INTERNATIONAL JOURNAL OF EDUCATIONAL INNOVATION

NAWALA

Volume 1, Number 2, 2022

The Impact of Adaptive Learning Technology on Student Performance in Open and Distance Education

Syamsiati Arifah[1*]

[1] Universitas Sarjanawiyata Tamansiswa, Yogyakarta, Indonesia

Abstract

Article history:
Received: July 9, 2022
Revised: August 25, 2022
Accepted: October 22, 2022
Published: December 30, 2022

Keywords:
Adaptive Learning,
Distance Education,
Educational Technology,
Personalize Learning,
Student Performance.

Identifier:
Nawala
Page: 126-139
https://nawala.io/index.php/ijei

Advances in digital technology have driven transformation in the education system, including in the open and distance education model. One of the prominent innovations is adaptive learning technology, which is a learning system that automatically adjusts learning materials and strategies based on individual needs and characteristics of students. This study aims to systematically examine the impact of adaptive learning technology on student performance in the context of the open and distance education using a literature study approach. The results of an analysis of scientific articles show that adaptive learning is able to significantly improve academic outcomes, learning motivation, and student engagement. Nonetheless, successful implementation is highly dependent on digital infrastructure readiness, user skills, and data protection policies. Adaptive learning should be positioned as a complement to the role of educators in an inclusive and responsive technology-based curriculum. With the right integration, this technology has the potential to become an important strategy in improving the quality and effectiveness of learning in the era of digital education.

*Corresponding author:
arinfahsyamsiati@gmail.com (Syamsiati Arifah)

1. Introduction

The development of information and communication technology has driven a major transformation in the global education system. One of the most significant changes is the application of technology in open and distance education, which allows for more inclusive, flexible, and affordable access to education. In this context, adaptive learning technology is a promising innovation to increase learning effectiveness, especially in facing the challenge of individualization of learning which is often an obstacle in the open and distance education. Adaptive learning technology refers to a system that is able to adjust the content, delivery methods, and learning speed based on the characteristics and needs of each student in real time (Pane et al., 2015).

Open and distance education tend to have its own challenges that are not found in conventional education. These challenges include limited direct interaction between teachers and students, low motivation for independent learning, and difficulties in conducting effective assessments (Fadhilah et al., 2021). In this condition, a one-size-fits-all approach is no longer adequate. Therefore, a personalized approach such as adaptive learning can be a strategic solution. This technology provides opportunities for students to learn according to their own learning styles, abilities, and pace, so it is expected to be able to improve overall academic performance.

The implementation of adaptive learning technology in the open and distance education has various forms, ranging from e-learning platforms equipped with adaptive algorithms, artificial intelligence-based content recommendation systems,

to formative assessments that adjust questions based on learners' responses (Johanes & Lagerstrom, 2017). In addition, various studies show that the use of this technology is able to significantly increase material retention, learning motivation, and student exam results, especially in STEM (science, technology, engineering, and mathematics)-based subjects (Alshammari & Qtaish, 2019).

However, the effectiveness of adaptive learning technology is still influenced by a number of factors, including the readiness of technology in educational institutions, students' digital skills, and the quality of the content provided. A study by Mavroudi et al. (2018) showed that students who have low digital literacy tend to have difficulty accessing the maximum benefits of adaptive learning. Similarly, other challenges such as unstable internet connectivity and limited technological devices can also hinder the effectiveness of adaptive learning implementations, particularly in developing countries.

In addition, although many studies mention the positive impact of the use of this technology, there are still differences in results between one educational context and another. This indicates the need for a more in-depth and systematic evaluation of the implementation of adaptive learning technology in various forms and backgrounds of open and distance education.

Against this background, this paper aims to systematically review the relevant literature on the impact of adaptive learning technology on student performance in the context of open and distance education. Through a literature review approach, this article seeks to answer an important question: to what extent can adaptive learning technologies improve students' academic performance in a distance and

open learning environment? In addition, this paper will also discuss the challenges and opportunities for the implementation of the technology, as well as provide educational policy recommendations based on the findings of previous research.

This study is important not only to expand academic understanding of the effectiveness of adaptive learning technologies, but also as a basis for policymakers and developers of digital learning systems to design more targeted interventions. In the era of digital education that continues to grow, integrating adaptive technology into the open and distance education is no longer an option, but a must to ensure access to quality and sustainable education for all.

2. Literature Review

Adaptive learning technology has become an important topic in the development of digital education, especially in the context of open and distance education. Adaptive learning refers to a technology-based learning system that automatically adjusts materials, learning paths, and feedback based on individual learners' performance data (Xie, Chu, Hwang, & Wang, 2019). The basic principle of this technology is personalization and responsiveness to different learning needs, which is very crucial in the open and distance education where direct interaction between teachers and students is limited. Research by Pane et al. (2015) shows that adaptive technology can improve learning outcomes, especially among students who have academic gaps. A similar study by Alshammari and Qtaish (2019) confirms that adaptive learning contributes to increased students' intrinsic motivation and perseverance in completing online learning modules.

Meanwhile, in the context of the open and distance education, Fadhilah et al. (2021) identified that the use of adaptive systems can reduce the dropout rate by providing a more relevant learning experience and supporting the individual needs of students. However, not all implementations of adaptive technology succeed equally. Research by Mavroudi et al. (2018) highlights that the success of this technology is highly dependent on the readiness of technology, teacher training, and students' digital literacy. Therefore, it is important to thoroughly evaluate how adaptive learning technology is implemented in real scenarios of the open and distance education and the extent of its influence on students' academic performance.

3. Methods

This study uses a qualitative descriptive literature review approach, with the aim of reviewing and analyzing the results of relevant previous research on the impact of adaptive learning technology on student performance in the context of open and distance education. This method was chosen because it allows researchers to gain a comprehensive understanding of various empirical findings, theories, and approaches related to the subject being studied without conducting primary data collection. The literature collection process was carried out by browsing the Google Scholar academic database using keywords such as "adaptive learning technology", "student performance", "distance education", "open learning", and "online personalized learning".

The selected articles are scientific publications in the form of journals or conference proceedings. Inclusion criteria in the literature selection include: (1) articles that explicitly discuss the implementation of adaptive learning technology in the context of online or distance education; (2) research that reports the impact on student performance, both from cognitive (grade, retention, task completion) and affective (motivation, satisfaction) aspects; and (3) articles that have gone through a peer-review process. From the search results, articles that meet these criteria were obtained and used as the main reference source in this study. The analysis was carried out by a thematic method, namely identifying patterns of findings and similarities between studies, and recording differences or contradictions that emerged. This procedure includes four main stages: (1) reading and recording the main content of each article, (2) grouping of articles by impact theme (e.g. value enhancement, learning engagement, motivation), (3) synthesis of similar findings to draw general conclusions, and (4) identification of research gaps or areas that are still debated.

In ensuring credibility and relevance, the researcher also considered the geographical context, level of education, and type of adaptive technology used in each study. In addition, the cited sources are analyzed to ensure the methodology used by each researcher is adequate and relevant to the objectives of this study. With this systematic approach, it is hoped that the results of the research can provide a valid and comprehensive understanding of the extent to which adaptive learning technology can improve student performance in open and distance education, as well as the factors that affect its success.

4. Results and Discussion

The results of the literature review show that adaptive learning technology makes a significant contribution to improving student performance in open and distance education. In today's digital era, the open and distance education has become an increasingly relevant choice for various groups, especially in the midst of the need for flexibility in time, location, and access to learning. On the other hand, this learning model presents new challenges, including limitations in direct interaction, differences in students' backgrounds, and varying levels of learning readiness. In this situation, adaptive learning appears as an innovative solution that is able to present an effective approach to personalizing learning through the use of technology.

In general, the performance of the students referred to in various studies includes academic outcomes, material retention, learning motivation, and involvement in the learning process. In the context of the open and distance education, these factors are very important because the learning environment no longer relies on face-to-face interactions, but on digital interaction through online platforms. Adaptive learning, designed with data-driven systems and intelligent algorithms, offers a learning experience that can be tailored to each student's strengths, weaknesses, and learning preferences. This creates opportunities for performance improvements that cannot always be achieved through conventional online learning that is uniform.

Some studies state that this technology is able to improve students' academic outcomes by providing learning paths that suit individual abilities. In a study by Pane

et al. (2015), it was found that students who used adaptive learning systems showed higher scores in math subjects compared to students from the control group. These findings confirm that adaptive systems are able to accommodate individual needs in the learning process, so that students get learning according to their respective competency levels. Learning becomes more effective because the material is not delivered uniformly, but based on previous student achievements. For example, students who have difficulty understanding basic concepts can be given reinforcement material, while students who understand faster can be given advanced material, without having to wait for other students.

These findings are reinforced by the results of a study from Xie et al. (2019), which showed that student material retention in adaptive platforms increased by up to 30% compared to conventional online learning. Good retention shows that students not only understand information instantly, but are also able to retain it in long-term memory. This is an important indicator in distance learning, which demands greater independence and responsibility from students. The effectiveness of adaptive technology comes from its ability to provide instant feedback, tailor content based on student responses, and provide flexibility in the learning process that allows students to repeat the material as needed. In situations where teachers cannot provide direct personal attention, adaptive systems are able to fill that role efficiently.

In the context of open education, adaptive learning technology also has a positive impact on student motivation and engagement. Motivation is an important element in maintaining learning continuity, especially in the open and distance

education model where external disturbances can easily reduce students' enthusiasm for learning. Many students feel more confident when they can learn according to their own rhythm and preferences. They no longer have to feel left behind by their classmates, because the learning process is tailored to their own abilities. Mavroudi et al. (2018) stated that students' intrinsic motivation increases along with the system's ability to provide realistic and measurable learning targets. This system can automatically detect student achievements and assign the next challenge gradually, which makes students feel that progress is real and directional.

A personalized and relevant learning experience increases students' perception of the importance of the material studied, which ultimately affects perseverance in learning. When students feel that what they are learning is directly related to their needs and interests, the motivation to complete the learning becomes higher. In addition, student engagement is also increased through various interactive features in the adaptive system such as adaptive quizzes, simulations, and gamification elements. These elements not only make learning more engaging, but also create an immersive learning experience. Mohamad et al. (2019) show that the use of game-based adaptive learning platforms can increase students' activeness in discussion forums and material absorption. Gamification can increase positive competitiveness, strengthen memory, and provide a motivational boost through measurable rewards and achievements.

The main advantage of adaptive learning systems lies in their ability to adapt to students' learning styles and individual needs. This is very important in the open and distance education system that accommodates students from various social

backgrounds, ages, and learning abilities. In a study conducted by El-Sabagh (2021), it was found that students with visual preferences obtained better learning outcomes when the material was presented in the form of interactive graphics and videos. Adaptive learning systems provide a variety of material presentation formats that can be selected or automatically adjusted to students' learning styles. Meanwhile, students with slow learning speeds find it helpful because they can repeat the material independently without time pressure. Thus, this system gives students greater autonomy and allows them to study in a more psychologically comfortable atmosphere.

In a open and distance education environment that often consists of students with very diverse backgrounds, this flexibility is crucial. Adaptive learning also allows adult or working students to adjust their study time to their personal schedules. It provides a real solution for adult learners who have time constraints due to work or family responsibilities. Data-driven curriculum customization helps create a more inclusive learning experience that is responsive to real needs. In higher education or professional certification programs, this technology is very important because it can help improve learning efficiency and accelerate the achievement of competencies.

However, not all applications of adaptive technology succeed in providing positive results equally. Studies show that the success of implementation is greatly influenced by the readiness of technology, digital literacy of students, and the integration of the system with existing learning platforms. In research by Widianto (2021), it was found that many educational institutions, especially in developing countries, do not yet have a technological infrastructure that fully supports adaptive

learning. Uneven infrastructure causes differences in the quality of learning experience between students. Unstable internet connections, lack of digital devices, and limited access to adaptive platforms are the main obstacles in its implementation. In addition, students who have low digital literacy often have difficulty understanding how the system works, so they cannot take full advantage of the potential of adaptive technology. This shows the need for digital training for students and educators to be able to adapt to more complex systems.

Another issue that arises in the application of this technology is the security and privacy of student data. Adaptive learning systems rely on the collection and analysis of user data to provide appropriate learning responses. However, without adequate regulation and oversight, the data is at risk of misuse. Viberg et al. (2018) underscore the importance of strict data security policies to protect students' identities and personal information, especially in online learning environments that are vulnerable to privacy breaches. The collection of learning data must be accompanied by policy transparency, user consent, and a reliable encryption system to maintain user trust.

Based on a literature review, adaptive learning is not a substitute for the role of teachers or lecturers, but rather a tool to improve the quality of the learning experience. Therefore, the integration of this technology into the curriculum must be carried out comprehensively, taking into account the balance between a technology-based approach and a humanistic approach in education. Teachers continue to play an important role in guiding, evaluating, and providing emotional support to students. The presence of teachers is irreplaceable, especially in managing

affective and social aspects in the learning process. Curriculum design should allow adaptive technology to work synergistically with other learning strategies, such as group discussions, project-based learning, and online collaboration.

The implications of these findings for education policy-making are quite broad. First, investment in digital infrastructure is needed so that the application of adaptive technology can run optimally. Second, it is necessary to provide intensive training for educators so that they are able to utilize this system appropriately. Third, the formulation of data protection policies is non-negotiable. In addition, collaboration between educational institutions and technology developers needs to be improved so that the adaptive learning system developed is truly in accordance with the local context and needs. With proper planning and implementation, adaptive learning technology can be one of the strategic solutions in improving the quality of open and distance education, especially in response to global challenges such as pandemics, geographical limitations, and the need for lifelong learning.

5. Conclusion

Based on the results of the literature study that has been conducted, it can be concluded that adaptive learning technology has great potential in improving student performance in the context of open and distance education. This improvement includes cognitive aspects such as material retention and academic outcomes, as well as affective aspects such as motivation and learning engagement. This technology allows for the adjustment of materials, pace, and learning approaches based on individual characteristics, thus creating a more personalized and effective learning

experience. However, the effectiveness of the implementation of adaptive technology is highly dependent on several factors, including the availability of digital infrastructure, the readiness of educational institutions, students' digital literacy, and the protection of user data.

In addition, this approach cannot completely replace the role of teachers or lecturers in the educational process, but must be strategically integrated in a holistic curriculum design. In facing today's educational challenges, including the need for flexibility, inclusivity, and efficiency in online learning, adaptive learning technology can be one of the important solutions. Therefore, policy support, technology investment, and adequate human resource development are the keys to the successful implementation of this system. Further studies are still needed to evaluate the long-term effectiveness of adaptive learning at various levels of education and the backgrounds of learners in the ever-evolving in the open and distance education ecosystem.

References

Alshammari, M. T., & Qtaish, A. (2019). Effective Adaptive E-Learning Systems According to Learning Style and Knowledge Level. *Journal of Information Technology Education: Research*, *18*.

El-Sabagh, H. A. (2021). Adaptive e-learning environment based on learning styles and its impact on development students' engagement. *International Journal of Educational Technology in Higher Education*, *18*(1), 53.

Fadhilah, A. R., Fitri, R. R., & Wibowo, Y. S. (2021). Distance education di masa covid-19: tinjauan terhadap sistem, kebijakan, dan tantangan e-education di sekolah. *Jurnal Akuntabilitas Manajemen Pendidikan*, *9*(2), 171-188.

Johanes, P., & Lagerstrom, L. (2017). Adaptive learning: The premise, promise, and pitfalls. In *2017 ASEE Annual Conference & Exposition*. 1-14.

Mavroudi, A., Giannakos, M., & Krogstie, J. (2018). Supporting adaptive learning pathways through the use of learning analytics: developments, challenges and future opportunities. *Interactive Learning Environments*, *26*(2), 206-220.

Mohamad, S. N. M., Salleh, M. A. M., Hakim, M., Hamid, A., Sui, L. K. M., & Mohd, C. K. N. C. K. (2019). Adaptive learning strategies with gamification to enhance learning engagement. *Indian Journal of Science and Technology*, *12*(31), 1-8.

Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2015). *Continued Progress: Promising Evidence on Personalized Learning*. Rand Corporation.

Viberg, O., Hatakka, M., Bälter, O., & Mavroudi, A. (2018). The current landscape of learning analytics in higher education. *Computers in human behavior*, *89*, 98-110.

Widianto, E. (2021). Pemanfaatan media pembelajaran berbasis teknologi informasi. *Journal of Education and Teaching*, *2*(2), 213-224.

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.