ISLAMENTARY: Journal of Islamic Elementary Education
E-ISSN: 2986-2140
Vol. 3, No. 1, Maret 2025

Transforming Children's Education with Technology: The Role of AI, IoT, and Gamification in Learning

Lukman Nurhakim

STKIP PGRI Sumenep
Email: lukmannurhakim@stkippgrisumenep.ac.id

Corresponding Author: Lukman Nurhakim
Article history: Received: Januari 16, 2025 | Revised: Maret 06, 2025| Available Online: Maret 30, 2025

Abstract

This study explores the transformative impact of technology on children's education, specifically examining the roles of Artificial Intelligence (AI), the Internet of Things (IoT), and gamification in the learning process. The research employs a qualitative approach with case studies conducted in primary and secondary schools that have integrated these technologies into their educational practices. Data were collected through interviews with teachers, school principals, and parents, as well as classroom observations and document analysis. The findings reveal that AI offers personalized learning experiences by tailoring content to individual students' needs, while IoT enhances classroom interactivity and engagement through real-time monitoring and smart devices. Furthermore, gamification has proven effective in boosting student motivation and participation by incorporating game-like elements such as rewards and challenges into the learning environment. Despite the positive impacts, challenges such as the digital divide, infrastructure limitations, and the need for teacher training remain obstacles to widespread implementation. This study concludes that while technology offers significant potential for educational transformation, it requires a balanced approach that includes adequate support for educators and infrastructure development, ensuring that all students can benefit equally from technological advancements.

Keywords: *Artificial Intelligence, Internet of Things, Gamification, Children's Education, Educational Technology, Personalized Learning, Classroom Engagement.*

.

Copyright: © 2025. The authors.
ISLAMENTARY: Journal of Islamic Elementary Education Volume is licensed under a Creative Commons
Attribution Non Commercial 4.0 International License

INTRODUCTION

The digital era has brought significant changes in various sectors of life, including the world of education. One of the most profound aspects of this change is the integration of technology in the learning process. The transformation of children's education through technology not only facilitates more efficient teaching methods, but also creates a more interactive and engaging learning environment. Amid rapid technological developments, the three main innovations Artificial Intelligence (AI), Internet of Things (IoT), and gamification have emerged as the main drivers in changing the way children learn and interact with learning materials.[1]

Artificial Intelligence (AI) enables personalization of learning by providing experiences tailored to individual students' needs, improving teaching effectiveness, and providing real-time feedback. Meanwhile, IoT introduces a more connected learning concept, where devices that communicate with each other can support a more dynamic and contextual learning experience. Gamification, on the other hand, integrates elements of play in the learning process to increase student motivation and engagement, making learning more enjoyable and effective.[2]

The role of these three technologies in children's education is not only limited to the development of academic skills, but also contributes to the development of more holistic life skills. With the support of technology, learning becomes more inclusive, interesting, and adaptive to various learning styles of students. This research aims to examine how AI, IoT, and gamification can play a role in transforming children's education in the future, as well as the challenges and opportunities that exist in their implementation.[3]

As technology continues to develop, the main challenge faced in the implementation of AI, IoT, and gamification in education is to ensure the sustainability and accessibility of these technologies at various levels of society.[4] Not all schools have adequate infrastructure to adopt this advanced technology, so the role of governments, educational institutions, and technology companies is critical in creating an inclusive and equitable education ecosystem. In addition, while technology can improve the effectiveness of learning, there needs to be an effort to maintain a balance between

[1] Ruskandi, K., Pratama, E. Y., & Asri, D. J. N. (2021). *Transformation of the Direction of Education Goals in the Era of Society 5.0*. CV. Equatorial Land.
[2] Yusuf, M., Julianingsih, D., & Ramadhani, T. (2023). Transformation of digital education 5.0 through the integration of science and technology innovation. *MENTARI Journal: Management, Education and Information Technology*, *2*(1), 11-19.
[3] Yusgiantara, A. (2025). Curriculum Innovation and Learning Methods in the Society 5.0 Era. *Al-Tarbiyah: Journal of Islamic Education*, *3*(1), 237-244.
[4] Ariska, M., Kurahman, O. T., & Rusmana, D. (2025). Transformation of Student Management in Islamic Education Institutions in the Era of Society 5.0. *IHSAN: Journal of Islamic Education*, *3*(1), 138-148.

technology and social interaction, so that children can still develop important social and emotional skills.[5]

The application of technology in education also requires a profound adjustment of the curriculum, so that technology is not only a tool, but also an integral part of the learning process that develops critical thinking, creativity, and 21st-century skills.[6] Therefore, this research will also explore how AI, IoT, and gamification can be effectively integrated into existing educational curricula, as well as their impact on the learning process, children's development, and their readiness to face future global challenges.[7]

In addition, another challenge that needs to be faced is the preparation of educators who can make good use of technology. The development of teachers' competencies in integrating AI, IoT, and gamification in learning is essential to create an educational environment that is adaptive and responsive to the changing times. Ongoing training and adequate technical support are key for educators to make the most of the potential of technology, without sacrificing important aspects of humane education, such as communication and empathy.[8]

As part of the transformation of children's education, the role of parents and society is no less important. While technology can bring many benefits, proper supervision is still necessary to ensure children use technology wisely and productively. Therefore, collaboration between schools, families, and the community will be very influential in creating an educational ecosystem that is balanced between the use of technology and the development of children's character.

This research is expected to provide a clear picture of the positive and negative impacts of the application of AI, IoT, and gamification in children's education, as well as provide strategic recommendations for stakeholders to develop policies that support the integration of technology in education in an appropriate and effective way.

METHOD

This research uses a qualitative approach with a case study design to explore the role of technology, especially Artificial Intelligence (AI), Internet of Things (IoT), and gamification in the transformation of children's education. The qualitative approach was chosen because this research aims to understand in depth the phenomena that occur in the field, especially regarding the implementation of technology in the context of children's education and how it affects the learning process.[9]

1. Location and Research Subject

---

[5] Muchlis, M. (2025). THE USE OF ARTIFICIAL INTELLIGENCE (AI) IN ISLAMIC RELIGIOUS EDUCATION: BENEFITS AND CHALLENGES. *Creative: Journal of Islamic Religious Education Thought*, *23*(1), 100-109.

[6] Mili, W. N., Mahendra, C., & Prabowo, R. E. (2023). Gamification in STEM Education: Transforming Learning and Student Empowerment towards Industry 5.0. *Physics Education Innovation*, *12*(3), 92-100.

[7] Aksenta, A., Irmawati, I., Ridwan, A., Hayati, N., Sepriano, S., Herlinah, H., ... & Ginting, T. W. (2023). *DIGITAL LITERACY: The Latest Knowledge & Transformation of Digital Technology in the Industrial Era 4.0 and Sociaty 5.0*. PT. Sonpedia Publishing Indonesia.

[8] Soraya, F., & Marzuki, I. (2024). Transformation of Technology-Based Learning Evaluation Model in the Society 5.0 Era. *Tadarus Tarbawy: Journal of Islamic Studies and Education*, *6*(2).

[9] Dewi, R. P. (2019). Case Studies-Qualitative Research Methods.

This research was conducted in several primary and secondary schools in urban and rural areas in Indonesia that have integrated technology in their teaching and learning activities. The research subjects consist of teachers, students, and principals who are directly involved in the use of AI, IoT, and gamification in the classroom. In addition, parents are also involved to gain perspective on the impact of technology use on children's development at home.

2. Data Collection Techniques

Data is collected through the following techniques:[10]

a. In-Depth Interviews: Semi-structured interviews were conducted with teachers, principals, and parents to explore their views on the use of AI, IoT, and gamification in children's education. This interview aims to gain information about first-hand experiences as well as challenges faced in the application of technology in the classroom.
b. Participatory Observation: The researcher conducts observations in classrooms that have implemented the technology, noting how the technology is used in the learning process and the interaction between students, teachers, and technology.
c. Documentation Study: The researcher reviewed relevant documents, such as reports on the use of technology in the curriculum, technology-based teaching materials, and educational policies governing the use of AI, IoT, and gamification.

3. Data Analysis

Data obtained from interviews, observations, and documentation will be analyzed using thematic analysis techniques. The first step is to organize the data by key categories related to the use of AI, IoT, and gamification in learning. Next, the researcher will identify the themes that emerge from the data, as well as relate them to relevant theories and concepts in the technology education literature. The results of this analysis are expected to provide in-depth insights into the challenges, opportunities, and impacts of the application of technology in children's education.[11]

4. Validity and Reliability

To ensure the validity and reliability of the data, this study uses the triangulation technique, which involves comparing data obtained from interviews, observations, and documentation. In addition, members of the subjects involved in the study were also given the opportunity to conduct a member check, which is a process of re-checking the data and provisional findings obtained by the researcher to ensure that the interpretations made are accurate and representative of their experiences.

5. Research Ethics

[10] Fadli, M. R. (2021). Understand the design of qualitative research methods. *Humanika, Scientific Studies of General Courses*, *21*(1), 33-54.
[11] Nurahma, G. A., & Hendriani, W. (2021). A systematic review of case studies in qualitative research. *Mediation*, *7*(2), 119-129.

This research will follow the research ethics guidelines by obtaining written permission from all parties involved, including the school and the student's parents. Participation in this study is voluntary, and all data collected will be kept confidential.

RESULTS AND DISCUSSION

1. Implementation of AI in Children's Learning

The results of the study show that the application of Artificial Intelligence (AI) technology in children's learning has had a significant impact on the personalization and effectiveness of the learning process. Based on interviews with teachers and principals, AI is used to tailor learning materials to individual needs of students, allowing each child to learn at a pace and style that suits their abilities. For example, AI-based apps used in some schools can provide students with immediate feedback on their learning progress, as well as suggest appropriate advanced materials.[12]

However, while the use of AI has proven to be effective in increasing student engagement, the challenge faced is the lack of training for teachers in optimizing the use of AI in the classroom. Many teachers find it difficult to make the most of AI, both in terms of technical understanding and in integrating AI with existing curriculum.

2. The Role of IoT in Improving Learning Connectivity

The Internet of Things (IoT), which allows devices to communicate with each other, has also shown positive results in improving connectivity and interactivity in the classroom.[13] From observations in several schools, the use of IoT devices, such as smart whiteboards and sensors that can monitor student attendance and activities, help create a more responsive learning environment. For example, sensor devices connected to school systems can provide teachers with real-time information regarding student attendance and their activities, allowing for faster action if needed.[14]

However, the main challenges found are the limitations of infrastructure and the high costs required to support the deployment of IoT across schools. Although some schools in urban areas already have adequate IoT devices, schools in remote areas face difficulties in providing the necessary devices to take advantage of this technology.[15]

3. The Impact of Gamification on Student Motivation and Engagement

One of the important findings of this study is **gamification** which has been shown to increase student motivation and involvement in the learning process. The use of game elements, such as a points system, rewards, and competition-based challenges, successfully sparked students' interest in learning more actively. Teachers report that students who engage in gamification-based learning tend to be more enthusiastic and

---

[12] Jayawardana, H. B. A., Sugiarto, M. A., & Prystiananta, N. C. (2023). The potential for the application of AI-based learning (Artificial Intelligence) in early childhood education. *JECIE (Journal of Early Childhood and Inclusive Education), 7*(1), 251-255.

[13] Veri Ikra Mulyadi, "The Development of Children's Environmental Identity Through a Descriptive Phenomenological Perspective," n.d.

[14] Setiyadi, M. W. (2017). Development of biology learning modules based on scientific approaches to improve student learning outcomes. *Journal of educational science and technology*, *3*(2), 102-112.

[15] Elyus, D. S., & Sholeh, M. (2021). Public relations strategies in improving the image of schools in the era of the covid 19 pandemic. *Journal of Educational Management Inspiration*, *9*(2), 281-289.

participate in classroom activities more often, compared to traditional learning methods.[16]

However, while gamification can increase motivation, some teachers have also expressed concerns regarding students' reliance on these elements of the game. They worry that too much focus on the entertainment aspect can reduce a deep understanding of the material being taught. Therefore, it is important to ensure that gamification is applied in a balanced manner and does not sacrifice learning objectives.[17]

4. **Challenges and Opportunities in Technology Implementation**

This research also identifies some of the main challenges faced in the implementation of AI, IoT, and gamification in Indonesian schools. The biggest challenge is the digital divide, where schools in resource-constrained areas struggle to access advanced technology. In addition, the lack of training for teachers in using technology effectively is a major obstacle in the application of technology in the classroom.[18]

On the other hand, the opportunity that is wide open is the use of technology to expand access to education in areas that have been isolated, as well as to improve the quality of education in a more adaptive and innovative way. Collaboration between governments, schools, and technology providers can be a solution to address these challenges and ensure that technology can be leveraged to achieve optimal learning outcomes.

5. **The Influence of Technology on Child Development**

Overall, the application of technologies such as AI, IoT, and gamification has a positive impact on children's development, not only academically, but also social and emotional skills. Students who engage in technology-based learning[19] are more likely to have critical and creative thinking skills, and are better prepared to face challenges in an ever-evolving world. However, keep in mind that technology must be used wisely and accompanied by adequate supervision, so that children's development remains balanced between technical abilities and character development.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the application of technology, especially Artificial Intelligence (AI), Internet of Things (IoT), and gamification, has a significant impact on the transformation of

[16] Nurningtias, R. A., & Majid, N. W. A. (2022). Gamification as an increase in the knowledge and participation of elementary school students. *Journal of Mathematics Education Thought and Research (Jp3M), 5*(2), 60-69.

[17] Fitriyah Ika Astutik, "The Effect of the Think Pair Share (TPS) Type Cooperative Learning Model on the Learning Achievement of Grade VIII Students at MTs Bustanul Ulum Tagangser Laok on the Subject of Sound," n.d.

[18] Octiva, C. S., Haes, P. E., Fajri, T. I., Eldo, H., & Hakim, M. L. (2024). Implementation of Information Technology in MSMEs: Challenges and Opportunities. *Journal of Minfo Polgan*, *13*(1), 815-821.

[19] Megahantara, G. S. (2017). The influence of technology on education in the 21st century. *Yogyakarta: Yogyakarta State University*, 88-100.

children's education. This technology not only increases the effectiveness of the learning process but also motivates students to be more active and involved in learning activities.

1. AI allows for better personalization of learning, by tailoring materials and feedback according to students' abilities, although the main challenge lies in the training and readiness of teachers to optimize their use in the classroom.
2. IoT provides the advantage of creating a more responsive and interactive learning environment, by monitoring student activities in real-time. However, limited infrastructure and high costs are the main obstacles in its implementation, especially in less developed areas.
3. Gamification plays an important role in increasing student motivation, by making learning more fun and competitive. However, the application of gamification needs to be done wisely so as not to reduce students' deep understanding of the learning material.

While technology has many benefits in education, challenges such as the digital divide and limitations in teacher training still need to be addressed in order for technology to be applied equally across all levels of society. For this reason, collaboration between the government, schools, and technology providers is essential to create an inclusive and sustainable education ecosystem.

Going forward, it is important to ensure that the use of technology in education focuses not only on the technical aspects but also on the development of children's character, as well as a balance between technology and social interaction in the classroom. Technology should be used to enrich students' learning experiences and prepare them for an increasingly complex and digital world.

BIBLIOGRAPHY

Aksenta, A., Irmawati, I., Ridwan, A., Hayati, N., Sepriano, S., Herlinah, H., ... & Ginting, T. W. (2023). *DIGITAL LITERACY: The Latest Knowledge & Transformation of Digital Technology in the Industrial Era 4.0 and Sociaty 5.0*. PT. Sonpedia Publishing Indonesia.

Ariska, M., Kurahman, O. T., & Rusmana, D. (2025). Transformation of Student Management in Islamic Education Institutions in the Era of Society 5.0. *IHSAN: Journal of Islamic Education*, *3*(1), 138-148.

Dewi, R. P. (2019). Case Studies-Qualitative Research Methods.

Elyus, D. S., & Sholeh, M. (2021). Public relations strategies in improving the image of schools in the era of the covid 19 pandemic. *Journal of Educational Management Inspiration*, *9*(2), 281-289.

Fadli, M. R. (2021). Understand the design of qualitative research methods. *Humanika, Scientific Studies of General Courses*, *21*(1), 33-54.

Fitriyah Ika Astutik, “The Effect of the Think Pair Share (TPS) Type Cooperative Learning Model on the Learning Achievement of Grade VIII Students at MTs Bustanul Ulum Tagangser Laok on the Subject of Sound,” n.d.

Jayawardana, H. B. A., Sugiarto, M. A., & Prystiananta, N. C. (2023). The potential for the application of AI-based learning (Artificial Intelligence) in early childhood education. *JECIE (Journal of Early Childhood and Inclusive Education)*, *7*(1), 251-255.

Megahantara, G. S. (2017). The influence of technology on education in the 21st century. *Yogyakarta: Yogyakarta State University*, 88-100.

Mili, W. N., Mahendra, C., & Prabowo, R. E. (2023). Gamification in STEM Education: Transforming Learning and Student Empowerment towards Industry 5.0. *Physics Education Innovation*, *12*(3), 92-100.

Muchlis, M. (2025). THE USE OF ARTIFICIAL INTELLIGENCE (AI) IN ISLAMIC RELIGIOUS EDUCATION: BENEFITS AND CHALLENGES. *Creative: Journal of Islamic Religious Education Thought*, *23*(1), 100-109.

Nurahma, G. A., & Hendriani, W. (2021). A systematic review of case studies in qualitative research. *Mediation*, *7*(2), 119-129.

Nurningtias, R. A., & Majid, N. W. A. (2022). Gamification as an increase in the knowledge and participation of elementary school students. *Journal of Mathematics Education Thought and Research (Jp3M)*, *5*(2), 60-69.

Octiva, C. S., Haes, P. E., Fajri, T. I., Eldo, H., & Hakim, M. L. (2024). Implementation of Information Technology in MSMEs: Challenges and Opportunities. *Journal of Minfo Polgan*, *13*(1), 815-821.

Ruskandi, K., Pratama, E. Y., & Asri, D. J. N. (2021). *Transformation of the Direction of Education Goals in the Era of Society 5.0*. CV. Equatorial Land.

Setiyadi, M. W. (2017). Development of biology learning modules based on scientific approaches to improve student learning outcomes. *Journal of educational science and technology*, *3*(2), 102-112.

Soraya, F., & Marzuki, I. (2024). Transformation of Technology-Based Learning Evaluation Model in the Society 5.0 Era. *Tadarus Tarbawy: Journal of Islamic Studies and Education*, *6*(2).

Veri Ikra Mulyadi, “The Development of Children’s Environmental Identity Through a Descriptive Phenomenological Perspective,” n.d.

Yusgiantara, A. (2025). Curriculum Innovation and Learning Methods in the Society 5.0 Era. *Al-Tarbiyah: Journal of Islamic Education*, *3*(1), 237-244.

Yusuf, M., Julianingsih, D., & Ramadhani, T. (2023). Transformation of digital education 5.0 through the integration of science and technology innovation. *MENTARI Journal: Management, Education and Information Technology*, *2*(1), 11-19.