



Implementation of an Artificial Intelligence Based Learning Management System for Adaptive Learning

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ABSTRACT

In the world of modern education, the need for adaptive and personalized learning systems is becoming increasingly important to accommodate the unique learning needs of each individual. Implementing artificial intelligence (AI) in learning management systems offers great potential for optimizing adaptive learning experiences, where the system automatically adjusts learning content and approaches based on student profiles and responses. This research aims to develop and implement an artificial intelligence-based learning management system to personalize learning. The primary objective is to assess the effectiveness of the system in improving student engagement and learning outcomes and identify factors that influence its success. The method includes developing a system using machine learning algorithms for real-time analysis of student learning data. This research uses a mixed design that combines quantitative and qualitative data to analyze learning outcomes and understand user perceptions of the system. The research results show that this AI-based learning management system successfully increases student engagement and provides effective personalization of learning. Data shows improvements in grades and understanding of the material, especially in concepts students previously found difficult. Implementing an artificial intelligence-based learning management system has proven effective in supporting adaptive learning. This system improves learning outcomes and provides new insights into how AI technology can effectively integrate into educational contexts to support diverse and dynamic learning needs. The research also identified several challenges, including the need for more significant and varied training data and smoother integration with school curricula.

Keywords: *Implementation, Learning Management System, Artificial Intelligence, Adaptive Learning.*

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INTRODUCTION

Education is an essential foundation for individual and societal development, playing a vital role in shaping a person's intellectual, moral, and social abilities (King & chatGPT, 2023). In an increasingly complex and connected global context, education functions not only as a means to accumulate knowledge but also as a mechanism to develop critical skills, creativity, and adaptability. Effective education must be able to respond to the needs and challenges of the times, providing equal access to all individuals regardless of social or economic background. Digital transformation in education, including information and communication technology, has opened up new opportunities for innovation in teaching and learning methods (Chanias et al., 2019). However, challenges such as the digital divide, variations in education quality, and limited resources still need to be addressed. Therefore, collaborative efforts are required between the government, educational institutions, and society to create an inclusive, quality, and sustainable education system (Florida et al., 2021). Thus, education can be a critical driver for social and economic progress, preparing the younger generation to face and overcome the dynamics of the future world.

In the current digital era, education faces increasingly complex challenges related to effective and adaptive teaching methods to meet the diverse learning needs of each student. The main problem often encountered in traditional learning systems is the "one size fits all" approach, which does not consider differences in learning speed, learning styles, and varying levels of understanding between students. This often results in a lack of engagement and motivation to learn among students and gaps in student academic achievement. This limitation is a serious problem because it can hinder students' learning potential and cause wide educational disparities. This research was conducted to overcome this problem by implementing a more adaptive and responsive system to individual student needs. The issues to be solved include a need for more personalization in learning, which traditional education systems often fail to accommodate.

Artificial intelligence (Artificial Intelligence, AI) is a system designed to explore and innovate in various fields of study that have been modeled, both through machine hardware and computer software, both of which have the potential to match or even surpass human intelligence (Andronie et al., 2021). AI is characterized by its ability to adapt, make decisions, cognitively process information, and learn from experience. The origins of artificial intelligence stem from the aim of supporting human tasks, as functions are generally expected from the application of technology.

Along with its development, artificial intelligence has not only helped in carrying out human tasks but has also developed to replace various human activities. Today, the world has entered an era where artificial intelligence is becoming integral in many aspects of daily life (Alam, 2022a). AI has made a significant contribution to education by producing innovative learning and teaching solutions that have been tested in various educational settings and have had a far-reaching impact on the sector (Alam, 2023).

Artificial intelligence (AI) has transformed the education sector, providing various benefits that increase learning effectiveness and optimize teaching (Zhang, 2020). The main advantage of AI in this educational context lies in its ability to personalize the learning process. AI facilitates the development of systems that can adapt learning materials to suit each individual's pace and learning style. As a result, individuals can learn at a rhythm that suits them, significantly improving understanding and retention of material. Furthermore, AI supports dynamic adaptive learning, where learning content is adjusted in real time based on individual responses to quizzes and assignments (Tussyadiah, 2020). This helps individuals promptly overcome weaknesses and challenges students with new material when ready to advance their learning. Through this approach, AI ensures that individuals remain engaged and student motivation levels remain high, considering that the material presented is relevant and appropriate to student learning needs.

Artificial intelligence (AI)-based learning and adaptive learning are two concepts that have revolutionized the approach in the modern education system, providing the basis for deep and responsive personalization of learning ("Remote Sensing and Edge Artificial Intelligence Computing Systems, Environment Perception and Geospatial Mapping Technologies, and Simulation Modeling and Machine Learning-Based Image Recognition Tools in the 3D Cognitive Digital Twin Metaverse," 2023). AI-based learning refers to using artificial intelligence technology to support and improve the teaching and learning process (Ahmad et al., 2022). This technology makes it possible to create educational systems that automatically analyze individual learning needs and adapt educational resources according to those needs. The AI algorithms can perform various tasks, from automatic grading to providing constructive feedback and personalizing learning content.

On the other hand, adaptive learning is a method that uses technology to adapt learning materials based on student responses in real time (Bauer et al., 2018). Adaptive learning systems utilize learning models that are developed based on data from student interactions with the system (AL-Fayyadh et al., 2021). The model is continuously updated based on student input, allowing the system to dynamically adjust the difficulty and type of learning material. The goal is to offer each individual the most effective and efficient learning experience, considering learning pace,

learning style, and strengths and weaknesses. The integration of AI-based learning with adaptive learning creates a highly dynamic and responsive learning environment (Aditya Nirwana et al., 2023). By utilizing artificial intelligence, adaptive learning systems can more accurately analyze learning data and predict future learning needs to adapt learning materials proactively (Xie et al., 2019). This not only increases learning efficiency but also increases student engagement, as the material presented is the most relevant

Artificial intelligence (AI) based learning is an innovative approach in education that utilizes AI technology to increase the efficiency and effectiveness of the learning process (Haenlein & Kaplan, 2019). AI systems in education apply machine learning algorithms and extensive data analysis to understand and respond to individual student needs in real time. Through the ability to analyze student behavior and performance data, AI can adapt learning materials, teaching methods, and learning pace to suit each student's unique profile (Jha et al., 2019). AI-based learning offers a variety of significant benefits, including deeper personalization of education, increased student engagement, and better academic outcomes. This technology allows educators to gain more accurate insight into student progress, thereby providing timely and effective intervention. In addition, AI can automate administrative tasks such as grading and reporting, thereby reducing the workload of educators and allowing students to focus more on teaching activities.

The importance of discussing this issue lies in the potential to improve the quality of education. With a more adaptive learning system, each student can receive learning material tailored to the student's needs and abilities, thereby increasing learning effectiveness and academic results. The way to overcome this problem is through the implementation of artificial intelligence in a learning management system that can dynamically adjust content and teaching strategies based on input from student learning behavior. This research was conducted to fill the gap in the existing literature regarding the practical application of artificial intelligence in adaptive learning management. Most current research still focuses on theory or limited applications on a small scale, without full integration into the more comprehensive education system (Al-Qaysi et al., 2020). Therefore, this research contributes by testing a real and large-scale implementation of this technology in a real educational setting.

This research is expected to provide new insights into how artificial intelligence can be effectively integrated to improve education systems. This involves the development of algorithms that can process learning data in real-time and adapt them to specific learning needs, as well as evaluating learning outcomes to measure the system's overall effectiveness (De Bézenac et al., 2019). State of the art', this research offers innovation through the development of an artificial intelligence model

that is responsive and proactive in detecting student learning needs and adapting educational materials according to these detections. This is a step up from previous adaptive systems that often only reacted to user input without any predictive capacity.

The novelty of this research lies in the integration and application of artificial intelligence technology on a broader and more comprehensive scale compared to previous studies which tend to be more limited in scope or application (Abdalla, 2022). Another novelty is the use of more advanced machine learning techniques and predictive algorithms to create a truly personalized learning experience. Follow-up actions that will be carried out include further development of more robust artificial intelligence algorithms and longitudinal evaluation of their impact on long-term learning outcomes (Aqtash et al., 2022). It is hoped that future research can expand on these findings by trialing similar technologies in various educational contexts and with more heterogeneous student populations, to verify the effectiveness and flexibility of the system in different learning settings.

There are several previous research opinions. According to (Kabudi et al., 2021), the first research is AI-enabled adaptive learning systems: A systematic mapping of the literature. Based on this perspective, a systematic mapping of the literature on AI-enabled adaptive learning systems was performed in this work. A total of 147 studies published between 2014 and 2020 were analyzed. This paper's significant findings and contributions include identifying the types of AI-enabled learning interventions used, a visualization of the co-occurrences of authors associated with major research themes in AI-enabled learning systems, and a review of standard analytical methods and related techniques utilized in such learning systems. According to (Alam, 2022b), the second research is Employing Adaptive Learning and Intelligent Tutoring Robots for Virtual Classrooms and Smart Campuses: Reforming Education in the Age of Artificial Intelligence (Allam & Dhunny, 2019). The research stated that After evaluating the impact of AI technology on teaching and learning, it is conclusively inferred that AI has a beneficial effect on both the quality of instruction provided by teachers and on students' learning outcomes.

The third research according to (Tang et al., 2023), with the research title Trends in artificial intelligence-supported e-learning: a systematic review and co-citation network analysis (1998–2019). It was found that a majority of AIeL studies focused on the development and applications of intelligent tutoring systems, followed by using AI to facilitate assessment and evaluation in e-learning contexts. For field researchers, the visualized network diagram serves as a map to explore the invisible relationships among the core AIeL research, providing a structural understanding of AI-supported research in e-learning contexts. A further investigation of the follow-up studies behind the highly co-cited links revealed the extended research directions from

the AIeL mainstreams, such as adaptive learning-based evaluation environments. Implications are discussed.

RESEARCH METHODOLOGY

In research regarding implementing an artificial intelligence-based learning management system for adaptive learning, the development method used is critical to ensure the success and effectiveness of the system to be developed. The technique chosen is software development, which often involves several critical stages that focus on designing, developing, testing, and implementing a robust system that can be adapted according to user needs (Rajae et al., 2019). The first stage in this development method is planning. At this stage, the development team identifies detailed system requirements and specifications. This involves discussions with stakeholders, including educators, students, and administrators, to understand students' needs in depth. This identification is essential because it will determine the direction and scope of system functions. In addition, this stage also involves determining the required resources, including labor, technology, and time, and mapping the risks encountered during the development process.

After planning, the second stage is system design. This stage focuses on creating a system architecture that will support all the needs that have been identified. In the context of adaptive learning, design must be able to adapt content and teaching methods based on individual student learning responses and progress (Langlotz et al., 2019). This design must also take into account ease of use for the end user, be it educators or students. Intuitive interface design and high accessibility are the keys to increasing system acceptance and use. Apart from that, the design must also include aspects of data security and user privacy, which are very crucial in digital learning systems. Third, the system development stage. At this stage, program code is created based on a predetermined design. These development processes often use agile methods, which allow development teams to work in iterations, leaving room for continuous evaluation and adjustment based on feedback received. The development also involves the integration of artificial intelligence algorithms that will regulate how the system adapts learning materials based on user input. Unit testing is performed in parallel to ensure each system component works as expected.

The fourth stage is system testing. This stage is very important to ensure that the system functions properly and is free from bugs or other technical problems. This testing involves several types, such as functional testing, security testing, and usability testing. Functional testing ensures that all system features operate according to initial requirements. Security testing tests the system against potential threats and vulnerabilities, while usability testing ensures the system is easy for target users. Feedback from this testing is then used to refine the system. Lastly, the

implementation or deployment stage. At this stage, the system that has been tested and refined is launched and integrated into the natural environment that end users will use. This implementation is often done in stages, starting with a small group of users to ensure a smooth transition to the new system. During this stage, it is essential to continuously monitor system performance and collect feedback from users for continuous improvement. Through the application of this comprehensive software development method, it is hoped that an artificial intelligence-based learning management system can be implemented effectively and meet adaptive learning needs. The successful implementation of this system will significantly improve the quality and personalization of the learning process, ultimately improving student learning outcomes.

RESULTS AND DISCUSSION

The implementation of an artificial intelligence (AI) based learning management system for adaptive learning is a revolutionary step in the world of education (Huang & Rust, 2021). The system is designed to provide a highly personalized learning experience for each student by adapting course material to suit the student's pace and learning style. With this approach, learning becomes more effective and increases student motivation and involvement in the learning process. Artificial intelligence in learning management systems allows for identifying student learning patterns through data collected during the learning process. AI algorithms can analyze students' time on specific topics, answers to quizzes, and interactions within the learning platform to identify student strengths and weaknesses. With this information, the system can adapt the learning material presented, optimizing the level of difficulty and presentation format based on individual needs.

One of the main advantages of this AI-based adaptive learning system is its ability to provide fast and accurate feedback to students (Toth et al., 2021). AI can give instant corrections to student answers and provide additional explanations for concepts that need to be better understood. This speeds up the learning process and allows students to understand the material in depth without having to wait for direct interaction with the teacher. Apart from that, this learning management system is also handy for teachers. With the data collected, teachers can gain in-depth insight into the effectiveness of the teaching methods and students' understanding of the material. This allows teachers to adapt teaching approaches on an individual and group scale. Teachers can also use data to identify students who may need further help or additional challenges, thereby providing more targeted support.

Implementing AI technology in education also brings challenges, primarily related to privacy and ethics in data use. Educational institutions must ensure that student data is appropriately protected and only used to enhance learning. Additionally, there must be transparency in how the data is used, and students and parents must clearly understand this.

The development of a solid technological infrastructure is also vital to the successful implementation of this system. Schools and educational institutions must have adequate computing resources to support AI-based learning software (Bennani et al., 2022). This includes having a stable and fast internet connection, hardware capable of supporting advanced software, and technical support capable of resolving any problems that may arise.

Changes in curriculum and teaching methodology may also be necessary to maximize the benefits of adaptive learning (Barrón Tirado & Diaz Barriga, 2017). Teachers must be trained in using new technologies and interpreting learning data to optimize teaching. This requires an investment of time and resources, but the long-term benefits of a more personalized learning approach. Furthermore, the adoption of AI-based adaptive learning systems must be accompanied by continuous evaluation and adjustment. This includes regularly testing the system to ensure the algorithms work as expected and do not introduce bias in the learning materials or assessments. In addition, users’ and teachers’ feedback must be continuously collected and used to improve the system. On the global side, implementing AI-based learning systems can help overcome educational gaps. With the ability to customize learning based on individual needs, students from various backgrounds and abilities can access quality education that may previously have been out of reach for students. This is especially important in areas with limited educational resources.

Table: Advantages and disadvantages of Artificial Intelligence Based Learning and Adaptive Learning

Aspect	Excess	Lack
Personalization	Enables particular customization of learning materials based on each student’s needs, preferences, and abilities, maximizing learning potential.	Requires extensive and sometimes invasive data collection to operate effectively, raising privacy concerns.
Efficiency	Optimize study time by targeting areas that need attention, reducing time spent on already mastered material.	Developing and maintaining efficient AI learning systems requires technology and human resources investment.
Scalability	It can be easily implemented across many students and multiple locations without requiring significant additional resources per student.	Scalability issues may arise regarding personalization quality, where the system may need to manage individuality at scale effectively.
Adaptability	Able to adapt to curriculum or educational needs changes quickly and efficiently without significant human intervention.	Limitations can hamper the algorithm’s adaptation speed, which may require adjustments or updates based on user feedback.

Cost	Potential to reduce costs per student in the long term through automation and reduced need for physical resources.	High initial costs for effective system development and the need for regular maintenance and updates also require investment.
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Table: Estimated percentages regarding adoption, effectiveness, and other elements of artificial intelligence-based learning management systems for adaptive learning.

NO	System aspects	Percentage
1	Adoption in Elementary School	40%
2	Adoption in Middle School	60%
3	Adoption in Higher Education	75%
4	Effectiveness in Increasing Value	80%
5	User Satisfaction (Student)	80%
6	User Satisfaction (Teacher)	80%
7	Level of Personalization of Learning	75%
8	Reduction of Teaching Time	50%
9	Integration with Other Educational Technologies	60%
10	Implementation Costs Relative to Budget	35%

To overcome the challenges arising from implementing artificial intelligence-based learning management systems for adaptive learning, a comprehensive strategy involving aspects of infrastructure technology, privacy policies, and teacher training is needed. Improving technological infrastructure is critical to supporting AI-based learning systems, ensuring that educational institutions are equipped with sufficient computing resources, stable and fast internet connections, and the latest hardware and software. Adequate training for teachers is essential to ensure that students can implement and utilize this technology effectively. Training programs should cover the use of the system and how to analyze learning data to improve teaching. In addition, it is important to take data privacy and security issues seriously. Institutions should implement strict privacy policies and adopt advanced data security technologies such as encryption and controlled access policies to protect student data. Given the importance of adapting curricula and teaching methodologies, institutions may need to modify curricula to support adaptive learning, which involves the integration of more interactive materials and dynamic assessment methods.

Additionally, supporting ongoing research and development will help improve AI-based learning systems. Institutions can form partnerships with academic and industry entities to explore innovations and apply research results to educational practice. An ongoing feedback and evaluation process is also vital to ensure the system is continually updated and refined based on user input. Effective communication with all stakeholders, including

students, faculty, parents, and administration, is also critical to ensure broad support for this initiative and address any concerns that may arise. Finally, dealing with cost constraints requires seeking alternative funding sources and gradually implementing a system to manage expenses while progressively measuring the system's effectiveness. Through the integration of these approaches, educational institutions can overcome existing challenges and maximize the benefits of artificial intelligence-based learning management systems for adaptive learning.

CONCLUSIONS

Based on the results and discussion above, it can be concluded that implementing an artificial intelligence-based learning management system for adaptive learning has positively impacted the learning process. One of them is that students tend to be more enthusiastic about learning and have high enthusiasm when studying. However, implementing an artificial intelligence-based learning management system for adaptive learning also faces several challenges. To overcome the difficulties arising from implementing artificial intelligence-based learning management systems for adaptive learning, a comprehensive strategy involving aspects of infrastructure technology, privacy policies, and teacher training is needed. Improving technological infrastructure is critical to supporting AI-based learning systems, ensuring that educational institutions are equipped with sufficient computing resources, stable and fast internet connections, and the latest hardware and software. Adequate training for teachers is essential to ensure that students can implement and utilize this technology effectively. Training programs should cover the use of the system and how to analyze learning data to improve teaching.

REFERENCES

- Abdalla, H. B. (2022). A brief survey on big data: Technologies, terminologies, and data-intensive applications. *Journal of Big Data*, 9(1), 107. <https://doi.org/10.1186/s40537-022-00659-3>
- Aditya Nirwana, Sudarmiati, & Melany. (2023). Implementing Artificial Intelligence in Digital Marketing Development: A Thematic Review and Practical Exploration. *Jurnal Manajemen Bisnis, Akuntansi Dan Keuangan*, 2(1), 85–112. <https://doi.org/10.55927/jambak.v2i1.4034>
- Ahmad, S. F., Alam, M. M., Rahmat, Mohd. K., Mubarak, M. S., & Hyder, S. I. (2022). Academic and Administrative Role of Artificial Intelligence in Education. *Sustainability*, 14(3), 1101. <https://doi.org/10.3390/su14031101>
- Alam, A. (2022a). Cloud-Based E-Learning: Development of Conceptual Model for Adaptive E-Learning Ecosystem Based on Cloud Computing Infrastructure. In A. Kumar, I. Fister, P. K. Gupta, J. Debayle, Z. J. Zhang, & M. Usman (Eds.),

- Artificial Intelligence and Data Science* (Vol. 1673, pp. 377–391). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-21385-4_31
- Alam, A. (2022b). Employing Adaptive Learning and Intelligent Tutoring Robots for Virtual Classrooms and Smart Campuses: Reforming Education in the Age of Artificial Intelligence. In R. N. Shaw, S. Das, V. Piuri, & M. Bianchini (Eds.), *Advanced Computing and Intelligent Technologies* (Vol. 914, pp. 395–406). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-2980-9_32
- Alam, A. (2023). Cloud-Based E-learning: Scaffolding the Environment for Adaptive E-learning Ecosystem Based on Cloud Computing Infrastructure. In S. C. Satapathy, J. C.-W. Lin, L. K. Wee, V. Bhateja, & T. M. Rajesh (Eds.), *Computer Communication, Networking and IoT* (Vol. 459, pp. 1–9). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-1976-3_1
- AL-Fayyadh, H. R. D., Ganim Ali, S. A., & Abood, Dr. B. (2021). Modeling an Adaptive Learning System Using Artificial Intelligence. *Webology*, 19(1), 01–18. <https://doi.org/10.14704/WEB/V19I1/WEB19001>
- Allam, Z., & Dhunny, Z. A. (2019). On big data, artificial intelligence, and smart cities. *Cities*, 89, 80–91. <https://doi.org/10.1016/j.cities.2019.01.032>
- Al-Qaysi, N., Mohamad-Nordin, N., & Al-Emran, M. (2020). What leads to social learning? Students' attitudes towards using social media applications in Omani higher education. *Education and Information Technologies*, 25(3), 2157–2174. <https://doi.org/10.1007/s10639-019-10074-6>
- Andronie, M., Lăzăroiu, G., Iatagan, M., Uță, C., Ștefănescu, R., & Cocoșatu, M. (2021). Artificial Intelligence-Based Decision-Making Algorithms, Internet of Things Sensing Networks, and Deep Learning-Assisted Smart Process Management in Cyber-Physical Production Systems. *Electronics*, 10(20), 2497. <https://doi.org/10.3390/electronics10202497>
- Aqtash, S., Alnusair, H., Brownie, S., Alnjadat, R., Fonbuena, M., & Perinchery, S. (2022). Evaluation of the Impact of an Education Program on Self-Reported Leadership and Management Competence Among Nurse Managers. *SAGE Open Nursing*, 8, 237796082211064. <https://doi.org/10.1177/23779608221106450>
- Barrón Tirado, M. C., & Diaz Barriga, F. (2017). Curriculum Management and the Role of Curriculum Actors. *TCI (Transnational Curriculum Inquiry)*, Vol. 13 No. 2, 13-33 Pages. <https://doi.org/10.14288/TCI.V13I2.188285>
- Bauer, M., Bräuer, C., Schuldt, J., & Krömker, H. (2018). Adaptive E-Learning Technologies for Sustained Learning Motivation in Engineering Science—Acquisition of Motivation through Self-Reports and Wearable Technology: *Proceedings of the 10th International Conference on Computer Supported Education*, 418–425. <https://doi.org/10.5220/0006787104180425>
- Bennani, S., Maalel, A., & Ben Ghezala, H. (2022). Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, 30(2), 628–642. <https://doi.org/10.1002/cae.22477>

- Chanias, S., Myers, M. D., & Hess, T. (2019). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *The Journal of Strategic Information Systems*, 28(1), 17–33. <https://doi.org/10.1016/j.jsis.2018.11.003>
- De Bézenac, E., Pajot, A., & Gallinari, P. (2019). Deep learning for physical processes: Incorporating prior scientific knowledge. *Journal of Statistical Mechanics: Theory and Experiment*, 2019(12), 124009. <https://doi.org/10.1088/1742-5468/ab3195>
- Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., Luetge, C., Madelin, R., Pagallo, U., Rossi, F., Schafer, B., Valcke, P., & Vayena, E. (2021). An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations. In L. Floridi (Ed.), *Ethics, Governance, and Policies in Artificial Intelligence* (Vol. 144, pp. 19–39). Springer International Publishing. https://doi.org/10.1007/978-3-030-81907-1_3
- Haenlein, M., & Kaplan, A. (2019). A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. *California Management Review*, 61(4), 5–14. <https://doi.org/10.1177/0008125619864925>
- Huang, M.-H., & Rust, R. T. (2021). A strategic framework for artificial intelligence in marketing. *Journal of the Academy of Marketing Science*, 49(1), 30–50. <https://doi.org/10.1007/s11747-020-00749-9>
- Jha, K., Doshi, A., Patel, P., & Shah, M. (2019). A comprehensive review on automation in agriculture using artificial intelligence. *Artificial Intelligence in Agriculture*, 2, 1–12. <https://doi.org/10.1016/j.aiia.2019.05.004>
- Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Computers and Education: Artificial Intelligence*, 2, 100017. <https://doi.org/10.1016/j.caeai.2021.100017>
- King, M. R. & chatGPT. (2023). A Conversation on Artificial Intelligence, Chatbots, and Plagiarism in Higher Education. *Cellular and Molecular Bioengineering*, 16(1), 1–2. <https://doi.org/10.1007/s12195-022-00754-8>
- Langlotz, C. P., Allen, B., Erickson, B. J., Kalpathy-Cramer, J., Bigelow, K., Cook, T. S., Flanders, A. E., Lungren, M. P., Mendelson, D. S., Rudie, J. D., Wang, G., & Kandarpa, K. (2019). A Roadmap for Foundational Research on Artificial Intelligence in Medical Imaging: From the 2018 NIH/RSNA/ACR/The Academy Workshop. *Radiology*, 291(3), 781–791. <https://doi.org/10.1148/radiol.2019190613>
- Rajaei, T., Ebrahimi, H., & Nourani, V. (2019). A review of the artificial intelligence methods in groundwater level modeling. *Journal of Hydrology*, 572, 336–351. <https://doi.org/10.1016/j.jhydrol.2018.12.037>
- Remote Sensing and Edge Artificial Intelligence Computing Systems, Environment Perception and Geospatial Mapping Technologies, and Simulation Modeling and Machine Learning-based Image Recognition Tools in the 3D Cognitive Digital

- Twin Metaverse. (2023). *Review of Contemporary Philosophy*, 22(0), 208. <https://doi.org/10.22381/RCP22202312>
- Tang, K.-Y., Chang, C.-Y., & Hwang, G.-J. (2023). Trends in artificial intelligence-supported e-learning: A systematic review and co-citation network analysis (1998–2019). *Interactive Learning Environments*, 31(4), 2134–2152. <https://doi.org/10.1080/10494820.2021.1875001>
- Toth, J., Rosenthal, M., & Pate, K. (2021). Use of Adaptive Learning Technology to Promote Self-Directed Learning in a Pharmacists' Patient Care Process Course. *American Journal of Pharmaceutical Education*, 85(1), 7971. <https://doi.org/10.5688/ajpe7971>
- Tussyadiah, I. (2020). A review of research into automation in tourism: Launching the Annals of Tourism Research Curated Collection on Artificial Intelligence and Robotics in Tourism. *Annals of Tourism Research*, 81, 102883. <https://doi.org/10.1016/j.annals.2020.102883>
- Xie, H., Chu, H.-C., Hwang, G.-J., & Wang, C.-C. (2019). Trends and development in technology-enhanced adaptive/personalized learning: A systematic review of journal publications from 2007 to 2017. *Computers & Education*, 140, 103599. <https://doi.org/10.1016/j.compedu.2019.103599>
- Zhang, Z. (2020). Big data analysis with artificial intelligence technology based on a machine learning algorithm. *Journal of Intelligent & Fuzzy Systems*, 39(5), 6733–6740. <https://doi.org/10.3233/JIFS-191265>

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