

# Developing Practices: The Role of Artificial Intelligence in Enhancing Teacher Instructional Quality in the Punjab Higher Education Sector

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**Abstract:** This paper aims to examine the impact of AI on teachers' instructional quality, how AI transforms the method of delivery of content, reduces administrative workload, and influences teachers' attitudes and readiness to utilize AI-based tools. This paper provides further explorations on the issues and opportunities presented by AI in general and its implications on enhancing the interaction among teachers and students, teaching effectiveness, and positive impacts on educational outputs. The present study targeted 500 teachers selected from various institutes of Punjab, using a convenience sampling technique. The primary data were collected for the research with the questionnaire-based Google Form, and it resulted in 204 valid responses. The questionnaire would capture the importance of personal information and insights about the use of AI in teaching. A causal approach was applied to examine the relationship between AI and instructional quality by taking the regression analysis to ascertain the strength of the relationship. By integrating the model summary and ANOVA results, predictability, and the significance of the effect of AI influence on teachers' performance are evaluated. Results suggest that AI indeed plays a crucial role in refining instructional strategies by automating tasks, facilitating learning personalization, and allowing teachers to make the most of their student engagement and planning time. The paper recommends innovation in teacher training programs to master the effective use of AI tools. Continued evaluation of AI's impact on teaching practices and outcomes is also recommended as a normal continuous process of refining its role in the class.

**Keywords:** Artificial Intelligence (AI), Instructional Quality, AI Integration in Teaching.

## 1. Introduction

### A. Background

The origin of Artificial Intelligence (AI) can be dated from the middle of the 20th century, with an attempt directed towards imitating human intelligence using symbolic logic and solution-finding algorithms. It was Alan Turing who back in the modern versions of thinking conceived the ideas surrounding machine intelligence and went on to create basic forms of current neural networks popularized concerning Perceptron back in the 50's. Though advances were made this progress received a setback due to the unavailability of computational power and data they

termed as "AI winter" mid 70s and mid-80s. It emerged again in the twenty-first century propelled by innovation in machine learning technology, big data, and deep neural networks to produce developments such as computer vision, natural language processing and autonomous systems. Modern AI is at the core of many industries as it improves various sectors from healthcare to finance using automation, prediction and intelligently made decisions.

### B. Aim of Study

This paper should state whether AI has any impacts on teaching and learning by pointing out the way AI changes the process of giving content in classrooms in the current context, thereby reducing the administrative workload burdened on teachers' shoulders. It also tries to track teachers' attitudes, readiness, and adaptability toward AI-integrated educational interventions, interfaces, and systems. The study also scopes the challenges and opportunities associated with AI adoption, focusing on how this influences teacher-student interaction and professional roles as well as job satisfaction. This paper will help in developing plans for the effective integration of AI in education, effectively utilizing these technologies that will support educators and help in enhancing learning outcomes.

### C. Meaning of Artificial Intelligence

Artificial intelligence is the representation of human intellectual power through machine or computerized system. It employs developed algorithms and software useful in doing activities that are proportional to the human brain, such as learning, thinking, interpretation, decision making, understanding of natural languages, and reasoning. It can be of two types:

*Narrow AI:* It is specifically developed to perform the tasks of voice recognition or visual processing.

*General AI:* It is designed to perform intellectual tasks theoretically as the human brain does. It mainly depends upon the datasets/details/information and automated machines or high-tech technologies like automated learning, neural computing models and deep learning. These systems help to investigate vast quantities of data, find correlations, and draw

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conclusions.

#### *D. Use of AI and Teachers' Instructional Quality*

The infusion of AI can help make teachers' instruction quality better because it provides learning experiences that are tailored toward students' needs. Artificially intelligent tools can analyze student information to identify learning gaps that exist. Upon accessing such information, the educator can alter the teaching strategies he or she adopts. The data-informed technique is much more closely connected to interventions that are critical in building interest and elevating performance in school. However, since AI can also assist teaching, automate routine work, and free up the teacher to focus more on instructional design and interactive teaching methods, it will only be possible with proper utilization if teachers change their practice and embrace new technologies in order ultimately to improve the overall quality of instruction.

#### *E. Application of Artificial Intelligence in Teaching Methods*

**Adaptive Learning Platforms:** Other forms of AI applications are driven in the sense that they adapt the delivery of lessons according to the performance of the learners. These systems adapt the lessons and the exercises based on the data obtained to provide students with the appropriate data which will help them learn effectively and without the need to distract them from learning.

##### *1) AI-Powered Content Creation*

It can also be applied to help teachers crowd-source the generation of quizzes, lesson plans and even computer simulations based on certain topics of learning. Such tools aid educators in developing unique instructional content in different formats in conformance with curriculum requirements with little effort.

##### *2) Automated Grading*

Where concerns multiple-choice and short-answer questions, AI tools can help grade students work within effective time that frees up the teacher's time to focus on scoring tasks that need the human touch.

##### *3) Content Recommendation Engines*

AI recommends learning content that students would like to learn as well as learning videos and articles based on the student's past performance.

##### *4) Behavior Prediction and Intervention*

AI analyzes students' behavior to detect their possible disinterest or difficulties in learning, preventing a teacher from reaching out and helping them.

##### *5) Intelligent Tutoring Systems*

Artificial intelligence-assisted tutors give instantaneous feedback and facilities as if every student is being guided by a tutor when one or many of them are having difficulties in understanding topics or lessons.

##### *6) Gamified Learning*

AI can incorporate such items as games into lesson plans, giving students incentives to perform well and the prospect of facing obstacles in their learning process.

#### *F. Issues in Using AI in Teaching Methods*

There are plenty of issues to which instructors must be

exposed while incorporating AI in teaching. One of them would be insufficient training or professional development that makes instructors unready for dealing with AI, as they are not given the right know-how for amalgamation with tools that may help accelerate learning in the classroom. Another concern is one related to data privacy and security, making quite a few nervous about any chances of implementing AI. One of the potential limitations is a reluctance to adapt and skepticism about the efficacy of AI, for instance, many teachers are skeptical about its role in enhancing student performance. Costs are another pertinent challenge in these underfunded educational settings including an appropriate implementation of AI technologies and maintenance of infrastructural setup.

## **2. Review of Literature**

Ghamrawi, N., Shal, T., & Ghamrawi, N. A. (2024). This paper aimed to examine the effects of the emerging technology to teachers, comprising of how it opened or constrained teacher leadership as observed by teachers applying it in their practice. A cross-sectional qualitative study with 13 teachers, derived from five various countries, were interviewed semi-structurally; the data received went through thematic analysis. Quantitative research findings highlighted how the aspects of teacher leadership were both extended and contracted using AI. AI contributed to leadership by providing customization, designing instructional experiences, automating procedures, and developing professionals. But it also lowered leadership by reducing roles because of technology that took over some of the work. Five priorities for maintaining leadership in an age of artificial intelligence were proposed by teachers.

Singh, V., & Ram, S. (2024). Teachers' education in the context of AI has been looked at in this essay with the historical development of AI up to the present. It established AI in education explaining how it has revolutionized teacher training. It highlighted the need to train educators for an AI future: how to teach and learn to personalize learning, support AI-infused learning environments, and develop AI-aided content. It examined the advantages of effective implementation of big data such as enhancing the ease of access and embracing the use of analytics in decision-making processes as well as considering the appropriate implications and the ethical issues. The essay was composed of cases on how AI was used and lessons from the successes and failures. Lastly it outlined advancing future AI trends as well as its strengthening teacher education and educator preparedness.

Kim, J. (2024). The focus of the study was the best way of achieving 'Teachers and AI (TAC)', thereby improving education. It reviewed the curriculum that needed to be taught in an AI classroom, the roles of teachers and learned AIED, and the learning environments given deep interviews of twenty senior teachers in China. The teachers identified key goals for TAC: enhancing students' subject content knowledge and their performance abilities by analyzing data on students' academic achievements and evaluating their performance and reflections on tasks and assessments. They stressed the importance of data literacy of teachers, collaboration with AI, and the AI's knowledge of TPACK and conflict-solving abilities.

Kaplan-Rakowski, R., Grotewold, K., Hartwick, P., & Papin, K. (2023). This quantitative work explored the teacher’s knowledge mobilization instrument about GAI and its applicability in teaching. One hundred and forty-seven teachers filled in a standardized questionnaire on survey, implementation, possibilities, and issues of GAI. A continuum of positive attitudes about GAI was evidenced amongst teachers irrespective of the teaching approach and perceived this training aid more positively, the more they applied it in their practice. Teachers agreed with statements that indicated that GAI could enhance teachers’ learning and students' learning. I found it important to note that while the results were positive, positive views do not necessarily mean that the technology would be adopted by teachers in as found by prior research, teachers’ initial attitudes towards the technology are very important for its usage. The presented study provides an understanding of how GAI can be implemented in education.

**A. Need of Study**

AI is likely to integrate at a particular level into teacher practice and make teaching more instructive. Students are taken in greater classes and placed under various learning patterns, making it difficult for a teacher to attend to each child. Therefore, making data-driven insights possible and automating routine work can make differentiated instruction possible. At present, a very limited body of research is being developed focusing on how AI affects the instructional effectiveness of teachers in some specific context, Punjab. This study is crucial to think about AI's role in improving teaching strategies, enabling data-based decision-making, and enhancing overall classroom experience for better educational outcomes.

**B. Scope of Study**

The study explores the impact of AI on instruction quality among 500 teachers from Punjab, India. In this respect, it aims to identify effective applications of AI in pedagogy, assess improvements in teaching methodologies, and evaluate the overall influence of AI on the educational outcomes in this region.

**C. Objectives**

- 1) To determine the impact of artificial intelligence on the ways of delivering content in today’s classes.
- 2) This study aims to examine how AI implementation can alleviate teacher’s administrative burden.
- 3) To examine the teachers’ attitude and readiness regarding Artificial Intelligence integrated educational interventions as well as educational interfaces and systems.

**3. Research Methodology**

This study was targeted at 500 teachers from colleges of Punjab with an estimate of how AI might alter the teacher’s instructional quality. The researchers obtained 204 responses through a Google Form using convenience sampling. These participants are dispersed among different institutions and branches within the district. Therefore, they constitute the

elementary sampling unit. Convenience sampling was used due to its ease of access and with a minimum number of returns. The information is based on these responses. A causal approach is used to investigate the case between the use of AI and teacher’s instructional quality. Of course, primary data were gathered through online questionnaires. Such an action allowed researchers to access very quickly many teachers and to get different views on the subject under investigation.

**4. Data Analysis and Interpretation**

Data analysis is done while running Multiple regression to check the impact of the independent variable on the dependent variable.

Table:1  
Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.808 <sup>a</sup>	.653	.651	.413060518266522

a. Predictors: (Constant), Use of AI

Source: Author

*Interpretation:*

The analysis shows a high positive correspondence between the predictor (use of AI) and the dependent variable (Teacher’s instructional quality), hence the Teacher's instructional quality with an R-value of 0.808. The obtained value for R Square value was 0.653, which shows the proportion of variance in teacher's instructional quality accounted by the factor of Use of AI. The model fits very well. The Adj R Square is adjusted for the number of predictors and stays close at 0.651, which tends to support the robustness of the model in the explanation of variance. A standard error of 0.413 indicates the average distance of the observed data points from the regression line.

Table: 2  
ANOVA

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.777	1	64.777	379.658	.000 <sup>b</sup>
	Residual	34.465	202	.171		
	Total	99.242	203			

a. Dependent Variable: Teacher’s instructional quality

b. Predictors: (Constant), Use of AI

Source: Author

*Interpretation:*

The ANOVA table reveals whether the regression model is significant in general. The sum of squares of the regression, which calculates the fraction of the variance in the dependent variable, Teacher's instructional quality, that is explained by the independent variable Use of AI, was 64.777. The residual sum of squares, or the variation unexplained, was 34.465. The total sum of squares, or total variation in the dependent variable, was 99.242. The model is statistically significant because of its F-value of 379.658 with a p-value (Sig.) at .000. Use of AI is a strong predictor of Teacher's instructional quality.

Hence Alternate hypothesis H<sub>1</sub>, that is, AI has a significant relationship with Teacher's Instructional Quality is accepted.

The regression model explains about 64.78% variation in teachers' instructional quality and describes a strong, statistically significant positive relationship between them.

### 5. Findings

The results of the study indicate that the use of AI influences instruction quality in teaching. Indeed, a positive correlation was observed, showing that infusing AI into pedagogical approaches can help teaching professionals better prepare through better planning tools, assessment, and student-centered learning approaches. It can help automate mundane workloads, assist in making data-driven decisions, and respond to the needs of students, thus creating room for more time to be spent on instructional strategies and activities involved with students. This study demonstrates that the application of AI explains a good part of the variance in instructional quality, implying that it could be a potentially meaningful contributor to educational outcomes. This model was proved statistically to be valid via strong explanatory power and significance. The following results focus on the high value of AI as an important tool for improving teaching effectiveness that results in better learning environments.

### 6. Suggestions

From the above analysis, it is thus suggested that educational institutes and policymakers encourage the integration of AI technologies into teaching pedagogies to enhance the quality of instructions. This could be done through planning tools, assessment tools, and persons or learning technologies spurred on by AI. End. It eliminates routine tasks that give a teacher more time for better impact instructional strategies, and on the other hand, it promotes a data-driven approach in working with varied kinds of student needs. Training programs should be designed to ensure that educators learn skills to effectively utilize AI, so they're adequately prepared to unleash its full benefit. Such research should encourage ongoing processes of tracking the effects of AI on educational results and developing

new applications in varying aspects of teaching.

### 7. Conclusion

In conclusion, the study brought to the limelight the tremendous positive impact of AI on the quality of teacher instructional quality based on the powerful statistical relationships found in the analysis of regression. With an R-value of 0.808 and with an F-value indicating its significance, a high predictability was obtained; therefore, this supports the integration of AI technologies into educational practices. Since this would be able to automate routine teaching tasks and encourage planning, assessment, and personalized learning through AI, educators will be able to enhance their instructional effectiveness. The inclusion of AI in these areas might tend toward strategic teaching activities because they leave routine tasks to the system. Implications of the finding suggest the necessity of having an integrated educator training system that would enable educators to effectively tap into the capabilities of AI and monitor outcomes in education, all as affected using AI over time. Ultimately, embracing AI in education improves the quality of instruction but also fosters a more responsive and dynamic learning environment for students.

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