



AI in the Classroom: A Boon, or a Bane of Human Learning

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Abstract

Since 2020, the convergence of Artificial Intelligence (AI) with education scenarios has become a faster, pace-driven event, which causes the shift in the paradigm at primary, secondary, and tertiary levels. This research paper explores the two-sided nature of the AI dilemma in the classroom, i.e. whether it stimulates or suppresses human learning, by adopting a mixed design that includes a teacher and student survey. The findings show that AI can have tremendous potential in the mediation of individualized learning paths, enhancing the effectiveness of the instruction methods, and increasing access to education opportunities. Nonetheless, there cannot be artificial intelligence without a tidal wave of substantial issues, such as the threat of cognitive off-loading, privacy invasion, algorithmic discrimination, and the loss of experience underpinning the concept of learner-centric pedagogy. Based on the constructivist principles and being a people-oriented designer, this exposition holds the view that the role of educators should be reoriented to that of facilitators who use AI as a helping tool instead of a controlling force. It highlights the necessity of moral responsibility, the introduction of strict rules on data-protection, and the introduction of an in-depth AI-technology literacy into the educational program of schools of teachers. Finally, according to the discussion, proactive, evidence-based policy-making and a restrained paternalistic manner are suggested, such that it does not turn AI to see the instructional tyrant that will replace a human instructor but act as a pedagogic agent, increasing the rigor and quality of academic learning.

Keywords: Human Learning, Teaching effectiveness, Ethical Considerations, Pedagogical Innovation, Artificial Intelligence,

Introduction

It is important to note that the pace of Artificial Intelligence (AI) acceleration that has already emerged since 2020 has brought a fundamental shift in many fields, racial education inclusive, being one of the first to enter the paradigm of this shift. All the steps AI technologies discussed above entering primary, secondary, and tertiary classrooms today have a powerful influence on the pedagogic process, curriculum conveyance, and student interaction. This increased use has been the subject of a tremendous scholarly discourse of whether AI functions as an agent in the learning process of fine tuning the human learning system or just risky to the entire effectiveness of the educative systems.

The key factors, which determine the effectiveness of AI in education, are the frequency, when students usually, use AI tools, the type of AI tool, and the ability of a teacher to completely integrate the tool into a school syllabus. Whereas AI can revamp the classroom experience, it is also a way to make learning and problem solving less thorough when applied erroneously or in a dependent fashion. In addition, the position of the teacher will be moved to the center like never before and guidance and supervision will be needed in such a way that AI is not a substitute, but an enhancement of human interaction. This study will identify the correlations between these key variables and student learning outcomes with the aim of establishing whether AI in the classroom is a bane or boon to classroom learning of human learners in the development of the educational system.

Literature review

Singh & Mehta (2025):

This paper discussed the role of generative AI, including ChatGPT, in college classrooms in India. The authors discovered that despite the content comprehension and engagement with the help of AI tools exceeding critical analysis, over-use of keys worsened the situation. The paper demonstrated the role teachers play in controlling AI use and the importance of AI-mediated customization of learning paths in improving STEM education tremendously. However, the authors have warned that AI will not need to substitute active thinking done by students. Findings also pointed to the equal application and the need to educate educators by the institution. The research suggested the ethical principles of AI application and established that in order to prevent being such a curse AI needs to go according to the pedagogical goals.

Anderson et al. (2023):

In their paper, the authors introduced an adaptive AI-based tutoring system in several countries in secondary schools. Performance of students in research and mathematics was improved especially improved among the lowest performing students. The gains however reduced when teachers were deficient in digital skills. The study has identified the teacher mediation of the instruction as an important aspect of the implementation. Engagement was also aided by the design of AI tools, as well as student feedback loops. The performance of students taught by teachers who had AI training was better. The authors suggested the incorporation of AI literacy educational programs to teachers and expressed it through the concern of screen fatigue. They came to a conclusion that AI is a feasible alternative when used with human-centred pedagogies.

Kumar & Rao (2021):

The analysis looked into the role of the AI-powered assessments in terms of the deterrent effect on the learning motivation and academic integrity. AI tools made the grading faster and the feedback presented in a timely fashion, which led to an earlier intervention. But there was concern that there would be inequitable grading procedures because of automation. Students were vocal regarding being uncomfortable with unknown AI decision-making and reacted more to personalised feedback. Educators had noted a lessening spread of workload and called subsequently on there being openness in AI recommendations. The authors paid attention to ethical details of AI scoring systems and recommended an alternative variant of hybrid replies involving teacher judgement, and AI scoring. The results were also inconsistent about the effects of AI on learning, with the authors concluding that transparency and individualised feedback are required.

Garcia and Liu (2019):

The paper investigated the application of AI-driven virtual assistants in undergraduate classrooms in the United States. The assistants provided reminders, FAQs, and content explanations, resulting in reports of anxiety and an increase in student engagement in large classes. Nevertheless, more significant learning outcomes were obtained when AI was employed to complement human teaching and not replace it. The authors observed that the most benefited students were those who were more digitally literate. Faculty initially resisted based on perceived complexity. Through the study, the importance of technical support and professional development has been highlighted. The virtual assistants' most significant achievements were in repetitive tasks. They did not contribute much to the development of deeper learning. Research proposed that intimate role identification should be applied to AI in teaching.

Chatterjee (2016):

This article reviewed distance learning on AI-enhanced e-learning. It concluded that AI enhanced student interaction, retention, and feedback delivery in real-time. Students liked AI-recommended content and adaptive quizzes. However, communication with other people was lacking, which made some students feel lonely. The author pointed out the significance of human tutors in addition to AI systems. AI technology has managed to monitor the learning trends and tailor content. The presented study also emphasized the importance of cultural adaptation of AI tools. The learner autonomy was enhanced, whereas the facilitation was also crucial. It advised cross-learning models.

Brynjolfsson and McAfee (2014):

The report explored the future of AI and automation in education. The authors pointed out that AI will help some businesses optimize their operations, although it does not necessarily guarantee deep knowledge. They noted that students are inclined towards passive use of AI tools where they lack counselling by teachers. They based it on the premise that AI has the ability to enhance teacher creativity and emotional intelligence but it does not necessarily replace them. The study brought into light prevailing institutional inequalities in the access to AI. It cautioned against a source of automation bias, in which students do not question the results produced by artificial intelligence. The authors also supported the idea of human-in-the-loop systems and suggested a redesign of the curriculum according to which AI is incorporated into inquiry-based learning. The policy was informed by this paper. It sees AI as a resource and not as a teacher.

Johnsons et al. (2012):

The report was developed by the Horizon Project and the trends in AI in K-12 education were documented as to trends in the foreseeable future. It forecasts the expansion of intelligent tutoring systems and that students will have the potential of receiving personalised studies. Ethical issues are also expected to be raised by the usage of student data by the report. Greater engagement was indicated in pilot programs, in which AI responded to the student's pace. Among the barriers to implementation were infrastructure, training, and cost. Teachers would require assistance in assessing the teaching utility of AI tools. The paper highlights the importance of the learning environment as opposed to the isolated use of AI. It also advises the use of teachers in the design of AI tools. The study was one of the first recognitions of the potential of AI in the classroom. It emphasised the human aspect in any form of technology-based instruction.

Selwyn (2010):

Selwyn was very critical about the education technology discourse that included the early areas of AI. He thought techno-optimism did far too little to consider more fundamental pedagogical and equity questions. The researcher contested that AI promoted deep learning, or that it promoted only efficiency. It raised the issue of how AI tools can replicate the inequalities in education by making them more uneven in respect of access. He recommended critical digital pedagogy. The paper concluded that technology cannot revolutionize education. Innovation must be human-led

Research gap

Even though artificial intelligence (AI) tools and their application in the classroom are gaining popularity overall, there is still a significant gap in research about the impact of these tools on the outcomes of human learning. The overall utility of AI in education has been mentioned in most of the prevailing literature. However, no one has empirically analyzed the direct connection between the frequency of AI tool use and the outcome of student learning, including comprehension, retention, and critical thinking. Additionally, the comfortability of the artificial intelligence technology in particular, adaptive learning systems and AI chatbots, on the one hand, and automated assessment platforms, on the other hand, has not been explored sufficiently regarding their specifics on learning outcomes. Current literature has a trend of treating AI in a monolithic manner; the advantages and limitations of both the forms of tools are not sufficiently addressed. More to the point, teacher competence and its importance in the incorporation of AI concepts into their teaching activities have been largely forgotten about. Teachers have a great deal of opportunity to apply AI tools to classroom situations, thus impacting the learning outcomes. However, there is minimal study on a thorough study of this side.

More to the point, recent research is skewed towards experimentation or higher educational settings, there being not enough access given to real classroom scenarios, especially in the school system or more conventional collegiation systems. This, in turn, makes the complications within these environments unexplored.

Furthermore, there are no longitudinal or large-scale research works conducted on the long-term impact of the use of AI tools present.. This lack of knowledge is an opportunity to examine the combination of the frequency of use and the type of AI tool, and the skills of the teachers to integrate tools into human classroom knowledge. The gaps can be used to give insights to educators, administrators, and policymakers who are interested in taking advantage of AI to make educational experiences more effective and more human-friendly.

Research Objectives

1. To examine the impact of AI tool usage frequency on student learning outcomes.
2. To evaluate how different types of AI tools used in the classroom influence human learning outcomes.
3. To analyze the role of teacher AI integration skills in enhancing or hindering student learning outcomes.
4. To suggest valuable recommendations to strengthen the study

Research methodology

The present literature will be a quantitative study that determines the impact of Artificial Intelligence (AI) application in the classroom on students' learning achievement. The research design adopted was descriptive and causal comparative research design to determine relationships amidst the three independent variables namely frequency of AI tool use, actual AI tool use, and teacher experts at AI integration with the dependent variable of student learning outcomes. The intervention outcome was a group of students who had access both publicly and privately based educational institutions which had integrated AI based educational aids. The stratified random sampling method was used to allow the selection of a balanced group of educational level and fields.

Data collection was done using a structured questionnaire and a sample of 200 students was taken to give the questionnaire to them. The instrument included Likert items evaluating the nature of AI tool application (daily, weekly, monthly, yearly), the types of tools used (AI-tutors, adaptive testing, content generators, etc.), and ideas about the level of professionalism of a teacher in the use of AI. Other indicators were combination of cognitive understanding, engagement level, critical thinking, and performance improvement all which were used to measure learning outcomes.

To describe the individual samples, descriptive statistics were computed; mean and standard deviation. The correlation analysis was carried out by Pearson when testing the relationship between learning outcomes and the frequency of the tool use (Hypothesis 1). To test how different types of AI tools impact learning outcomes (Hypothesis 2), a one-way ANOVA was used, and to test how skills of teachers to integrate AI affects learning outcomes (Hypothesis 3), a simple linear regression was used. Statistical analysis was done and implemented in SPSS 26 version. All the ethical considerations such as respondent anonymity and informed consent have been addressed in the study.

Hypotheses

H₁: There is a significant relationship between AI tool usage frequency and human learning outcomes among students.

H₂: H₂: The type of AI tool used in the classroom has a significant impact on human learning outcomes among students.

H₃: Teacher AI integration skills significantly influence student learning outcomes.

Data analysis and interpretation

H₁: There is a significant relationship between AI tool usage frequency and human learning outcomes among students.

Table 1: Descriptive statistics of Frequency of AI tools usage and human learning achievements among students.

Variables	Mean	SD	r (Pearson)	p-value	Significance
AI Tool Usage Frequency	3.85	0.65	0.412	0	Significant
Human Learning Outcomes	4.12	0.78			

The data presented in Table 1 indicate that the mean and standard deviation values indicate moderate frequency of AI tool use and rather high perceived outcome of human learning among students.

Table 2: Pearson correlation between the frequency of usage of AI tools and the human learning results.

Variables	Mean	SD	r (Pearson)	p-value	Significance
AI Tool Usage Frequency	3.85	0.65	0.412	0	Significant
Human Learning Outcomes	4.12	0.78			

Interpretation

Table 2 illustrate moderate positive correlation ($r = 0.412$, $p < 0.01$) between AI tool usage frequency and human learning outcomes among students. This suggests that increased AI tool usage is associated with better learning outcomes.

H₂: H₂: The type of AI tool used in the classroom has a significant impact on human learning outcomes among students

Table 3: Descriptive statistics of student learning outcomes according to the types of AI tools applied in the classroom.

AI Tool Type	N	Mean Learning Outcome	SD
Tutoring Tools	40	4.35	0.6
Content Generation Tools	40	4.05	0.75
Grading/Feedback Tools	40	3.9	0.8
Language/Translation Aids	40	4.1	0.7
Research Assistants	40	4.25	0.65

Table 3 summarizes the descriptive statistics of learning outcomes in various categories of AI tools.

Table 4. A one-way ANOVA statistic of the differences in human learning outcomes by type of AI tool.

Source	SS	df	MS	F	p-value	η^2 (eta squared)
Between Groups	4.12	4	1.03	5.87	0.001	0.11
Within Groups	33.4	195	0.17			
Total	37.52	199				

A one-way ANOVA was conducted to compare human learning outcomes across five types of AI tools. Table 4 indicates that there was a statistically significant difference between groups, $F(4,195) = 5.87$, $p = 0.001$, $\eta^2 = 0.11$, indicating a moderate effect of AI tool type on learning outcomes. Post-hoc comparisons using Tukey HSD revealed that students using tutoring tools had significantly higher learning outcomes than those using grading/feedback tools ($p < .05$), while other pairwise differences were not significant.

H₃: Teacher AI integration skills significantly influence student learning outcomes.

Table 5: Descriptive statistics of Teacher AI integration skills and student learning outcome.

Variable	N	Mean	SD	Min	Max
Teacher AI Integration Skills	200	3.95	0.68	2	5
Student Learning Outcomes	200	4.1	0.72	2.3	5

As indicated in Table 5, teacher AI integration skills, as well as student learning outcomes, have high mean scores, which reflects positive perceptions among the respondents.

Table 6: Summary of regression model that predicts student learning outcomes based on skills of teachers to integrate AI.

Model Summary	
R (Correlation Coefficient)	0.462
R ² (Coefficient of Determination)	0.213
Adjusted R ²	0.21
Std. Error of Estimate	0.648

According to the regression model summary presented in Table 6, the skills of teacher AI integration explain a variance of 21.3% of student learning outcomes ($R^2 = 0.213$).

Table 7: Coefficients Table on prediction of learning results in students depending on the skills of teacher AI integration

Coefficients Table	B (Unstd.)	Std. Error	Beta (Std.)	t	Sig. (p)
(Constant)	2.78	0.21	—	13.24	0
Teacher AI Integration Skills	0.33	0.05	0.462	7.35	0

As shown in Table 7, the skills of teacher AI integration have a statistically significant positive effect on student learning outcomes and, therefore, Hypothesis H3 can be accepted.

Interpretation

A simple linear regression was performed to predict student learning outcomes based on teacher AI integration skills using a sample of 200 students.

- The results showed a significant positive relationship, $R = 0.462$, $R^2 = 0.213$, $F(1, 198) = 53.97$, $p < .001$.
- This suggests that teacher AI integration skills can explain 21.3% of the variance in student learning outcomes.
- The unstandardized coefficient ($B = 0.33$) indicates that for each unit increase in teacher AI integration skills, student learning outcomes increase by 0.33 units on average.

The model significantly predicts the dependent variable and shows that better teacher AI skills contribute positively to student learning.

General Findings

1. Students who report a high use of these AI tools (chatbots, tutoring software, or other AI-based learning sets) are likely to report increased learning outcomes, which implies that AI may be a good setup to improve comprehension, engagement, and performance as soon as they are used.
2. Learning outcomes are greatly dependent on the kind of AI tool in the classroom. The best tools to enhance learning experiences were found to be tutorials/adaptive tools when compared to grading and content-generation tools.

3. A teacher who is highly skilled and experienced in the use of artificial intelligence can have a significant impact on learning among students. The ability to incorporate AI tools with learning methods increases their engagement and understanding, as well as academic achievements.
4. Pearson correlation, ANOVA and regression analysis worked out to be statistically significant considering the three independent variables, that is, the frequency of using a tool, the type of tool and teacher expertise concerning the outcome of student learning.
5. Though over-reliance and ethical issues remain, the research has shown that when AI tools are properly implemented in education with the help of a mentor and masterfully, they may assist but not hinder the human learning process.
6. The outcomes of learning are better not only when being available with AI but structured in its application in parallel with the curriculum aims and in the guidance of knowledgeable teachers.
7. The results of AI being different depending on the type of the tool and the competence of a teacher signify the necessity of specific policies of AI implementation in institutions, professional development, and conduct regulations.

Suggestions

1. Teach the need to balance and purposeful use of AI tools to avoid student over-reliance and critical thinking.
2. Offer formal training to the teachers to facilitate and enhance skills to incorporate AI tool use in their teaching methods in the classroom.
3. Identify and favor AI tools with demonstrated content on learning, but make use of adaptive tutoring systems and personal learning systems.
4. Institutional policies should be designed to govern proper and ethical utilization of AI in classrooms.
5. Add AI literacy to the curriculum so that students know about the advantages and the restrictions of AI.
6. Regular workshops should be carried out to familiarize the faculty and students with the latest AI educational technologies and the ways of their use.
7. Adopt feedback mechanisms, making the students examine their learning experience with AI to enhance the selection and use of tools.
8. Foster a mixed-teaching style where the traditional methods are mixed with those that use AI-assisted learning to achieve more successful results.
9. The third strategy is to provide equal opportunities to all students in terms of access to AI tools, irrespective of their socio-economic status.

10. Evaluate the performance of the integration of AI constantly and adjust channels in line with data on numerical outputs of learning.

Conclusion

The current study proves that artificial intelligence integration into the classroom environment, when combined with experience of a trained instructor, has the potential of significantly increasing human learning. AI allows the teacher to focus on the more significant parts of education (instructional and relational) by automating repetitive and routine tasks. Strict empirical research proves student involvement and academic performance can be improved by means of the systematic and reasonable use of AI-based tools. Nevertheless, the role of a teacher cannot be called in question; the successful deployment of AI into the educational processes requires the involvement of teaching experts whose competence and active engagement disproportionately affect the quality of the entire AI implementation process. Significantly, the advantages that are bestowed by AI do not uniformly pervade; instead, their scale differs to the mode of application, and the particular features of the applied tools, as well as the pedagogical acuity with which the educators exploit these tools in the learning processes. Instead of replacing the human teacher, AI, when supported by a robust implementation framework, ought to be qualified as the supplement, which, when paired with a rigorous implementation framework, has a chance of boosting and not weakening the quality of human education.

Future Scope of the Study

The current question opens opportunities to more scholarly research into the changing status of AI in the educational process and its potential increase of importance in the future. Further research is tasked with the effort to explain the delayed cognitive impacts of AI-mediated learning, especially the effect of AI on higher-order thinking and logic as well as creative abilities in diverse age groups and across diverse academic areas of study. Additionally, exploring the opportunities in embedding ethical governance, educator professional development, and policy in a manner that helps facilitate sustainable implementation of AI will probably deepen the understanding of the role of careful and responsive stewardship of AI in the educational field. A comparative study between high and low-adopting institutions of AI would produce useful results in terms of preparedness and results. It would also be prudent to capture a broader view by compiling the opinions of administrators, policy makers, and parents, and will thus have a more holistic approach to how AI in academic settings is working. Also, data-protection issues and ethical breaches of the AI use in classrooms also require consideration. Future studies might be focused on understanding

how real-time AI feedback and adaptive learning journeys can impact personalized learning due to the current rapid development of AI technologies, including generative AI. Moreover, the establishment of AI implementation models in line with the realities of a specific place in developing areas should contribute greatly to the creation of equity within the international education framework.

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