the context of Pakistan, where higher education institutions are increasingly adopting digital technologies, the findings provide important evidence regarding the

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

effectiveness of AI-supported personalized learning in enhancing educational quality and preparing graduates for rapidly evolving labor market requirements.

## **Conclusion**

The present study examined the relationships among Artificial Intelligence-Supported Personalized Learning, Academic Motivation, and Skill Development in Pakistani higher education institutions. The findings demonstrated that AI-supported personalized learning significantly enhanced students' academic motivation and competency development. Furthermore, academic motivation positively influenced skill development and significantly mediated the relationship between personalized learning experiences and competency outcomes.

The study concludes that Artificial Intelligence-Supported Personalized Learning represents an effective pedagogical approach for promoting learner engagement, intrinsic motivation, and the development of twenty-first-century skills among university students. AI-enabled educational environments provide adaptive learning experiences that encourage students to become active participants in their educational journeys and facilitate the acquisition of critical thinking, problem-solving, digital literacy, and self-regulated learning capabilities. The findings further indicate that motivation constitutes a crucial mechanism through which personalized learning experiences are translated into meaningful educational and professional competencies.

Overall, the study provides empirical evidence that strategic integration of artificial intelligence within higher education can substantially improve educational effectiveness and contribute to the development of digitally competent and globally competitive graduates in Pakistan.

## **Implications**

### **Theoretical Implications**

The study contributes significantly to the literature on Artificial Intelligence in Education by integrating Artificial Intelligence-Supported Personalized Learning, Academic Motivation, and Skill Development into a comprehensive conceptual framework. The findings extend Self-Determination Theory by demonstrating that AI-enabled personalized learning environments satisfy students' psychological needs for autonomy and competence, thereby enhancing motivation and competency development. The study also contributes to educational technology literature by empirically establishing the mediating role of academic motivation in explaining how personalized learning experiences influence students' skill acquisition.

### **Managerial Implications**

University administrators and academic leaders should recognize Artificial Intelligence-Supported Personalized Learning as a strategic educational resource capable of enhancing student engagement and educational outcomes. Institutions should invest in intelligent tutoring systems, adaptive learning platforms, learning analytics technologies, and AI-supported instructional tools that provide individualized learning experiences. Universities should also establish institutional frameworks that facilitate effective integration of AI technologies into teaching and learning practices.

# **Liberal Journal of Language & Literature Review**

**Print ISSN: 3006-5887**

**Online ISSN: 3006-5895**

## **Practical Implications**

Faculty members and instructional designers should incorporate AI-supported personalized learning strategies into curriculum design and classroom practices. Educational activities should emphasize adaptive instruction, personalized feedback, learner autonomy, and self-regulated learning experiences. Instructors should also facilitate the development of digital competencies and higher-order cognitive skills by utilizing AI-powered educational technologies that promote critical thinking, creativity, collaboration, and problem-solving abilities.

## **Policy Implications**

The findings provide evidence-based guidance for policymakers and educational regulatory bodies, particularly the Higher Education Commission of Pakistan. Policymakers should formulate national strategies and institutional guidelines for the responsible and effective integration of Artificial Intelligence within higher education. Furthermore, investments should be directed toward strengthening digital infrastructure, promoting equitable access to educational technologies, enhancing institutional readiness, and improving digital competencies among educators and students. Such initiatives can contribute significantly toward developing future-ready higher education systems and supporting national digital transformation agendas.

## **Recommendations**

Based on the findings of the study, the following recommendations are proposed:

1. Higher education institutions should adopt AI-supported personalized learning platforms that provide adaptive instructional content, individualized feedback, and customized learning pathways.
2. Universities should strengthen digital infrastructure and technological capabilities to facilitate effective implementation of AI-enabled educational systems.
3. Faculty members should receive continuous professional development and training regarding the pedagogical integration of artificial intelligence and personalized learning technologies.
4. Educational institutions should incorporate digital literacy, problem-solving, critical thinking, and self-regulated learning activities into curricula to maximize the benefits of AI-supported learning environments.
5. Universities should establish mechanisms for monitoring and evaluating the effectiveness of AI-based educational interventions through learning analytics and evidence-based assessment practices.
6. Policymakers should formulate comprehensive national frameworks and ethical guidelines governing the implementation, accessibility, and responsible use of artificial intelligence in higher education.
7. Collaborative partnerships among universities, technology providers, industry stakeholders, and government agencies should be promoted to develop innovative AI-driven educational ecosystems capable of enhancing graduate employability and workforce readiness.

## **Limitations and Future Directions**

Despite its contributions, the study possesses several limitations. First, the study employed a cross-sectional research design, which limited the ability to establish causal relationships among the study

# Liberal Journal of Language & Literature Review

Print ISSN: 3006-5887

Online ISSN: 3006-5895

variables. Future studies may employ longitudinal designs to examine changes in motivation and skill development over time.

Second, the study relied primarily on self-reported questionnaire data, which may be subject to common method bias and social desirability effects. Future investigations may adopt mixed-method approaches by integrating qualitative interviews, observations, and objective measures of educational outcomes.

Third, the study was conducted within Pakistani higher education institutions, thereby limiting the generalizability of the findings to other educational and cultural contexts. Future research may conduct comparative studies across different countries and educational systems to examine contextual variations in the effectiveness of AI-supported personalized learning.

Fourth, the study examined only Academic Motivation as a mediating mechanism. Future studies may investigate additional mediating and moderating variables, including self-efficacy, digital literacy, technology readiness, learner engagement, institutional support, and perceived usefulness of artificial intelligence technologies.

Finally, the rapidly evolving nature of artificial intelligence necessitates continuous empirical investigations regarding the pedagogical effectiveness, ethical implications, and long-term consequences of AI-enabled educational systems. Future research should therefore examine emerging technologies such as generative artificial intelligence, intelligent tutoring systems, predictive learning analytics, and immersive AI applications to develop a more comprehensive understanding of their implications for higher education.

## References

- Alam, A. (2021). Possibilities and apprehensions in the landscape of artificial intelligence in education. *International Journal of Advanced Computer Science and Applications*, 12(6), 509–522.
- Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., & Negretti, R. (2024). Generative artificial intelligence in higher education: A global perspective of institutional adoption and implications for teaching and learning. *Computers and Education: Artificial Intelligence*, 6, 100270.
- Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264–75278.
- Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education*, 20(1), 22.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., & Ahuja, M. (2023). “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71, 102642.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage Publications.
- Higher Education Commission Pakistan. (2023). *Annual report 2022–23*. Higher Education Commission of Pakistan.

# Liberal Journal of Language & Literature Review

Print ISSN: 3006-5887

Online ISSN: 3006-5895

- Holmes, W., Bialik, M., & Fadel, C. (2022). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Ifenthaler, D., & Schumacher, C. (2016). Student perceptions of privacy principles for learning analytics. *Educational Technology Research and Development, 64*(5), 923–938.
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeiffer, F., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, 102274.
- Krouska, A., Troussas, C., & Virvou, M. (2022). Machine learning applications in personalized education: A systematic review. *Education and Information Technologies, 27*(7), 9933–9957.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.
- Ouyang, F., Zheng, L., Jiao, P., & Moore, M. G. (2022). Artificial intelligence in online higher education: A systematic review of empirical research from 2011 to 2020. *Education and Information Technologies, 27*(6), 7893–7925.
- 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.
- Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology, 60*, 101832.
- Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments, 10*(1), 15.
- Troussas, C., Krouska, A., Sgouropoulou, C., & Voyiatzis, I. (2021). Personalized learning pathways using intelligent recommendation systems in online learning environments. *Education and Information Technologies, 26*(6), 7979–8006.
- World Economic Forum. (2023). *The future of jobs report 2023*. World Economic Forum.
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Where are the educators? *International Journal of Educational Technology in Higher Education, 16*(39), 1–27.