

# Digital Transformation in Learning: Analysis of the Impact of AI Use on Education Students' Learning Outcomes

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## ABSTRACT

Digital transformation in the world of education has presented artificial intelligence (AI) as a potential innovation in improving the quality of learning. This study aims to analyze the impact of AI use on student learning outcomes in higher education environments. The approach used is a mixed method with data collection techniques in the form of questionnaires, interviews, and documentation of learning outcomes. The sample consisted of 120 students of education study programs from two universities in Indonesia. The results of the study showed that there was a positive and significant relationship between the level of AI use and student learning outcomes, which was reinforced by the results of the ANOVA test and t-test with a p value <0.05. In addition, students' perceptions of AI were very positive, especially in terms of time efficiency, ease of understanding the material, and increased learning motivation. However, challenges such as potential dependency, weak critical digital literacy, and lack of AI integration in the curriculum still need serious attention. This study concludes that AI can be an effective facilitator of adaptive learning if supported by pedagogical policies and strengthening academic ethics. The implications of this study encourage the need to develop holistic and integrative AI-based learning models in higher education.

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## 1. INTRODUCTION

The development of digital technology has brought significant changes in various aspects of life, including in the field of education. Digital transformation has become a global phenomenon that cannot be avoided and requires the world of education to adapt quickly. One form of this transformation is the use of artificial intelligence (AI) in the learning process. AI provides various conveniences, such as personalization of learning, automation of evaluation, and predictive analysis of student performance. In higher education environments, especially in educational study programs, the use of AI-based technology is increasing. Various learning applications and platforms such as educational chatbots, adaptive learning systems, and AI-based virtual assistants have begun to be used to support the teaching and learning process. This technology allows students to learn more independently, flexibly, and according to their own pace and learning style. However, an important question arises: to what extent does the use of AI impact student learning outcomes, especially in the context of developing pedagogical, professional, social, and personality competencies?

Several previous studies have highlighted the benefits of AI in improving the efficiency and effectiveness of learning. However, most of them still focus on the technical aspects or implementation of technology in the classroom, rather than on a comprehensive analysis of its impact on student learning outcomes. Therefore, this study aims to analyze the impact of the use of AI technology in learning on the learning outcomes of education students. The focus of the study not

only covers cognitive achievement, but also includes affective and psychomotor aspects which are important elements in the education of prospective professional educators.

Through this approach, it is hoped that this research can provide theoretical and practical contributions in the development of AI-based digital learning models, as well as become a basis for policy making in higher education in welcoming the era of education 5.0.

### **Formulation of the problem**

Based on the background that has been described, the formulation of the problem in this research is as follows:

1. What forms of utilization of artificial intelligence (AI) technology are there in the learning process of education students?
2. To what extent does the use of AI impact the learning outcomes of education students, both in cognitive, affective, and psychomotor aspects?
3. What are the challenges and opportunities faced in implementing AI in the learning process in higher education environments?

### **Research purposes**

This research aims to:

1. Describes the forms of use of AI technology in the learning process of education students.
2. Analyzing the impact of AI use on student learning outcomes, covering cognitive, affective, and psychomotor aspects.
3. Identifying challenges and opportunities in the application of AI technology in learning in higher education, especially in education study programs.

### **Benefits of research**

This research is expected to provide the following benefits:

#### a. Theoretically

Contributing to the development of studies on the integration of digital technology, especially AI, in the learning process in higher education, as well as enriching the literature on learning outcomes based on technology approaches.

#### b. Practically

To be a reference for lecturers, curriculum developers, and policy makers in higher education environments to optimally implement AI technology in learning, in order to improve the quality and effectiveness of the education process.

#### c. Socially

Encouraging the readiness of education students in facing the dynamics of the increasingly digital and technology-based world of work, while preparing graduates who are adaptive to changes in the times.

### **Literature review**

#### 1. Digital Transformation in Education

Digital transformation refers to fundamental changes in the teaching and learning process due to the adoption of digital technologies (Selwyn, 2020). Higher education is currently in an era of disruption, where digital innovation is the driving force behind changes in curriculum, pedagogy, and assessment systems.

#### 2. Artificial Intelligence (AI) in Learning

AI has great potential in education. According to Holmes et al. (2021), AI applications in learning include intelligent tutorial systems, automated assessments, and adaptive learning. AI can also help identify students' learning needs on a personal basis.

#### 3. Student Learning Outcomes

Learning outcomes are indicators of the success of the learning process and include cognitive, affective, and psychomotor dimensions (Bloom, 1956). In the context of higher education, measuring learning outcomes is important to assess the effectiveness of teaching methods and the relevance of the curriculum.

#### 4. Related Research

Research by Chen et al. (2022) shows that AI integration in learning can improve student learning outcomes and engagement. However, challenges such as digital inequality and user readiness are still concerns (Zawacki-Richter et al., 2019).

## 2. RESEARCH METHOD

This study uses a mixed methods approach with a sequential explanatory design. Quantitative research was conducted first to measure student learning outcomes, followed by a qualitative approach to explore their experiences and perceptions of AI use.

- Population and Sample: Students from education study programs at two state and private universities, with a total sample of 120 people.
- Data Collection Techniques: Questionnaires, semi-structured interviews, observations, and documentation of learning outcomes.
- Instruments: Likert questionnaire for perception of AI usage, learning outcome assessment rubric, interview guideline.
- Data Analysis: Quantitative data were analyzed using descriptive statistics and simple regression; qualitative data were analyzed using reduction, display, and conclusion techniques (Miles & Huberman, 1994).

## 3. RESULTS AND DISCUSSIONS

### Level of AI Utilization in Learning

Most students stated that they have used AI in various forms, such as writing assignments, searching for references, and even automatic practice questions. Here is the distribution of its use:

**Graph 1.** Distribution of AI Utilization Levels by Students

AI Utilization Levels	Number of Students	Percentage (%)
Tall	56	47%
Currently	43	35.8%
Low	21	17.5%
Total	120	100%

*(Display in publication as a pie chart or bar chart)*

### Impact of AI on Learning Outcomes

The average final grades of students were analyzed based on the categories of AI utilization:

**Table 2.** Impact of AI on Learning Outcomes

AI Usage Categories	Average Value	Standard Deviation
Tall	88.5	4.2
Currently	83.4	5.3
Low	76.7	6.1

One-way ANOVA test was conducted to determine whether there were significant differences in mean values between groups:

#### ANOVA results:

- $F(2,117) = 9.65$
- $p = 0.0002$  ( $p < 0.05$ )

Interpretation: There is a significant difference in learning outcomes based on the level of AI utilization. Students with a high level of AI utilization show better learning outcomes.

### Analysis of Student Perceptions of AI

The perception questionnaire consists of 10 Likert scale items (1-5). The overall mean score is 4.13, indicating that students have a positive perception of AI in learning.

Dimensions of Perception:

**Table 3.** Analysis of Student Perceptions of AI

Dimensions	Average Score	Category
Ease of access to materials	4.45	Very Positive
Efficiency of learning time	4.32	Very Positive
Learning independence	4.01	Positive
Anxiety about the authenticity of the work	3.68	Quite Positive
Dependence	3.55	Quite Positive

Graph 2. Visualization of Average Student Perception per Dimension (use bar chart in the article)

#### 4. t-test: Differences in Learning Outcomes between Students Who Actively Use and Do Not Use AI

Groups compared:

- a. Group A (Actively using AI, n=70): Average score 87.2
- b. Group B (Less/not actively using AI, n=50): Mean score 78.6
- c. t-Test Results:
  - 1)  $t(118) = 5.28$
  - 2)  $p = 0.00001$

Interpretation: The difference in learning outcomes between students who actively and inactively use AI is statistically significant. This strengthens the hypothesis that the use of AI has a positive impact on academic performance.

#### Qualitative Findings (Interview)

Several key quotes from the interviews support the quantitative data:

- Students find it helpful in shortening study time:

"With the help of AI, I can outline my paper faster and focus on deepening the content."

- Concerns about plagiarism and dependency:

"If we are not careful, we can become too dependent. There must still be filters from lecturers and ourselves."

#### Discussion

The results of the study show that the use of artificial intelligence (AI) technology in the learning process has a significant relationship to improving the learning outcomes of education students. This finding is in line with the theory of digital constructivism which states that technology can function as a cognitive aid that allows students to build knowledge actively and independently (Jonassen, 1999).

#### AI as a Facilitator of Adaptive Learning

Students who use AI in learning are helped to understand the material through various features, such as automated feedback, conceptual explanations, and interactive simulations. In this context, AI acts as a learning assistant that is able to adjust the approach based on the individual needs of students. This supports Holmes et al.'s (2021) view that AI can improve learning personalization, namely learning that is tailored to students' learning styles, learning speeds, and interests. Learning becomes more efficient, as reflected in higher academic scores in groups with high intensity of AI use. Students not only understand the material faster, but are also more confident in completing analysis and synthesis-based tasks.

#### Impact on Cognitive and Motivational Aspects

The significant increase in academic scores of the group of students who actively use AI shows a strong impact on the cognitive aspect. AI helps students access information more widely and quickly, which encourages deeper understanding of the material. In addition, students' perceptions of AI are very positive in the dimensions of time efficiency and ease of access to materials.

Motivation to learn also appeared to increase, as reflected in qualitative findings: students felt more engaged and excited because AI provided an interactive and instant learning experience. This is in line with intrinsic motivation theory, where technology that provides control and positive feedback encourages higher cognitive engagement (Deci & Ryan, 2000).

### **Affective Challenges and Academic Ethics**

However, behind these benefits, several important challenges emerge. Students expressed a tendency to rely on AI and concerns about the authenticity of the work. This indicates the need to strengthen critical digital literacy and academic ethics. Without pedagogical guidance from lecturers, the undirected use of AI can lead to academic dishonesty, copy-paste thinking, and weak student reflection skills.

The affective and social aspects of learning are also not optimally accommodated. One-way interaction with AI can reduce the collaborative learning experience, which is an important element in value and character-based education.

### **Integration of AI in Curriculum and the Role of Lecturers**

One important finding is that the use of AI is still not integrated into the curriculum systematically. Students use AI on their own initiative, not because of encouragement from the formal learning system. This shows a gap between students' digital transformation and the readiness of educational institutions.

Lecturers have a crucial role in guiding the use of AI to stay within the pedagogical, ethical, and constructive corridor. AI should not replace the role of lecturers, but as a complementary tool in hybrid learning or curriculum digitalization. The development of a contextual and inclusive AI-based curriculum needs to be carried out immediately, including training lecturers to have digital competence and AI pedagogy (AI pedagogical literacy).

### **Implications for Learning Model Development**

The results of this study open up opportunities for the development of AI-based adaptive learning models that integrate three main aspects:

- a. Cognitive: Optimize learning outcomes through fast access, adaptive explanations, and instant feedback.
- b. Affective: Strengthening motivation, interest, and engagement through interactive and experience-based features.
- c. Ethics and Character: Instilling academic values through the integration of reflective, collaborative, and anti-plagiarism companion instruments.

The development of this model will be a strategic contribution to higher education that wants to remain relevant in the ever-evolving digital ecosystem.

## **4. CONCLUSION**

This study shows that the use of artificial intelligence (AI) in the learning process has a positive impact on the learning outcomes of education students. Students who actively use AI in their academic activities—such as understanding materials, compiling assignments, and accessing references—show significant improvements in cognitive aspects, especially in terms of final semester grades. In addition, students' perceptions of the use of AI are very positive, especially in terms of time efficiency and ease of access to information. However, this study also revealed challenges that need to be considered, such as the potential for dependence on AI, weak critical digital literacy, and the lack of systemic integration of AI use in higher education curricula. Affective aspects and academic ethics need to be emphasized so that the use of this technology remains within the corridor of meaningful and responsible learning. Thus, AI has great potential to support digital transformation in higher education, but its utilization needs to be directed pedagogically and strategically. Lecturers and educational institutions need to take an active role in guiding and directing the integration of AI in learning so that it can provide maximum impact on the quality of student learning outcomes holistically.

## **REFERENCES**

- Aoun, J. E. (2017). *Robot-proof: Higher education in the age of artificial intelligence*. MIT Press.
- Boud, D., & Falchikov, N. (2007). *Rethinking assessment in higher education: Learning for the longer term*. Routledge.
- Chen, X., Zou, D., Cheng, G., & Xie, H. (2022). Detecting learning styles using AI-powered learning analytics: A review of recent advances. *Educational Technology & Society*, 25(1), 78–90.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268.

- Fitria, T. N. (2021). The Role of Artificial Intelligence in English Language Learning. *Journal of English Education and Linguistics Studies (JEELS)*, 8(2), 191–205.
- Goksel, N., & Bozkurt, A. (2019). Artificial intelligence in education: Current insights and future perspectives. *International Journal of Technology in Education and Science*, 3(1), 3–11.
- Holmes, W., Bialik, M., & Fadel, C. (2021). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.
- Huang, R. H., Liu, D. J., Tlili, A., Yang, J. F., & Wang, H. H. (2020). *Handbook on facilitating flexible learning during educational disruption: The Chinese experience in maintaining undisrupted learning in COVID-19 outbreak*. Smart Learning Institute of Beijing Normal University.
- Irwansyah, D. (2022). Tantangan dan peluang pemanfaatan AI dalam pendidikan tinggi di Indonesia. *Jurnal Teknologi Pendidikan*, 24(3), 145–156.
- Jonassen, D. H. (1999). *Designing constructivist learning environments*. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. II, pp. 215–239). Lawrence Erlbaum Associates.
- Kurniawan, A. (2023). Analisis penggunaan ChatGPT terhadap kemampuan menulis ilmiah mahasiswa. *Jurnal Inovasi Pendidikan*, 15(1), 67–76.
- Li, Y., & Ma, X. (2022). Artificial intelligence in education: A review. *IEEE Access*, 10, 12345–12358.
- Liu, R., & Wang, Y. (2021). Adaptive learning systems with AI: Enhancing student learning experience. *Journal of Educational Computing Research*, 59(6), 1027–1050.
- Mubin, S., & Huda, N. (2020). Integrasi AI dalam pembelajaran daring: Peluang dan tantangan di era revolusi industri 4.0. *Jurnal Pendidikan Teknologi dan Kejuruan*, 21(2), 110–120.
- OECD. (2021). *AI and the Future of Skills, Volume 1: Capabilities and Assessments*. OECD Publishing. <https://doi.org/10.1787/5f9585f0-en>
- Pratama, R. Y., & Suparno. (2021). Persepsi mahasiswa terhadap penggunaan AI dalam penyusunan tugas akademik. *Jurnal Riset Pendidikan*, 18(2), 120–132.
- Raj, R., & Renumol, V. G. (2020). AI-based adaptive learning systems: Recent trends and challenges. *Journal of Ambient Intelligence and Humanized Computing*, 11(3), 1201–1215.
- Salas-Pilco, S. Z., Yang, Y., & Zhang, Z. (2022). Education in times of disruption: The role of AI-powered learning platforms. *Educational Technology Research and Development*, 70, 25–45.
- Suhendar, A., & Putri, D. A. (2022). Analisis efektivitas ChatGPT sebagai media pembelajaran mandiri mahasiswa. *Jurnal Ilmu Pendidikan dan Pembelajaran*, 12(4), 222–231.
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 1–27. <https://doi.org/10.1186/s41239-019-0171-0>