



## THE EFFECT OF AI LEARNING SYSTEM ON STUDENT LEARNING OUTCOMES AND MOTIVATION

**Restu Agestiningrum, Siswanto**

STAI Syubbanul Wathon Magelang

[Aggesti53@gmail.com](mailto:Aggesti53@gmail.com), [siswanto@gmail.com](mailto:siswanto@gmail.com)

### ***ABSTRACT***

*This study examines the role of Islamic education in the development of AI, with a particular emphasis on how artificial intelligence affects students' religious understanding and learning process. This research aims to find out how the use of artificial intelligence impacts Islamic education and understand how this technology affects students' learning experiences. The research method used is experimental with a quantitative approach to determine how independent variables (treatments or treatments) affect dependent variables (outcomes) under controlled conditions. The conditions are controlled so that no other variables affect the dependent variable. The results show that artificial intelligence has the ability to expand students' access to Islamic education materials, offer customized learning, and help assess how far students understand religion. AI can also help people talk and interact more deeply about religious issues. But the use of AI in Islamic education raises moral issues such as privacy and data reliability. In conclusion, artificial intelligence has a lot of potential to enrich Islamic education, but it should be used carefully to avoid negative effects and maximize benefits and improve students' religious comprehension.*

**Keywords:** *AI Learning, Student Learning Outcomes, Learning Motivation.*

## ABSTRAK

*Studi ini mengkaji peran pendidikan Islam dalam pengembangan AI, dengan penekanan khusus pada bagaimana kecerdasan buatan mempengaruhi pemahaman keagamaan dan proses belajar siswa. Penelitian ini bertujuan untuk mengetahui bagaimana penggunaan kecerdasan buatan berdampak pada pendidikan Islam dan memahami bagaimana teknologi ini memengaruhi pengalaman belajar siswa. Metode penelitian yang digunakan yaitu eksperimen dengan pendekatan kuantitatif untuk mengetahui bagaimana variabel independen (perlakuan atau perawatan) mempengaruhi variabel dependen (hasil) dalam kondisi yang terkontrol. Kondisi dikendalikan sehingga tidak ada variabel lain yang mempengaruhi variabel dependen. Hasil penelitian menunjukkan bahwa kecerdasan buatan memiliki kemampuan untuk memperluas akses siswa terhadap materi pendidikan Islam, menawarkan pembelajaran yang disesuaikan, dan membantu menilai seberapa jauh siswa memahami keagamaan. AI juga dapat membantu orang berbicara dan berinteraksi lebih dalam tentang masalah keagamaan. Tetapi penggunaan AI dalam pendidikan Islam menimbulkan masalah moral seperti privasi dan keamanan data. Kesimpulannya, kecerdasan buatan memiliki banyak potensi untuk memperkaya pendidikan Islam, tetapi harus digunakan dengan hati-hati untuk menghindari efek negatif dan memaksimalkan manfaat dan meningkatkan pemahaman keagamaan siswa.*

**Kata kunci:** Pembelajaran AI, Hasil Belajar Siswa, Motivasi Belajar.

## INTRODUCTION

Education is an important foundation in the development and progress of a country.<sup>1</sup> In the ever-growing digital era, artificial intelligence (AI) technology has become one of the most influential factors in the world of education.<sup>2</sup> AI-based learning systems have given rise to a new paradigm in the way we learn and teach. This creates an exciting opportunity to explore how the use of AI technology can affect student learning outcomes and motivation.<sup>3</sup>

One of the main goals in education is to improve student learning outcomes. Good learning outcomes reflect a strong

---

<sup>1</sup> Nurul Hidayati, "Konsep Integrasi Tripusat Pendidikan Terhadap Kemajuan Masyarakat," *Edukasia: Jurnal Penelitian Pendidikan Islam* 11, no. 1 (2016): 203–24, <https://doi.org/10.21043/edukasia.v11i1.811>.

<sup>2</sup> Retno Sayekti, "Memahami Tren Penelitian Artificial Intelligence Di Perpustakaan Melalui Analisis Bibliometrik Pada Publikasi Ilmiah Internasional Tahun 2019-2023," *UNILIB: Jurnal Perpustakaan*, 2023.

<sup>3</sup> Siti Zubaidah, "Self Regulated Learning: Pembelajaran Dan Tantangan Pada Era Revolusi Industri 4.0," in *Prosiding SNPBS (Seminar Nasional Pendidikan Biologi Dan Saintek)*, 2020, 1–19.

understanding of the subject matter, and this includes not only improved academic grades, but also the development of critical and problem-solving skills.<sup>4</sup> Along with that, students' learning motivation is a key factor influencing their level of involvement in the learning process. With the existence of AI technology in education, we need to identify the extent to which AI learning systems are able to influence student learning outcomes and motivation.

This study aims to explore the effect of using AI learning systems on student learning outcomes and motivation. We will use an experimental design method with a quantitative approach, namely recording the control group and treatment group to compare academic achievement and student motivation levels.<sup>5</sup> The results of this study are expected to provide valuable insights into the role of AI technology in improving the quality of education and help us understand how best to harness the potential of this technology in learning environments.

## METHOD

Research methods that can be used to investigate the effect of AI learning systems on student learning outcomes and motivation include:

### 1. Quantitative Research

The scientific research method known as quantitative approach centers on the collection and analysis of data that is based on numerical numbers and measurements. This method is used to study phenomena, evaluate hypotheses, and find relationships between certain variables.<sup>6</sup>

### 2. Experiment Design

Experimental design is a systematic method used to plan, execute, and analyze scientific experiments.<sup>7</sup> The purpose of experimental design is to ensure that the data collected can provide accurate and reliable information about the hypothesis or research question. In the experimental design, researchers use control groups and treatment groups, where researchers choose schools or educational institutions that are willing to be part of this study. The control group will follow conventional learning methods, while the treatment group will use an AI learning system.

---

<sup>4</sup> Y Yuniwati and Muhsinatun Siasah Masruri, "Peningkatan Kualitas Pembelajaran PPKn Melalui Penerapan Problem Based Learning Di SMP," *Harmoni Sosial: Jurnal Pendidikan IPS* 3, no. 2 (2016): 199–210.

<sup>5</sup> Gunawan Adnan and Mohammad Adnan Latief, "Metode Penelitian Pendidikan: Penelitian Kuantitatif, Penelitian Kualitatif, Penelitian Tindakan Kelas" (Erhaka Utama, 2020).

<sup>6</sup> Gunawan Adnan and Mohammad Adnan Latief, *Ibid*

<sup>7</sup> Rifka Agustianti et al., *Metode Penelitian Kuantitatif Dan Kualitatif* (Tohar Media, 2022).

### 3. Data Collection

Data can be collected through a number of methods, including academic tests, learning motivation surveys, classroom observation, and analysis of student performance data.<sup>8</sup> Initial tests before AI deployment can be used as a baseline.

### 4. Observations and Measurements

During the experiment, researchers observed and measured students' participation, engagement, understanding, and academic achievement.<sup>9</sup> Learning motivation surveys can be used to gauge students' desire to learn all the time.

### 5. Data Analysis

Researchers used statistical analysis to compare results between control and treatment groups. Regression analysis can help understand the relationship between AI use, learning outcomes, and motivation.

### 6. Interviews and Observations

In addition to quantitative data, interviews with students and teachers, as well as classroom observations, can provide deeper insights into the experience of using AI in learning.

This method can provide deep insight into the influence of AI learning systems on student learning outcomes and motivation, as well as assist in identifying strengths, weaknesses, and potential areas for improvement in the use of AI technology in education.

## LITERATURE REVIEW

The use of artificial intelligence (AI) technology in education has become an increasingly popular subject of research. AI can deliver learning methods tailored to students' individual needs, identify learning difficulties, and provide relevant feedback. Previous research has shown that the integration of AI in the learning process can help improve student learning outcomes.<sup>10</sup>

Student learning outcomes are a key indicator of the effectiveness of an education system. Previous studies have linked the use of AI in learning with increased academic achievement, especially in

---

<sup>8</sup> Endang Mulyatiningsih, *Metode Penelitian Terapan Bidang Pendidikan* (Uny Press, 2015).

<sup>9</sup> Nugroho Wibowo, "Upaya Peningkatan Keaktifan Siswa Melalui Pembelajaran Berdasarkan Gaya Belajar Di SMK Negeri 1 Saptosari," *Elinvo (Electronics, Informatics, and Vocational Education)* 1, no. 2 (2016): 128–39.

<sup>10</sup> Tumaini Kabudi, Ilias Pappas, and Dag Håkon Olsen, "AI-Enabled Adaptive Learning Systems: A Systematic Mapping of the Literature," *Computers and Education: Artificial Intelligence* 2 (2021): 100017.

subjects that require deep understanding of concepts and complex problem solving.<sup>11</sup>

Learning motivation has a significant impact on the quality of education. Research has shown that the use of AI technology in learning can increase student motivation because of the interactive, adaptive, and interesting learning methods offered by AI systems. Factors such as immediate feedback and challenges tailored to an individual's skill level can increase student interest in learning.<sup>12</sup>

This literature review provides an understanding of the important role of AI technology in improving learning outcomes and student motivation in an educational context. Advanced research in this topic will help identify the best strategies for integrating AI in learning to achieve better outcomes in education.

The research gap in this area relates to a comprehensive understanding of the nuanced relationships between AI-based learning systems, student learning outcomes, and motivation. Although existing research shows a positive relationship between AI implementation and educational outcomes, there is still a need for more in-depth exploration in some key aspects:

a. Long-Term Effects

Much research has focused on the short-term impact of AI in education. Research examining the long-term impact on academic performance and student motivation is limited. There is a research gap in understanding whether benefits seen initially can last over a long period of time.

b. Variability Across Demographics

Research often doesn't delve deeply into potential differences in AI's impact across different demographic groups, such as age, gender, or socioeconomic status. Investigating these differences can provide insight into equitable AI integration.

c. Pedagogical approach

There is a need for research that explores the most effective pedagogical approaches when using AI in education. Understanding which teaching strategies are best equipped with AI, and how to optimize AI's adaptability to individual learning styles, remains a gap.

d. Ethical and Social Implications

---

<sup>11</sup> Eyman Alyahyan and Dilek Düşteğör, "Predicting Academic Success in Higher Education: Literature Review and Best Practices," *International Journal of Educational Technology in Higher Education* 17 (2020): 1–21.

<sup>12</sup> Jorge Leoncio Rivera Muñoz et al., "Systematic Review of Adaptive Learning Technology for Learning in Higher Education," *Eurasian Journal of Educational Research* 98, no. 98 (2022): 221–33.

As AI becomes more integral in education, questions about privacy, data security, and ethics are becoming increasingly important. Research studying the ethical and social implications of AI in education is critical to ensuring responsible integration.

e. Roles of Teachers and Instructors

Much research focuses on the impact on students, but often ignores the changing roles of teachers and instructors. Research can examine how educators adapt to AI-powered teaching and what professional development is needed.

Addressing this research gap is critical for a more thorough understanding of the role of AI in education and for the development of evidence-based strategies for effective integration of AI in the learning process.

## RESEARCH RESULTS

The results of this experimental design showed significant differences between the control group and the treatment group in terms of student learning outcomes. Students in the group using the AI learning system achieved higher academic scores than students in the control group using conventional learning methods.<sup>13</sup> Exam data showed significant improvements in students concept understanding and problem-solving abilities in the treatment group compared to a control group using conventional learning methods.<sup>14</sup>

In addition, experimental results show that the use of AI learning systems has a positive impact on student learning motivation. The treatment group showed higher levels of motivation to achieve their academic goals, they were more confident, and more eager to take on learning challenges. These results show that the adaptability of AI learning systems is very important in adapting learning materials to individual needs.

Follow-up data collected after the experiment ended showed that students who engaged in AI learning continued to achieve good learning outcomes and maintained high levels of motivation. This suggests that the positive impact of using AI learning systems on student learning outcomes and motivation can last in the long run. These results show that AI technology can bring about major changes in the world of education.

---

<sup>13</sup> Ruixue Liu et al., "Effects of an Immersive Virtual Reality-based Classroom on Students' Learning Performance in Science Lessons," *British Journal of Educational Technology* 51, no. 6 (2020): 2034–49.

<sup>14</sup> Ni P Rizky Wulandari, Nyoman Dantes, and P Aditya Antara, "Pendekatan Pendidikan Matematika Realistik Berbasis Open Ended Terhadap Kemampuan Pemecahan Masalah Matematika Siswa," *Jurnal Ilmiah Sekolah Dasar* 4, no. 2 (2020): 131–42.

Table 1  
 Research Results The Effect Of AI Learning Systems On Student  
 Learning Outcomes And Motivation

Variable	Control Group (n=30)	Treatment Group (n=30)
Academic Grade Average	75.4	82.8
Standard Deviation	6.2	4.5
Learning Motivation Average	4.6	5.9
Standard Deviation	0.9	0.7

This table shows a comparison of average academic scores between the control group and the treatment group. The treatment group (n = 30) had a significantly higher academic grade point average (82.8) than the control group (n = 30) with an academic grade point average of 75.4. Standard deviation is used to measure the spread of values, and in this case, the treatment group has a lower standard deviation, indicating better consistency in student learning outcomes. And the table compared the average level of learning motivation between the control group and the treatment group. The treatment group had a higher average learning motivation (5.9) compared to the control group (4.6). A lower standard deviation in the treatment group indicates a higher level of consistency in student learning motivation.

This statistical table provides a brief overview of the differences in learning outcomes and motivation between the control group (conventional methods) and the treatment group (use of AI learning systems). The results showed that the use of AI learning systems had a significant positive impact on both variables, namely student learning outcomes and learning motivation. This data supports the findings in the study which states that the use of AI in education can significantly increase academic achievement and student learning motivation.<sup>15</sup>

The results of this study confirm previous findings showing the positive impact of using AI learning systems in educational contexts.<sup>16</sup> First of all, it is seen that the use of AI can improve student learning outcomes. This may be due to AI's adaptability in tailoring learning materials to individual skill levels, so students don't feel left behind or

<sup>15</sup> Zi Yan, Ming Ming Chiu, and Po Yuk Ko, "Effects of Self-Assessment Diaries on Academic Achievement, Self-Regulation, and Motivation," *Assessment in Education: Principles, Policy & Practice* 27, no. 5 (2020): 562–83.

<sup>16</sup> Ibrahim Youssef Alyoussef, "E-Learning Acceptance: The Role of Task–Technology Fit as Sustainability in Higher Education," *Sustainability* 13, no. 11 (2021): 6450.

overly facilitated. This improvement in learning outcomes has positive implications in improving the quality of education.

Furthermore, the increase in the level of student motivation in the treatment group indicated that learning methods involving AI technology were able to make learning more interesting and meaningful for students. Factors such as immediate feedback and challenges tailored to an individual's skill level can increase student interest in learning.<sup>17</sup>

However, keep in mind that the implementation of AI technology in education should not be ignored aspects of ethics, privacy, and student data protection.<sup>18</sup> Strict measures must be taken to ensure that student data is secure and that ethics in the use of AI technology are well maintained. In addition, continuous education for teachers and instructors to make good use of AI technology is important.<sup>19</sup>

Thus, the results and discussion of this study suggest that AI learning systems have great potential to improve learning outcomes and student motivation in educational contexts, with emphasis on the need for ethical action and adequate training in the use of these technologies.<sup>20</sup>

Table 2  
Results of interviews with teachers and students about the effect of AI on learning outcomes and motivation

Respondents	Respondent statements
1	"I feel that using AI makes learning more interesting. This system helps me to understand difficult concepts in a more understandable way."
2	" I feel more motivated to learn because this system provides useful feedback and challenges that match my abilities."
3	" As a teacher, I see that students are more focused and enthusiastic in learning. They also get more

<sup>17</sup> Aylul Fajrinniar Ainiyah et al., "Pembudayaan Membaca Kritis Dan Menulis Kreatif Bagi Siswa Sanggar Bimbingan Sentul Kuala Lumpur Malaysia," *Jurnal Keilmuan Dan Keislaman*, 2023, 144–54.

<sup>18</sup> Andy Nguyen et al., "Ethical Principles for Artificial Intelligence in Education," *Education and Information Technologies* 28, no. 4 (2023): 4221–41.

<sup>19</sup> Hui Luan et al., "Challenges and Future Directions of Big Data and Artificial Intelligence in Education," *Frontiers in Psychology* 11 (2020): 580820.

<sup>20</sup> Francesco Longo, Antonio Padovano, and Steven Umbrello, "Value-Oriented and Ethical Technology Engineering in Industry 5.0: A Human-Centric Perspective for the Design of the Factory of the Future," *Applied Sciences* 10, no. 12 (2020): 4182.

	individualized help in understanding the material."
4	" AI helps me to speed up the understanding of the material. I don't find it difficult anymore in subjects that are usually difficult."
5	" The use of AI makes the learning process more interactive and fun. I feel more motivated to come to school every day."
6	" I found this system very helpful in identifying my weaknesses in the understanding of the material. I can focus on areas that need improvement."
7	" AI helps me to manage my study time more efficiently. I can study at a time that suits me best."
8	" AI systems help me to develop analytical and problem-solving skills. I feel better prepared for exams and assignments."
9	" I feel more confident in participating in class discussions and answering teacher questions. I'm not ashamed anymore if I'm wrong."
10	" I feel like a personal mentor helping me reach my maximum potential in learning."

The results of this interview reflect the positive perceptions and experiences of students and teachers regarding the use of AI learning systems in education. They feel that AI improves learning understanding, motivation, and efficiency, and provides a more engaging and personalized learning experience.

## ANALYSIS

The results of this study reveal the significant impact of the use of AI learning systems on student learning outcomes and motivation. Some of the key findings include:

### 1) Improved Learning Outcomes

The group of students engaged in AI learning significantly improved their academic achievement.<sup>21</sup> Their average academic scores improved markedly compared to the control group using conventional methods.

### 2) Increased Learning Motivation

Students who use AI learning systems show higher levels of learning motivation. They feel more involved in the learning

---

<sup>21</sup> Juan L Rastrollo-Guerrero, Juan A Gómez-Pulido, and Arturo Durán-Domínguez, "Analyzing and Predicting Students' Performance by Means of Machine Learning: A Review," *Applied Sciences* 10, no. 3 (2020): 1042.

process, more motivated to pursue their academic goals, and more confident in taking on learning challenges.

### 3) Individualization of Learning

AI systems help in tailoring learning to the individual needs of students. This allows students to learn at a level that suits their abilities, so they don't feel left behind or overly facilitated.

### 4) Long-Term Effects

In addition to the positive results observed during the experiment, there is evidence that the positive effects of using AI in learning can last in the long term. Students using AI learning systems continued to show improvements in their learning outcomes and learning motivation after the experiment ended.

This research shows that AI learning systems have great potential in improving education by improving student learning outcomes and increasing their motivation.<sup>22</sup> The integration of AI technology in education can yield ongoing positive benefits and encourage the development of more adaptive and effective learning methods.<sup>23</sup> However, it should be noted that successful implementation requires attention to proper ethics, privacy, and teacher training.

## CONCLUSION

The conclusion of this study is that the use of artificial intelligence (AI)-based learning systems has a significant positive impact on student learning outcomes and learning motivation.<sup>24</sup> In the group of students involved in AI learning, there was a clear increase in academic achievement compared to the control group using conventional learning methods.<sup>25</sup> The average academic scores of students in the treatment group were significantly higher. In addition, the level of learning motivation of students in the treatment group was also higher compared to the control group.

These results show that AI learning systems are able to create a more efficient and effective learning experience. The individualization

---

<sup>22</sup> Francesc Pedro et al., "Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development," 2019.

<sup>23</sup> Liu et al., "Effects of an Immersive Virtual Reality-based Classroom on Students' Learning Performance in Science Lessons."

<sup>24</sup> Pedro et al., "Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development." *Ibid*

<sup>25</sup> Radenna Humaira Iqlima, "PENGARUH MODEL PROBING PROMPTING LEARNING TERHADAP KEMAMPUAN MENGANALISIS PESERTA DIDIK PADA KONSEP USAHA DAN ENERGI," n.d.

of learning provided by AI technology allows students to learn at a level that suits their abilities, so they don't feel left behind or overly facilitated.<sup>26</sup> This positive impact is not only valid in the short term, but also seems to last in the long term.

Thus, this study provides strong evidence that the integration of AI technology in education can significantly improve learning outcomes and student motivation. However, it is important to remember that the implementation of AI technology in education must also pay attention to aspects of ethics, privacy, and proper teacher training.<sup>27</sup> Further efforts in unlocking the full potential of this technology and ensuring its benefits are widely achieved is the next step in improving the quality of education.

## BIBLIOGRAPHY

- Adnan, Gunawan, and Mohammad Adnan Latief. "Metode Penelitian Pendidikan: Penelitian Kuantitatif, Penelitian Kualitatif, Penelitian Tindakan Kelas." Erhaka Utama, 2020.
- Agustianti, Rifka, Lissiana Nussifera, L Angelianawati, Igat Meliana, Effi Alfiani Sidik, Qomarotun Nurlaila, Nicholas Simarmata, Irfan Sophan Himawan, Elvis Pawan, and Faisal Ikhrum. *Metode Penelitian Kuantitatif Dan Kualitatif*. Tohar Media, 2022.
- Ainiyah, Aylul Fajrinniar, Putri Oktafia Rani, Risda Irianti, Maulidya Eka Wahyudi, Nora Pita, Maya Sofiya Intantri, Cyntia Dewi, Harun Joko Prayitno, Miftakhul Huda, and Murgiyanti Murgiyanti. "Pembudayaan Membaca Kritis Dan Menulis Kreatif Bagi Siswa Sanggar Bimbingan Sentul Kuala Lumpur Malaysia." *Jurnal Keilmuan Dan Keislaman*, 2023, 144–54.
- Alyahyan, Eyman, and Dilek Düşteğör. "Predicting Academic Success in Higher Education: Literature Review and Best Practices." *International Journal of Educational Technology in Higher Education* 17 (2020): 1–21.
- Alyoussef, Ibrahim Youssef. "E-Learning Acceptance: The Role of Task–Technology Fit as Sustainability in Higher Education." *Sustainability* 13, no. 11 (2021): 6450.
- Hidayati, Nurul. "Konsep Integrasi Tripusat Pendidikan Terhadap Kemajuan Masyarakat." *Edukasia: Jurnal Penelitian Pendidikan Islam*

---

<sup>26</sup> Yetkin Yildirim, Fatima Camci, and Elif Aygar, "Advancing Self-Directed Learning Through Artificial Intelligence," in *Advancing Self-Directed Learning in Higher Education* (IGI Global, 2023), 146–57.

<sup>27</sup> Nguyen et al., *Ibid*

- 11, no. 1 (2016): 203–24.  
<https://doi.org/10.21043/edukasia.v11i1.811>.
- Iqlima, Radenna Humaira. “PENGARUH MODEL PROBING PROMPTING LEARNING TERHADAP KEMAMPUAN MENGANALISIS PESERTA DIDIK PADA KONSEP USAHA DAN ENERGI,” n.d.
- Kabudi, Tumaini, Ilias Pappas, and Dag Håkon Olsen. “AI-Enabled Adaptive Learning Systems: A Systematic Mapping of the Literature.” *Computers and Education: Artificial Intelligence* 2 (2021): 100017.
- Liu, Ruixue, Lei Wang, Jing Lei, Qiu Wang, and Youqun Ren. “Effects of an Immersive Virtual Reality-based Classroom on Students’ Learning Performance in Science Lessons.” *British Journal of Educational Technology* 51, no. 6 (2020): 2034–49.
- Longo, Francesco, Antonio Padovano, and Steven Umbrello. “Value-Oriented and Ethical Technology Engineering in Industry 5.0: A Human-Centric Perspective for the Design of the Factory of the Future.” *Applied Sciences* 10, no. 12 (2020): 4182.
- Luan, Hui, Peter Geczy, Hollis Lai, Janice Gobert, Stephen J H Yang, Hiroaki Ogata, Jacky Baltes, Rodrigo Guerra, Ping Li, and Chin-Chung Tsai. “Challenges and Future Directions of Big Data and Artificial Intelligence in Education.” *Frontiers in Psychology* 11 (2020): 580820.
- Mulyatiningsih, Endang. *Metode Penelitian Terapan Bidang Pendidikan*. Uny Press, 2015.
- Muñoz, Jorge Leoncio Rivera, Federico Moscoso Ojeda, Dina Lizbeth Aparicio Jurado, Percy Fritz Puga Peña, Christian Paolo Martel Carranza, Haydeé Quispe Berríos, Shanda Ugarte Molina, Amanda Rosa Maldonado Farfan, José Luis Arias-González, and Mario José Vasquez-Pauca. “Systematic Review of Adaptive Learning Technology for Learning in Higher Education.” *Eurasian Journal of Educational Research* 98, no. 98 (2022): 221–33.
- Nguyen, Andy, Ha Ngan Ngo, Yvonne Hong, Belle Dang, and Bich-Phuong Thi Nguyen. “Ethical Principles for Artificial Intelligence in Education.” *Education and Information Technologies* 28, no. 4 (2023): 4221–41.
- Pedro, Francisc, Miguel Subosa, Axel Rivas, and Paula Valverde. “Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development,” 2019.
- Rastrollo-Guerrero, Juan L, Juan A Gómez-Pulido, and Arturo Durán-Domínguez. “Analyzing and Predicting Students’ Performance by Means of Machine Learning: A Review.” *Applied Sciences* 10, no. 3

- (2020): 1042.
- Sayekti, Retno. “Memahami Tren Penelitian Artificial Intelligence Di Perpustakaan Melalui Analisis Bibliometrik Pada Publikasi Ilmiah Internasional Tahun 2019-2023.” *UNILIB: Jurnal Perpustakaan*, 2023.
- Wibowo, Nugroho. “Upaya Peningkatan Keaktifan Siswa Melalui Pembelajaran Berdasarkan Gaya Belajar Di SMK Negeri 1 Saptosari.” *Elinvo (Electronics, Informatics, and Vocational Education)* 1, no. 2 (2016): 128–39.
- Wulandari, Ni P Rizky, Nyoman Dantes, and P Aditya Antara. “Pendekatan Pendidikan Matematika Realistik Berbasis Open Ended Terhadap Kemampuan Pemecahan Masalah Matematika Siswa.” *Jurnal Ilmiah Sekolah Dasar* 4, no. 2 (2020): 131–42.
- Yan, Zi, Ming Ming Chiu, and Po Yuk Ko. “Effects of Self-Assessment Diaries on Academic Achievement, Self-Regulation, and Motivation.” *Assessment in Education: Principles, Policy & Practice* 27, no. 5 (2020): 562–83.
- Yildirim, Yetkin, Fatima Camci, and Elif Aygar. “Advancing Self-Directed Learning Through Artificial Intelligence.” In *Advancing Self-Directed Learning in Higher Education*, 146–57. IGI Global, 2023.
- Yuniwati, Y, and Muhsinatun Siasah Masruri. “Peningkatan Kualitas Pembelajaran PPKn Melalui Penerapan Problem Based Learning Di SMP.” *Harmoni Sosial: Jurnal Pendidikan IPS* 3, no. 2 (2016): 199–210.
- Zubaidah, Siti. “Self Regulated Learning: Pembelajaran Dan Tantangan Pada Era Revolusi Industri 4.0.” In *Prosiding SNPBS (Seminar Nasional Pendidikan Biologi Dan Saintek)*, 1–19, 2020.