

Original Research Article

An Analysis of AI in Education and Skill Development

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Abstract: Artificial Intelligence (AI) is increasingly becoming part of teaching, learning, assessment and skill-development activities. AI tools can support personalized learning, provide rapid feedback, assist with problem solving and help students practise technical and communication skills. At the same time, excessive or uncritical use of AI may create risks such as over-dependence, reduced independent thinking, inaccurate information, privacy concerns and academic-integrity problems. This research paper examines the relationship between AI use in education and student skill development, with particular attention to AI literacy, conceptual understanding, critical thinking, problem solving, communication and responsible use of AI. The study follows a secondary-data research design using a publicly available Kaggle dataset on academic outcomes and AI dependency, supported by findings from recent peer-reviewed research. The proposed analysis uses descriptive statistics, an independent-samples t-test, correlation analysis and regression-based interpretation. The paper argues that the educational value of AI depends less on simple frequency of use and more on purposeful, ethical and guided use that strengthens rather than replaces human skills.

Keywords: Artificial Intelligence, AI in Education, AI Literacy, Skill Development, Critical Thinking, Academic Performance, AI Dependency, Higher Education.

1. Introduction :

1.1 Artificial Intelligence in Education

Artificial Intelligence in education refers to the use of computational systems that can perform or support activities traditionally requiring human intelligence, including language processing, prediction, recommendation, tutoring, feedback and content generation. In education, AI is now used through adaptive learning platforms, intelligent tutoring systems, automated feedback, learning analytics and generative-AI applications such as conversational assistants.

1.2 AI Literacy and Student Skills

AI literacy involves more than knowing how to operate an AI application. It includes understanding basic AI concepts, evaluating AI-generated information, recognizing limitations and bias, using AI responsibly, and applying AI to solve problems. Recent research on AI literacy identifies knowledge, affective attitudes and AI-related thinking as important dimensions. Project-based AI-literacy instruction has also been found to improve students' problem-solving ability and ethical understanding.

1.3 Skill Development through AI-Supported Learning

AI-supported education can contribute to technical and transferable skills when students actively engage with the learning process. Examples include coding assistance, research support, language practice, brainstorming, feedback, simulation and personalized practice. However, the same tools can weaken skill development when students use them mainly to obtain finished answers. Therefore, the central issue is not whether students use AI, but how and why they use it.

2. Literature Review

Delcker et al. (2024) examined the AI competence of first-year university students and its relationship with their intended and actual use of AI tools for learning. The study found that students' AI competence influences how they use AI applications during learning. It highlights the importance of developing AI knowledge and skills for effective AI-supported higher education.

Liu and Zhong (2024) conducted a systematic review of 45 empirical studies on AI education in K-12 education. Their findings indicate that AI education can develop students' AI literacy, knowledge, attitudes and AI-related thinking. The researchers also emphasized experiential learning approaches and identified the need for improved instructional design and further research in AI education.

Deng et al. (2025) conducted a systematic review and meta-analysis of experimental studies examining ChatGPT's impact on student learning. The findings showed positive effects on academic performance, affective-motivational outcomes and higher-order thinking. However, the researchers recommended stronger assessments that measure actual skills and long-term learning rather than simply evaluating AI-generated outputs.

Almasri (2024) examined the impact of Artificial Intelligence on teaching and learning in science education through a systematic review of empirical research. The study found that AI is transforming instructional practices and assessment strategies and can support student learning. It also identified challenges related to implementation, teacher perceptions and effective integration of AI in education.

Mustafa et al. (2024) reviewed existing literature reviews on Artificial Intelligence in Education to identify

major research themes and future directions. The study found that AI can support students and teachers and may improve learning, engagement, understanding, critical thinking and creativity. However, responsible implementation, ethical concerns and effective educational integration require continued research

Zhai, Wibowo and Li (2024) investigated the effects of over-reliance on AI dialogue systems on students' cognitive abilities. Their systematic review highlighted concerns about students accepting AI-generated recommendations without sufficient evaluation. The study emphasizes that excessive AI dependence may affect critical thinking, analytical thinking and decision-making, making responsible AI use important for student development.

3.1 Gap Analysis

Existing studies show that AI can improve learning, personalization, AI literacy and skill development. However, limited research examines AI usage, dependency, ethical awareness, conceptual understanding and academic performance together. There is also insufficient evidence regarding AI's long-term effect on independent thinking and problem-solving skills. This study addresses these gaps.

4. Objectives, Variables and Hypotheses

4.1 Objectives

To examine the role of Artificial Intelligence in education and student skill development.

- To identify patterns of AI use among students and distinguish productive use from dependency.
- To examine the relationship between AI usage/dependency and academic or learning outcomes.
- To study whether responsible and ethical AI use is associated with better conceptual understanding.
- To provide recommendations for students and educational institutions for effective AI supported learning.

4.2 Variables

Independent Variables

These are the factors that may influence students' learning and skill development:

1. **AI Usage** – frequency and extent of using AI tools.
2. **AI Dependency** – level of reliance on AI for academic tasks.
3. **AI Literacy** – students' knowledge and understanding of AI.
4. **AI Ethical Awareness** – awareness of responsible and ethical AI use.
5. **Study Habits** – study time and learning consistency.
6. **AI-Generated Content Usage** – extent to which students use AI-generated answers/content.

Dependent Variables

These are the outcomes that may be affected by the independent variables:

1. **Academic Performance** – final score/academic achievement.
2. **Conceptual Understanding** – students' understanding of academic concepts.
3. **Problem-Solving Skills** – ability to solve problems independently.
4. **Critical Thinking Skills** – ability to analyze and evaluate information.
5. **Overall Skill Development** – development of technical and soft skills.

4.3 Hypotheses

H1: There is a statistically significant relationship between AI usage intensity and student

learning/academic outcomes.

H2: Responsible and ethical use of AI is positively associated with conceptual understanding.

H3: Higher AI dependency is associated with weaker independent learning outcomes that purposeful AI-supported learning.

H4: AI literacy and effective use of AI are positively associated with skill-development indicators such as problem solving and conceptual understanding.

5. Methodology

5.1 Research Design

The study uses a quantitative, secondary-data research design. The research combines a review of recent academic literature with statistical analysis of a publicly available Kaggle dataset. The approach is explanatory because it aims to identify relationships between AI-related variables and learning outcomes rather than merely describe AI adoption.

5.2 Sample Size

Sample Size Calculation

For a population of **8,000 students**, with a **5% level of precision**, Yamane's formula is:

Formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- **n** = Required sample size
- **N** = Population size = 8,000
- **e** = Level of precision = 0.05

Calculation:

$$\begin{aligned} n &= \frac{8000}{1 + 8000(0.05)^2} \\ n &= \frac{8000}{1 + 8000(0.0025)} \\ n &= \frac{8000}{1 + 20} \\ n &= \frac{8000}{21} \\ n &= 380.95 \\ n &\approx 381 \end{aligned}$$

Therefore,

Required Sample Size = 381 respondents

5.3 Data Collection

Secondary data will be obtained from Kaggle in CSV format. The selected dataset contains demographic variables, study habits, AI interaction measures, AI dependency, AI ethics, academic performance and concept-understanding measures. The dataset should be downloaded and retained with its original attribution/license information.

5.4 Data Pre-processing

- Check column names, data types and coding consistency.
- Identify missing values and document the treatment used.
- Check duplicate records and remove only confirmed duplicates.
- Inspect numerical ranges and categorical values for invalid entries.
- Encode categorical variables where required for statistical modelling.
- Create derived groups such as low, medium and high AI dependency if justified by the data distribution.
- Document every transformation so the analysis can be reproduced.

6. Data Analysis and Findings

6.1 Descriptive Analysis

The first stage should summarize the distribution of AI use, AI dependency, AI ethics, study behaviour and academic outcomes. Recommended outputs include frequency tables for categorical variables, mean/median/standard deviation for continuous variables, and bar charts or histograms for major variables.

Measure	Recommended statistic	Purpose
AI usage	Frequency, percentage, mean usage time	Describe adoption and intensity
AI dependency	Mean, SD, quartiles	Measure reliance on AI
AI ethics	Mean, SD	Assess responsible-use behaviour
Concept understanding	Mean, SD	Measure learning/skill outcome
Final score	Mean, SD, range	Measure academic performance

6.2 Hypothesis Testing Plan

An independent-samples t-test can be used to compare the mean learning outcome of two groups, for example AI users versus non-users, provided the grouping variable and assumptions are appropriate. Pearson correlation can be used for continuous variables, while multiple regression can be used to examine whether AI-related variables predict outcomes after controlling for study behaviour and demographic factors.

Hypothesis	Test	Decision rule	Result to report
H1	Independent-samples t-test / correlation	$p < 0.05$	t, df, p-value, mean difference / r
H2	Pearson correlation / regression	$p < 0.05$	r or β , p-value, R^2
H3	Correlation / regression	$p < 0.05$	direction and strength of association
H4	Regression / correlation	$p < 0.05$	β , p-value, R^2

6.3 T-Test Reporting Table

The following table is intentionally left as a reporting template. The numerical values should be calculated from the downloaded CSV file rather than copied from another study.

Group	N	Mean outcome	SD	t-value	df	p-value	Decision
AI users	To calculate	To calculate	To calculate	To calculate	To calculate	To calculate	Reject/Fail to reject H_0
Non-AI users	To calculate	To calculate	To calculate				

6.4 Interpretation Framework

If the p-value is below 0.05, the null hypothesis for the relevant test can be rejected and the difference or association may be treated as statistically significant within the dataset. If the p-value is 0.05 or higher, the null hypothesis should not be rejected. Statistical significance should not be interpreted as proof of causation. Effect size, confidence intervals, data quality and the synthetic nature of the selected dataset should also be considered.

6.5 Findings Expected from the Literature

The literature reviewed for this paper suggests that effective AI integration is more likely to support learning when students use AI for explanation, feedback, practice, brainstorming and guided problem solving. Recent evidence also suggests that AI literacy and project-based learning can strengthen problem-solving and ethical understanding. At the same time, excessive dependency and uncritical acceptance of AI output may undermine independent reasoning. These findings provide the theoretical basis for testing the hypotheses in the selected dataset.

7. Recommendations Based on the Study

Recommendation	Action
Teach AI literacy as a core skill	Students should learn how AI systems work at a basic level, how to evaluate outputs, and how to recognize bias, hallucination and privacy risks.
Use AI as a learning partner	Students should ask AI to explain concepts, generate practice questions, provide feedback and challenge their reasoning rather than simply produce final answers.
Assess skills, not only answers	Teachers should use project work, oral explanations,

	demonstrations and process-based assessment so that students must show how they reached a solution.
Promote ethical AI use	Institutions should provide clear rules on attribution, privacy, academic integrity and acceptable AI assistance.
Monitor dependency	Students who rely heavily on AI-generated content should be encouraged to complete independent practice and reflection activities.
Develop employability skills	AI education should be combined with communication, critical thinking, problem solving, teamwork, creativity and domain-specific technical skills.

8. Conclusion

Artificial Intelligence has the potential to reshape education and skill development by providing personalized support, rapid feedback, accessible explanations and opportunities for practice. However, AI should complement human learning rather than replace it. The central educational goal should be to develop students who can understand AI, question its outputs, use it ethically and apply it to solve real problems. This research paper proposes a data-driven approach to examining AI usage, dependency, ethical awareness and learning outcomes using a public Kaggle dataset. The proposed statistical tests can help determine whether observed differences and associations are statistically meaningful. Because the selected dataset is synthetic, future studies should validate the findings using primary survey data or longitudinal data collected from real students across different institutions and educational levels.

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