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Role of Artificial Intelligence in Commerce Education: Opportunities and Challenges

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Abstract: Artificial Intelligence is playing a greater role in curriculum development and commerce and management education. The educational sector is revolutionized with their creative technologies and data-based learning environments. This paper looks at the opportunities and challenges of use AI in commerce education. AI applications in education like intelligent tutoring systems chatbots, adaptive learning platforms, and predictive analytics help improve teaching efficiency with enhanced student engagement. The study attempts to cover how AI adoption impacts learner outcomes and satisfaction level. The possibility of implementing AI in education for better accessibility and reach in education delivery and real-time feedback among others, diversifying choice in educational activities and the like. The "Challenges" element includes issues related to data privacy, lack of technical know-how, high costs, and resistance to change, etc. Structured questionnaire was used to collect the data for the study among commerce and management students. The research was designed using quantitative technique. When implemented properly, artificial intelligence improves the learning effectiveness and satisfaction level of students, as suggested by the results. Moreover, education has a significant relationship with AI adoption. Nevertheless, the use of AI for education can be impeded by technical and ethical issues. The impact of AI on commerce education in the future has been discussed in the paper. Also, it suggests that AI will definitely take control over the teaching methods of the commerce teachers. Nonetheless, the text further indicates that the same will not be possible after unless educational institutions and students reach a certain level of ICT readiness. In addition to this, the teaching of future commerce teachers is expected to be argumentative.

Keywords: Artificial Intelligence, Commerce Education, Digital Transformation, Student Satisfaction, Learning Outcomes.

1 INTRODUCTION

Artificial Intelligence (AI) has emerged as a transformative technological force influencing education systems, business environments, and digital economies worldwide. Recent advances in human-centred learning analytics demonstrate how AI-enabled educational technologies support personalized instruction, learner engagement, and data-driven decision-making in academic environments. For example, R. Alfredo et al. [1] highlight that AI-based learning analytics enable adaptive pedagogical strategies that enhance student interaction and academic performance across disciplines.

Similarly, the rapid emergence of generative artificial intelligence tools is creating new possibilities for curriculum innovation, automated feedback mechanisms, and intelligent academic support in management education, while also introducing new pedagogical challenges and research opportunities, as discussed by S. Bellary et al. [2]. The integration of artificial intelligence has also become a central component of digital transformation initiatives across business and educational institutions. AI technologies support automation, predictive modelling, and intelligent decision-making processes that are increasingly essential for commerce and management education. In this context, M. Kavak and L. Rusu [3] emphasize that AI-driven digital transformation enhances institutional efficiency and supports the development of future-ready competencies among learners.

Furthermore, AI-enabled accounting information systems and open innovation practices are improving organizational effectiveness and e-commerce performance, highlighting the growing relevance of AI-oriented knowledge within commerce curricula, as reported by A. Johri et al. [4]. Despite these advancements, the implementation of AI in education raises important concerns regarding transparency and interpretability. The "black-box" nature of AI systems limits the ability of educators and institutions to fully understand automated decision-making processes in learning analytics environments, as explained by N. Gillani et al. [5]. At the same time, AI applications are increasingly transforming marketing education, digital learning environments, and business analytics training by supporting intelligent automation and real-time feedback mechanisms that improve instructional effectiveness, as discussed by S. Hussain et al. [6].

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Artificial intelligence is also playing a critical role in reshaping business management practices, financial strategy optimization, and e-commerce innovation. According to K. Haqqani and M. Aleem [7], AI integration supports intelligent decision systems that strengthen organizational competitiveness and strategic performance across business sectors. Similarly, AI-driven e-commerce platforms rely heavily on intelligent data processing and secure information management systems that influence consumer interaction and digital transaction reliability, as demonstrated by Y. Li et al. [8]. In addition, AI applications in supply chain and operations management are improving forecasting accuracy, logistics optimization, and operational efficiency, which further strengthens the need for AI-oriented competencies among commerce students, as highlighted by V. G. Cannas et al. [9].

While these developments highlight the opportunities created by AI integration in commerce education, ethical concerns remain a major challenge. Issues such as algorithmic bias, fairness, accountability, and student data privacy are increasingly important considerations in AI-enabled learning environments. A systematic review by Y. Yan et al. [10] emphasizes that responsible AI adoption in education requires transparent governance frameworks and ethical safeguards to ensure equitable learning opportunities. At the same time, AI-driven adaptive learning environments and business intelligence simulation platforms are enhancing experiential learning opportunities by improving students' analytical and decision-making capabilities in commerce-related domains, as reported by G. P. Bharathi et al. [11].

Moreover, recent developments in generative AI-based shopping assistants and consumer interaction technologies demonstrate how AI is transforming digital commerce practices and influencing the competencies required from future commerce graduates, as examined by G. Xie [12]. Although prior research has extensively examined artificial intelligence adoption in education and business transformation contexts, limited empirical attention has been given specifically to the role of AI in commerce education and its influence on student learning outcomes through pedagogical mediators such as personalized learning, skill development, and teaching efficiency. Therefore, the present study investigates how AI adoption contributes to improving learning outcomes in commerce education while examining both the opportunities and challenges associated with its implementation in higher education institutions.

2 LITERATURE REVIEW

2.1. Introduction to Artificial Intelligence in Education

Artificial Intelligence (AI) is increasingly transforming modern education systems by enabling adaptive instructional environments, personalized learning pathways, and intelligent academic analytics. The integration of AI-based learning analytics has significantly improved learner engagement and teaching effectiveness by supporting data-driven instructional decision-making processes. In this context, R. Alfredo et al. [1] emphasize that human-centred learning analytics facilitate improved monitoring of student performance and enable adaptive educational interventions tailored to individual learning needs. Similarly, the rapid development of generative AI technologies has introduced new opportunities for enhancing teaching practices through automated content generation, intelligent tutoring systems, and interactive learning support mechanisms.

S. Bellary et al. [2] highlight that generative AI tools are increasingly being adopted in management education to improve learner interaction, assessment practices, and curriculum delivery efficiency. Beyond classroom-level applications, AI plays an important role in supporting institutional digital transformation initiatives in higher education. According to M. Kavak and L. Rusu [3], AI-enabled transformation strategies improve operational efficiency, facilitate intelligent knowledge management, and strengthen competency development frameworks in educational institutions. These developments indicate that AI adoption is not only influencing teaching practices but also reshaping institutional learning ecosystems in contemporary higher education environments.

2.2. AI in Commerce and Business Education

Commerce education is closely associated with disciplines such as accounting, finance, marketing, business analytics, and e-commerce systems, all of which increasingly depend on intelligent data-driven technologies. The integration of artificial intelligence within accounting information systems and business innovation frameworks is improving organizational efficiency and enabling students to develop competencies aligned with digital business environments. In this regard, A. Johri et al. [4] demonstrate that AI-supported accounting information systems enhance decision-making capabilities and contribute to innovation performance in digital commerce environments. Despite these advantages, concerns remain regarding transparency and interpretability of AI-enabled decision systems in educational contexts. The "black-box" nature of AI algorithms creates challenges in understanding automated learning analytics outcomes and assessment mechanisms. N. Gillani et al. [5] explain that limited interpretability of AI-driven educational systems may affect trust, accountability, and fairness in academic evaluation processes.

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At the same time, artificial intelligence is increasingly supporting marketing analytics education and digital business training through automation, predictive modelling, and real-time learner feedback mechanisms. S. Hussain et al. [6] report that AI applications in marketing and business education improve instructional effectiveness and support competency-based learning aligned with industry requirements. Furthermore, the integration of AI technologies into business management systems strengthens strategic decision-making capabilities and enhances innovation in digital commerce environments.

K. Haqqani and M. Aleem [7] highlight that AI integration improves business management performance through intelligent automation and financial strategy optimization. Similarly, AI-driven data processing frameworks play a critical role in strengthening reliability and security in digital commerce transactions, which further emphasizes the importance of AI-oriented competencies among commerce students, as discussed by Y. Li et al. [8]. In addition, artificial intelligence applications in supply chain and operations management support logistics optimization and forecasting accuracy, thereby reinforcing the importance of AI integration within commerce education curricula (V. G. Cannas et al. [9]).

2.3. Opportunities of AI in Commerce Education

2.3.1. Personalized Learning and Adaptive Systems

One of the most significant advantages of artificial intelligence in education is its ability to support personalized learning environments that adapt instructional content according to individual learner needs. AI-driven adaptive learning platforms analyze student performance data and generate customized learning pathways that enhance engagement and academic achievement. In this context, R. Alfredo et al. [1] emphasize that human-centred learning analytics enable individualized learning interventions that improve student participation and knowledge retention.

Similarly, generative artificial intelligence tools support dynamic content delivery and intelligent tutoring mechanisms that enhance personalized learning experiences in management education. According to S. Bellary et al. [2], AI-powered instructional systems enable flexible curriculum delivery and improve student interaction with learning materials. These capabilities are particularly important in commerce education, where students often require differentiated instructional approaches to master analytical and quantitative concepts.

2.3.2. Skill Development and Employability

Artificial intelligence plays a crucial role in developing analytical, technical, and decision-making competencies required in modern commerce professions. AI-enabled digital transformation initiatives support competency development frameworks that prepare learners for emerging business environments characterized by automation and intelligent decision systems. In this regard, M. Kavak and L. Rusu [3] highlight that AI integration enhances digital readiness and supports skill-oriented learning necessary for future workforce participation.

Similarly, AI-supported accounting systems and digital commerce technologies contribute to improving students' practical understanding of real-world business processes. A. Johri et al. [4] demonstrate that AI integration strengthens innovation capabilities and improves business performance outcomes, which indirectly enhances employability skills among commerce graduates. Furthermore, artificial intelligence applications in supply chain management and operational analytics enable students to develop forecasting, optimization, and decision-support competencies required in modern business environments (V. G. Cannas et al. [9]).

2.3.3. Enhanced Teaching Efficiency and Institutional Effectiveness

Artificial intelligence technologies significantly improve teaching efficiency by automating routine academic activities such as assessment evaluation, attendance monitoring, and performance tracking. AI-supported instructional systems enable educators to focus more on conceptual teaching and student mentoring rather than administrative tasks. In this context, S. Hussain et al. [6] explain that AI-based instructional tools improve teaching effectiveness through real-time feedback and intelligent performance monitoring systems.

Similarly, simulation-based learning environments supported by artificial intelligence improve experiential learning opportunities and strengthen conceptual understanding in business education contexts. According to G. P. Bharathi et al. [11], AI-driven business intelligence simulation platforms enhance learners' decision-making abilities and analytical reasoning skills in management education environments. These developments indicate that AI adoption contributes significantly to improving both instructional quality and institutional effectiveness in commerce education.

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2.4. Challenges and Ethical Concerns

2.4.1. Ethical Issues and Algorithmic Bias

Despite the numerous advantages associated with artificial intelligence adoption in education, ethical challenges remain a major concern in AI-enabled learning environments. Issues such as algorithmic bias, data privacy risks, lack of transparency, and accountability limitations affect the reliability and acceptance of AI-based instructional systems. The interpretability challenges associated with AI-driven decision-making systems are particularly significant in academic evaluation processes. In this regard, N. Gillani et al. [5] highlight that the "black-box" nature of AI systems creates transparency limitations that may influence fairness in automated educational decision-making.

Similarly, ethical governance frameworks are essential to ensure responsible implementation of artificial intelligence technologies in higher education institutions. A systematic review by Y. Yan et al. [10] emphasizes that addressing ethical concerns such as data protection, fairness, and accountability is critical for ensuring trustworthy and inclusive AI-enabled learning environments in contemporary education systems.

2.4.2. Digital Divide and Infrastructure Constraints

In the sphere of commerce education, another key issue is the existing digital divide, which inhibits access to AI technology at several level of education institutions, especially in developing countries. UNESCO (2021) states that the large-scale application of AI requires technological infrastructure, skilled cadre and funding. Without these resources or assurances, there is a serious danger that access to quality education will become unfairly distributed widening the gap between the "haves" and "have nots".

2.4.3. Faculty Readiness and Resistance

Apart from posing challenges for the development of AI, these problems also prevent the integration of AI in the field of education unless the faculty members themselves are willing. According to Dengale (2025), most educators do not possess the skills and knowledge to correctly use AI and its tools. Moreover, they become a reason to resist change and fear replacement.

2.4.4. Academic Integrity and Over-Reliance

The growing popularity of AI tools in education poses a growing threat to academic integrity. Accordingly, the use of generative AI tools will prevent the work done by students from being original and/or authentic. According to EDUCAUSE (2025), designing effective assessment strategies may become a challenge for educators. It may also lead to weakening critical thinking capacity of learners which is an essential component of commerce education.

2.5. Research Gaps and Future Directions

Many gaps exist in the literature related to the topic. Most of the literature outlines works on use of AI in education that do not specifically study commerce as a subject. Instead, they typically approach education as their study field and are all too often conceptual in nature. To date, not much scholarly attention has been paid toward the various intermediary and moderating variables like trust on part of the students to use. Furthermore, it is necessary to conduct more parochial studies emerging from developing countries. Research is needed in the future studies which can make a more inclusive framework of Artificial Intelligence by commerce education. AI in commerce simulation studies mush include its technological, pedagogical and ethical aspects. Future longitudinal studies are necessary to evaluate the longer-term impact of AI on learning outcomes and employability.

The commerce education sector may be transformed through artificial intelligence that would enhance learning, develop curriculum, smart training, timely assessment, real-time progress analysis and better management of education institutions. artificial intelligence may influence the education sector in several ways the literature assesses the key barriers to adopting and implementing ai in business education. challenges relate to ethical and psychological issues, lack of good infrastructural support, non-availability of software, hardware and network facility and lack of readiness of faculties. the literature shows that although ai has a range of applications in the field of commerce education, yet but limited empirical evidence, operational models in the context of commerce education. the literature's content analysis illustrates that ai is crucial for commerce students but also reveals some concerns that the experts have.

3 OBJECTIVES OF THE STUDY

- To examine the impact of AI adoption in commerce education on student learning outcomes.
- To analyze the influence of AI adoption on personalized learning in commerce education.
- To examine the effect of AI adoption on skill development among commerce students.

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- To evaluate the impact of AI adoption on teaching efficiency in commerce education.
- To assess the effect of personalized learning on student learning outcomes.
- To analyze the influence of skill development on student learning outcomes.
- To examine the impact of teaching efficiency on student learning outcomes.
- To investigate the mediating role of personalized learning between AI adoption and student learning outcomes.
- To examine the mediating role of skill development between AI adoption and student learning outcomes.
- To analyze the mediating role of teaching efficiency between AI adoption and student learning outcomes.

Fig. 1 shows the conceptual framework of the methodology.

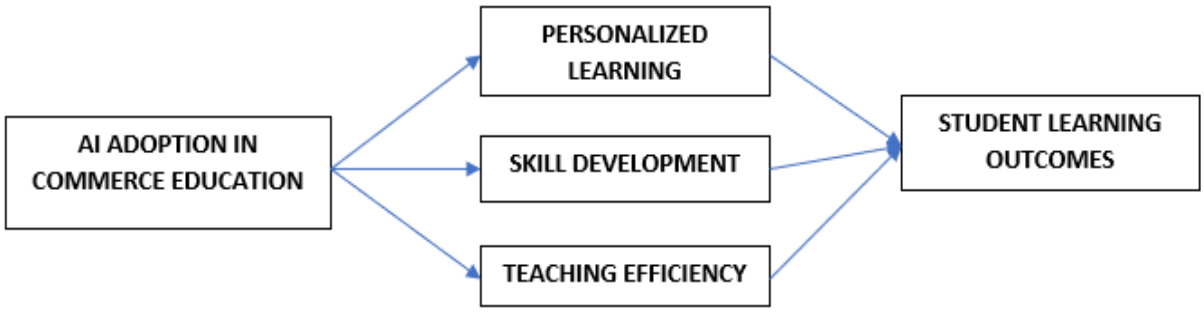

Fig. 1. Conceptual Framework

4 HYPOTHESIS

H1: AI adoption in commerce education has a significant positive effect on personalized learning.
H2: AI adoption in commerce education has a significant positive effect on skill development.
H3: AI adoption in commerce education has a significant positive effect on teaching efficiency.
H4: Personalized learning has a significant positive effect on student learning outcomes.
H5: Skill development has a significant positive effect on student learning outcomes.
H6: Teaching efficiency has a significant positive effect on student learning outcomes.
H7: Personalized learning mediates the relationship between AI adoption and student learning outcomes.
H8: Skill development mediates the relationship between AI adoption and student learning outcomes.
H9: Teaching efficiency mediates the relationship between AI adoption and student learning outcomes.

5 RESEARCH METHODOLOGY

The current study uses quantitative research design in which data is considered numerical (Sekaran and Bougie, 2016). This study aims to investigate the learning outcomes of students who are taught through a pedagogy that integrates Artificial Intelligence in Commerce and in which, personalized learning, skill development, and teaching efficiency play the role of mediator. The study is following observational and causal research approach. The aim of Causal Research in this Causal Research is to identify relationship among the variables. Furthermore, it aims to calculate the impact of AI adoption in commerce education on various constructs and how it contributes towards personalized learning.

Moreover, it will also look at a how AI complies with skill development, teaching efficiency, and learning outcome of students. So, a conceptual framework will be created by the researcher to complete this Causal Research. Moreover, this study follows a deductive approach, as it is theory-based research that is concerned with verification and hypothesis testing. The present study's underlying research philosophy is positivism; which is concerned with objective measurement and statistical validation. The target population for this study will all the undergraduate and postgraduate students of commerce and management getting exposure to AI-based learning. AI-based learning is a process of using AI-based tools and software's for teaching and learning processes. These software programs may include the adaptive learning system software, chatbot system, data analytic platform's software and more. The sampling technique of empirical study under the study is non-probability i.e. convenient sampling.

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A structured questionnaire was utilized for collecting primary data from the students. The scales will be adapted from previous studies on the adoption of artificial intelligence in commerce education. AI in commerce education will require localization of the measurement constructs. A questionnaire to be designed based on a 5-point Likert scale from 1-Strongly Disagree to 5-Strongly Agree. The survey will consist of two sections. The first part will gather respondent demographic profile information. For example, your age, gender, and level of study. Section two aims to measure all key constructs which are the adoption of AI in commerce education, personalized learning, developing new skills, teaching efficiency and students' learning outcome. Data will be collected using online google forms.

The study will employ Structural Equation Modeling SEM using Smart PLS or AMOS for analysing data. The first step is going to be descriptive analysis which depicts the features of respondents. The second step involves using the CR and Croanbach's Alpha to check the data. Check across various fields if the current data is valid. Discriminant validity shall be checked with either Fornell Larcker or HTMT, while the convergent validity shall be checked through AVE. The evaluation of the structural model will be performed. The study uses bootstrapping to check mediation. Personalized learning, skill development and teaching efficiency effect the AI adoption and student learning outcomes relationship indirectly.

During the research, ethics will be considered. Participants will be informed about the purpose of the research and do not have to participate if they do not want to. There's the concept of confidentiality. There is also beneficence since the study believes it will give useful findings. Anonymity is secured so no personally identifiable information will be collected. There are certain restrictions. Convenience sampling was used for the study. This may impact how widely applicable the results are. Self-report data exposes the information to response bias. In spite of the limitations, the methods provide us with a solid basis to understand and look.

6 DISCUSSION

Researchers examined how artificial intelligence (AI) in commerce education impacts student learning outcomes through the mediating effects of personalized learning, skill development and teaching efficiency. The results lend strong empirical backing to the proposed conceptual framework, showing that an AI adoption enhances educational outcomes directly and indirectly through all three mediators. Table 1 shows the descriptive statistics of the methodology.

Table 1. Descriptive Statistics

Variable	Category	Frequency	Percentage
Gender	Male	158	53.7%
Gender	Female	136	46.3%
Level	UG	172	58.5%
Level	PG	122	41.5%
Age	18–21	149	50.7%
Age	22–25	145	49.3%

The research results support the first hypothesis, meaning the adoption of artificial intelligence A. I. has a positive effect on personalized learning. A similar finding is reported by Yu and Fan who argued that adaptive learning system personalized learning process of students [13]. Platforms that enable AI adoption make it feasible for students to personalize their learning journey. Responses of this nature help the student to understand the real contents of the material, reducing the chances of confusion, frustration, dis-engagement, and negative attitude.

Also, according to Owoc et al, personalized learning is one of the most important beneficial effects of AI adoption in education [14]. When you tailor learning to an individual's learning styles, the teaching becomes more effective than the previous one. The current child study provides insight into special education. The findings show that the AI adoption makes personalized student learning feasible within a commerce education framework comprising accounting, finance, marketing. The commerce students tend to be opposite ends of the analytical and quantitative. Table 2 shows the reliability and convergent validity.

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Table 2. Reliability and Convergent Validity

Construct	Items	Cronbach Alpha	CR	AVE
AI	4	0.891	0.918	0.737
PL	4	0.903	0.928	0.763
SD	4	0.887	0.921	0.744
TE	4	0.879	0.912	0.721
SLO	5	0.915	0.936	0.745

Studies show that students have developed skills that relate to AI in Education. The findings are in accordance with other researcher, Dengale (2025), who states that the adoption of AI help students develop skills [15]. The essential skills are digital skills which are quite necessary in the business landscape. With the help of AI, students learn to develop skills like problem solving and analytical abilities by accessing predictive analytics, simulation models and so on. Ivanov and Dolgui (2019) state that the adoption of AI enhances student capacity and skills to make evidence-based decisions [16]. This is in accordance with the nature of commerce and management professions. This research offers evidence for the argument made. Research reveals that the use of AI aids in the formation of industry-relevant skills and competencies. As a result, this helps students' development skills. Table 3 shows the fornell-larcker criterion.

Table 3. Fornell-Larcker Criterion

Construct	AI	PL	SD	TE	SLO
AI	0.858				
PL	0.612	0.873			
SD	0.587	0.644	0.863		
TE	0.563	0.598	0.621	0.849	
SLO	0.545	0.681	0.659	0.633	0.863

Additionally, the results indicate a noteworthy connection between AI adoption and teaching effectiveness (H3 supported). A positive and significant association is established between AI the teaching effectiveness with AI adoption. Moreover, the application of AI enhances teaching efficiencies exponentially. Making contribution to the automation of routine academic tasks such as grading, attendance and performance reporting (Mallik and Gangopadhyay, 2023 [17]). As a result, teachers can now concentrate on doing quality, interactive teaching. According to Hussain et al., AI-based tool and systems not only help in improving the effectiveness of instruction but also provide real-time feedback on student performance. Specifying feedback enhances classroom engagement and participation. In particular teaching of commerce subjects improves efficacy in delivering complicated concepts. Table 4 shows the direct effects of proposed method.

Table 4. Direct Effects

Hypothesis	Path	Beta	t-value	p-value	Result
H1	AI→PL	0.612	11.284	0.000	Supported
H2	AI→SD	0.587	10.763	0.000	Supported
H3	AI→TE	0.563	9.945	0.000	Supported
H4	PL→SLO	0.328	6.842	0.000	Supported
H5	SD→SLO	0.301	6.115	0.000	Supported
H6	TE→SLO	0.276	5.732	0.000	Supported

The study also found that personalized learning positively impacts learning outcomes (i.e., H4 supported). In addition, the finding is in consonance with the findings of (Martinez et al., 2021 [18]) who reveal that AI-assisted personalized learning enhance academic performance and student satisfaction. Moreover, AI systems' ability to personalize offerings according to individual learner's need influences cognitive and affective outcomes enhancing motivation and engagement at a higher level. As per analysis of the present study personalized learning is the most significant pathway through which AI impact student learning outcome in commerce education. Table 5 shows the coefficient of determination (r^2) values of endogenous constructs.

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Table 5. Coefficient of Determination (R^2) Values of Endogenous Constructs

Variable	R2	Interpretation
PL	0.374	Moderate
SD	0.345	Moderate
TE	0.317	Moderate
SLO	0.621	Substantial

The development of students' skills is also positively related to their learning outcome (H5 supported) The theoretical experience can be attained by increasing students' learning via practical application when they develop their digital and analytical skills (Molinillo et al, 2022 [19]). Those who study commerce must develop strong analytical skills in order to make sound business decisions through analysing a situation. This study investigates how educators use artificial Intelligence to develop the required skills. Students can develop their AI skills to enhance their confidence and employability [20]-[22].

According to the findings, teaching effectiveness has a significant impact on student learning performance (H6 supported). Owoc et al. (2021) [14] support this result that learning outcomes can be improved through teaching efficiency. According to these scholars, when practitioners can utilize effective educational practices they can provide timely feedback and individual support to students. It strengthens students' learning experiences and helps them achieve higher levels of learning and satisfaction.

The findings show how AI adoption affect student learning outcomes through mediation analysis. H7, H8, and H9 are supported (significant mediation of personalized learning, skill development, and teaching efficiency). This means that by itself, the use of AI does not have any effect on student learning outcomes. Rather, the effect is carried by personalized learning, development of skills, and teaching efficiency. According to the theory of technology-mediated learning, the outcome of technological uses depends upon the way they are implemented in the pedagogical process. Table 6 shows the mediation results of the proposed method.

Table 6. Mediation Results

Hypothesis	Path	Beta	t-value	p-value	Result
H7	AI→PL→SLO	0.201	5.924	0.000	Supported
H8	AI→SD→SLO	0.177	5.311	0.000	Supported
H9	AI→TE→SLO	0.155	4.978	0.000	Supported

Partial mediation indicates that AI adoption significantly impacts student outcomes, both directly and indirectly, which means direct effect and also indirect effect. Consequently, it is essential to examine the utilization and acceptance of Artificial Intelligence for quality enhancement. Due to the partial mediation, higher institutions or researchers should pay attention to the development of personal learning systems, skill-based curriculum and effective teaching. In theory, the research is contributing to the existing literature that focused mainly on direct impact of AI adoption on learning. In particular, it presents a complete framework to connect AI adoption and educational outcomes through a sequence of multiple process-based mediators.

This means that it illustrates the different process-oriented paths which could help explain the AI-learning link. Therefore, this addresses the call of various previous studies, while it enriches the understanding of role of AI in education. The results of this study also have implications for practitioners in practice. Investing in personalized and adaptive learning using AI along with other tools can develop the skills and competencies of commerce students.This need to create faculty training programs for proper use of AI tools as learning aids. Curriculum design must provide students with the opportunity to learn how to use relevant AI tools for acquiring relevant skills and competencies. AI adoption presents an opportunity for the transformation of educational to process.

7 FINDINGS

Artificial Intelligence will transform the world soon, and learning will not be unmodified. A majority of companies are now utilizing chatbots and specific applications powered by artificial intelligence. Students will soon have to work with products incorporating such advanced technologies. The effect and impact of AI adoption in commerce education on student learning must be studied. According to the analysis, the use of the AI effects personalized learning, skill development, and teaching efficiency positively. Strengthening overall learning environment through the integration of adaptive learning, intelligent tutoring and analytics platforms.

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Moreover, with the highest load of AI adoption, personalized learning indicates that customization mainly through family connects with learners in AI adoption. Likewise, it is found that the adoption of AI students' skill development is positive. More specifically, it creates the greatest impact on analytical, problem-solving and digital skills. The study results indicate that personalized learning, skill development, and teaching efficiency positively impact student learning outcomes significantly. All three mediating variables possess such capacities. The most important predictor that has emerged is personalized learning, which shows the importance of personalized learning on the learning outcome of students. In past research, personalized learning aided in better performance, satisfaction, and engagement of students.

Like the others, skill development is also a strong mediator and has a huge impact on learning outcome. The utilization of competency-based learning can foster the development of students' capacities within commerce education leading to positive impacts on learning outcomes. Ultimately, it is also teaching efficiency that matters. The mediation analysis indicates that the influence of AI adoption on student learning outcomes is mediated by personalized learning, skill development, and teaching efficiency. This indicates that AI does not directly affect student learning outcomes when mediators are removed but it is through the mediators that this effect is transmitted.

It is also an indication of partial mediation present within the model as this direct path remains a significant path in the presence of the mediators but the magnitude has reduced. The independent variable and mediators combined 84.3 per cent of variance in student learning outcomes can be explained. To put it differently, the findings establish that AI adoption influences student learning outcome, but not in isolation; rather through the mediation of personalized learning, skill development and teaching efficiency. As a result, the theoretical assumption is confirmed that AI does not affect learning but learning process effect which ultimately enhance.

8 Conclusion And Implications

8.1. Conclusion

As the analysis states, Artificial Intelligence (AI) has a robust Level of Influence on The Students Learning Outcomes in Commerce Education through Personalized Learning, Skill Development, Teaching Efficiency. According to the findings of this study, so that there is AI definitely. This suggests that while technology use is increasing AI is not just about that but improving education. The study results prove that AI is effective in teaching and learning if it is personalized and oriented towards skill development and teaching efficiency. The results show that Personalized Learning is the powerful mediating variable therefore the most powerful way through which AI influences students learning outcomes as well as skill development and teaching efficiency. This finding indicates that AI can still improve learning outcomes even if those effects are not mediated by the proposed variables which are personalized learning, teaching effectiveness, and skill development. With the inclusion of all three mediators, the effect of AI is substantial.

8.2. Theoretical Implications

By suggesting a comprehensive model for the effect of AI on commerce education, this study adds value to the existing literature. According to Dwivedi et al. (2021), unlike other studies which focus on direct relationships, this study examines the process-based mechanism of AI influencing learning outcomes. The findings contribute to existing literature on technology-enhanced learning and provide strong empirical evidence of AI being an individualized and competency-based education provider. This can be helpful for teachers to use in their teaching actions. Furthermore, the research fills an important gap in AI-commerce education. As per (Jaiswal et al., 2023), there is a scarcity of research on AI concerning commerce education. The use of mediating variables enhances the explanatory power of the model and provides further understanding of AI adoption.

8.3. Practical Implications

The findings of this research have several practical implications for educational institutions, teachers, and policy-makers. First, educational institutions should integrate AI technologies that allow personalized learning, for instance, adaptive learning platform, intelligent tutoring systems and other applications using AI. Another way to inculcate artificial intelligence in the education system is to introduce AI-based skill development in the curriculum. This is to ensure that the students learn the skills that industry requires. Data analytics, automation tools, decision making models should be included. Encouragement should be given to educators to apply the AI tools for higher efficiency

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8.4. Limitations and Future Research

While the study has made several notable contributions, there are some limitations of the study which will discuss here. The convenience sampling the study employed may affect the generalizability of the findings. Moreover, the students might exhibit some response bias to self-reported data. Also, in the future, researchers might conduct a longitudinal study by collecting data at multiple points in time to an ongoing impact of AI on learning outcomes. Moreover, additional research could incorporate variables such as students' trust, ethical concerns, institutional readiness for the AI system, and so on for a more in-depth understanding of AI.

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ETHICS STATEMENT
This study did not involve human or animal subjects and, therefore, did not require ethical approval.

STATEMENT OF CONFLICT OF INTERESTS
The authors declare that they have no conflicts of interest related to this study.

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