The Adaptive Learning Effect on Individual and Collective Learning

[1]Yulius Kurniawan, [2]Didit Darmawan

[1]*Widya Kartika University, Indonesia*
[2]*Mayjen Sungkono University, Indonesia*

A R T I C L E I N F O

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A B S T R A C T

Adaptive learning is an important solution to address the challenges of education in the digital age, as it offers a more personalized approach that can be tailored to the needs of individual students. However, its implementation faces a number of challenges, mainly related to unequal access to technology, limited teacher training, and the issue of secure student data management. Reliance on technology and different levels of access between urban and rural areas may exacerbate the education gap, while management of student data that is not in line with privacy policies risks lowering the trust of parents and students. This research examines the challenges faced in implementing adaptive learning, including the aspects of teacher training and data protection, and how these factors can affect the effectiveness of adaptive learning. Collaborative efforts between teachers, educational institutions and technology providers are needed to overcome these challenges. By providing better training to teachers and ensuring more equitable access to technology, as well as strict data protection, adaptive learning can be optimized. This will enable a more inclusive education environment, improve the quality of education and reduce inequalities in the education system.

INTRODUCTION

The phenomenon of adaptive learning in education is gaining attention due to its ability to be tailored to individual needs. Adaptive learning refers to the use of technology or learning approaches that are able to adjust materials, methods and pace of learning according to each student's ability and learning style (Garmston & Wellman, 2016). On a more general level, this phenomenon is part of the digital transformation in education that aims to improve learning effectiveness by utilizing data to analyze and understand students' strengths and weaknesses (Siemens, 2014). The rapid advancement of technology has enabled the creation of systems that are more responsive to students' needs so that they can learn in a way that best suits their pace and way of proceeding (Truong, 2016).

In particular, adaptive learning plays an important role in supporting both individualized and collaborative learning. In individualized learning, this approach provides a more personalized and efficient learning experience, where each student gets material that suits their level of understanding (Krasny & DuBois, 2019). Meanwhile, in collective learning, adaptive learning can improve interactions between students by providing a space for them to work together, share information, and develop collaborative skills to solve problems (Peng et al., 2019). This phenomenon can create a more inclusive and productive environment that not only focuses on individual achievement, but also prioritizes cooperation in groups (Dabbagh & Kitsantas, 2012). Thus, adaptive learning has the potential to optimize academic achievement and facilitate the development of students' social and collaborative skills.

One of the main issues that arise in the implementation of adaptive learning is the unequal access to technology. While adaptive learning offers great potential to enhance individual and collective learning experiences, significant challenges arise in areas or environments with limited technological resources. Many schools, especially in rural or low-economic areas, do not have adequate infrastructure to support technology-based learning (Colchester et al., 2017). This leads to inequalities in the implementation of adaptive learning, where students in areas with limited access may not be

* *Corresponding author, email address:* ***yulius.michael@yahoo.com***

able to fully benefit from learning that is tailored to their needs. According to Warschauer (2011), inequality in technology access can exacerbate educational disparities, resulting in unequal learning opportunities among students with different socioeconomic backgrounds.

The implementation of adaptive learning often requires very specific data on the needs and progress of individual students. Issues arise related to the collection and use of such data, especially with regard to student data privacy and security issues. Many educational institutions do not have clear and secure policies regarding the management of students' personal data obtained through adaptive learning systems. This can trigger concerns from parents and the community about how the data is used and protected. According to McKinney et al. (2018), concerns about data privacy have been a barrier to the adoption of educational technology, especially those involving big data analytics, which are often used in adaptive learning systems to provide customized learning recommendations.

Another issue that is often faced is the readiness of teachers to implement adaptive learning in the classroom. Adaptive learning requires considerable skill and understanding from teachers regarding the use of technology, how to interpret student data, and how to create an environment that supports both individual and collaborative learning (Peng et al., 2019). Many teachers find it difficult to adapt to the rapid changes in technology-based teaching approaches, which can reduce the effectiveness of adaptive learning implementation. According to Collis and Moonen (2001), although technology in education continues to evolve, many teachers feel poorly trained to integrate the technology into their teaching in an effective way, which ultimately hinders the maximum benefits of adaptive learning.

The importance of observing the influence of adaptive learning on individual and collective learning cannot be underestimated, especially in light of today's rapid technological advances. Adaptive learning allows for a more personalized learning experience that is responsive to students' needs, which is critical to helping them reach their full potential. However, the problem of unequal access to technology, which is highly dependent on economic factors and geography, can exacerbate inequalities in education. If not addressed, these inequalities can widen the educational gap between students from rich and poor backgrounds, ultimately leading to unequal opportunities in the world of work and social life. Therefore, it is important to understand and assess the impact of adaptive learning to ensure that educational technology is equitably accessible and benefits all members of society (Warschauer, 2011).

The urgency to study the application of adaptive learning is also related to the challenges in teacher training and the protection of students' personal data. In this digital era, technology-based learning such as adaptive learning is increasingly dominating in many educational institutions. However, many teachers are still poorly trained to use this technology effectively so that the full potential of this approach cannot be optimally utilized. The management of student data collected through adaptive systems is also a major concern regarding data privacy and security issues. This requires clear policies to protect students' personal information, so that this technology can be used safely and reliably. Observing and understanding these issues will help create policies that support more effective and secure implementation of adaptive learning (McKinney et al., 2018).

The purpose of this study is to analyze how unequal access to technology in the implementation of adaptive learning can affect the education gap between students from different socioeconomic backgrounds. This research also aims to identify the challenges faced by educators to effectively implement adaptive learning, as well as explore how student data management can be guaranteed to be secure and compliant with applicable privacy policies.

RESEARCH METHOD

The research method used in this study is a literature study approach, which aims to analyze various sources and previous research related to the implementation of adaptive learning in relation to inequitable access to technology and the challenges faced by teachers. This approach allows researchers to collect and evaluate relevant findings from various disciplines, including educational technology, educational policy and educational psychology. By using literature review, this research can map a more comprehensive understanding of the impact of adaptive learning on educational disparities and the challenges that arise in its implementation (Graham et al., 2019).

The literature review will include an analysis of existing education policies related to the integration of technology in learning, as well as how these policies affect the distribution and access of technology in different regions, especially in areas with limited infrastructure. This research will also review the literature on the effectiveness of adaptive learning to improve learning outcomes, with a focus on disparities between students from different socio-

economic backgrounds. Based on the literature review, this research aims to provide insights into how educational policies and practices can be adjusted to address the inequalities created by differential access to technology in education (Hattie, 2009).

The literature review method also makes it possible to examine the challenges related to data privacy in adaptive learning. This study will evaluate previous research on the use of students' personal data in technology-based learning systems, as well as the issues faced in managing and protecting such data.

This study will identify the policies that various educational institutions have implemented to address data privacy and security issues, and how these may affect the implementation of adaptive learning. The results of this study are expected to provide useful recommendations to improve student data management and support the wider and more secure implementation of adaptive learning (Kizilcec et al., 2017).

RESULT AND DISCUSSION

Unequal Access to Technology and its Impact on Education Gaps in Adaptive Learning

Unequal access to technology in the implementation of adaptive learning is one of the main factors affecting the education gap between students from different socio-economic backgrounds. Adaptive learning, which utilizes technology to provide learning experiences tailored to individual needs, can provide great benefits for students who have access to adequate devices and internet connections. However, students from families with low incomes or who live in remote areas often do not have the same access to such technology. This creates inequalities in learning opportunities, with students from wealthier families and those in urban areas benefiting more from the application of these educational technologies (Warschauer, 2011).

This inequality can exacerbate the academic achievement gap between students from different socioeconomic backgrounds. Students who do not have equal access to the devices or internet needed to access adaptive learning will be left behind in terms of the quality of education they receive (Truong, 2016). For example, students who are unable to take part in online learning or use adaptive learning apps may miss out on opportunities to learn in ways that are more suited to their learning styles, which can lead to lower academic achievement. This creates a vicious cycle, where the inability to access technology hinders academic development, further exacerbating future social and economic inequalities (Selwyn, 2016).

Furthermore, this unequal access to technology includes not only physical devices such as computers or tablets, but also basic infrastructure such as a fast and stable internet connection. In many rural or low-income areas, access to high-speed internet is very limited, which makes technology-based learning inaccessible. This deprives these students of access to adaptive learning that can help them improve their understanding and skills in various academic areas. Adaptive learning, which should be a tool to equalize opportunities, has the potential to exacerbate educational inequality (Van Dijk, 2017).

Unequal access to technology also includes inequalities in students' ability to utilize learning devices and applications effectively. Students from more affluent families may have more support in terms of guidance and supervision of technology use, while students from less affluent families often have to learn independently without adequate guidance. This potentially leads to students from lower socioeconomic backgrounds not being able to fully utilize the potential of educational technology. Research shows that this unequal digital skills factor can exacerbate inequalities in educational outcomes.

Given these inequalities, educators and policymakers need to consider the impact of unequal access to technology on students' academic achievement and social development (Garmston & Wellman, 2016). Several studies have shown that students who cannot access technology-based learning tend to have difficulty following curricula adapted to use digital devices. As a result, they often cannot compete with students who have full access to technology (Peng et al., 2019). Therefore, it is important to identify solutions that can reduce this inequality and ensure that all students, regardless of their socioeconomic background, have equal opportunities to access and utilize adaptive learning (Cohen & Ball, 2015).

Educational policies that support the provision of devices and internet access for students from low-income families are essential to ensure equity in adaptive learning. Various government and educational organization initiatives should be focused on providing affordable devices and improving technology infrastructure in less developed areas. According to Van Dijk (2017), policymakers should ensure that educational technology is not only available to those who can afford it, but also to those who are less financially able. Thus, educational technology can serve as an effective tool to reduce educational disparities and provide fairer opportunities for all students.

Finally, while adaptive learning technologies have great potential to improve the quality of education, inequitable access to technology remains a significant barrier. Therefore, addressing this inequality should be a priority in the effort to create an inclusive and equitable education system. With greater efforts to address these technology access issues, adaptive learning can serve to support the academic development of all students, regardless of their socioeconomic background (Warschauer, 2011).

Challenges of Adaptive Learning Implementation by Teachers and Student Data Management related to Security and Privacy

Implementing adaptive learning presents a number of significant challenges for educators that need to be addressed in order for the learning to be effective. One of the main challenges is the reliance on adequate technology and tools. Many educators are not fully familiar with the adaptive learning tools or platforms being used (Colchester et al., 2017). As a result, teachers often struggle to make the most of the technology's features. This affects the quality of learning delivered, as adaptive learning requires a good understanding of how the system works to provide a personalized learning experience (Puentedura, 2014).

Another challenge is the different levels of students' ability to interact with adaptive learning technology. Every student has different levels of technology skills, which can affect their learning experience. Students with lower digital skills may struggle to keep up with adaptive learning, even if the system is designed to help them. Teachers need to be able to adapt their approach to support students with these difficulties, which in turn requires additional training and more time to ensure all students can make optimal use of the system (Ally, 2008).

In addition to the challenges in technology mastery, student data management is also an aspect that needs to be considered in the implementation of adaptive learning. In this learning system, students' data, such as their learning performance, learning style, and progress, are collected and analyzed to tailor the learning experience to individual needs (Zhu et al., 2016). However, collecting and managing this data raises concerns about privacy and security. In many countries, there are strict regulations governing the use and storage of personal data, requiring educational institutions to comply with relevant privacy policies (Morrow & Haase, 2017). Inadequate management of student data can lead to privacy breaches that adversely affect the reputation of educational institutions and lower parents' and students' trust in adaptive learning systems (Krasny & DuBois, 2019).

Another challenge is the lack of clear policies related to the protection of personal data related to adaptive learning. Most educational institutions do not have comprehensive enough guidelines on how student data should be stored, accessed and used. This lack of policy often leads to confusion and errors in data management. To ensure that student data is secure, educational institutions need to implement stricter data protection policies, ensuring that only authorized parties can access the information (Smith et al., 2019). This requires cooperation between faculty, administration, and information technology professionals to develop systems that are secure and compliant with applicable laws.

Not only that, the limited resources that educational institutions have are also a major challenge to effectively implement adaptive learning. Not all educational institutions have adequate budgets or facilities to provide the necessary technology tools to support adaptive learning. This is particularly pronounced in schools with limited resources, both in terms of hardware and software. In this situation, teachers often struggle with limitations that can affect the effectiveness of implementing adaptive learning in the classroom (Levin & Wadmany, 2008).

Furthermore, the aspect of teacher readiness cannot be ignored. Despite the rapid development of educational technology, many teachers feel inadequately trained in the use of digital tools that support adaptive learning. Teachers who are not prepared to use these technologies may feel pressured, leading to a lack of effective implementation in the classroom. Adequate training for teachers is essential so that they can optimize the use of technology in adaptive learning and reduce the workload that can interfere with the quality of learning provided (Bates, 2015).

In the area of student data privacy, one approach is to use technology that has adopted strict security standards, such as encryption and user authentication. Adaptive learning platform providers need to ensure that student data is protected in a way that complies with applicable regulations, such as the General Data Protection Regulation (GDPR) in Europe or the Children's Online Privacy Protection Act (COPPA) in the United States. These policies ensure that the data collected is only used for legitimate purposes and is not misused. This approach allows for more secure data management, which in turn increases acceptance of adaptive learning among teachers and students (Schwartz & Heider, 2018).

CONCLUSION

While adaptive learning has great potential to improve the quality of education and aid more personalized teaching, its implementation faces a number of significant challenges. In particular, dependence on technology and inequality in access to technology between different regions and socio-economic groups may exacerbate educational inequality. Issues related to the secure management of student data and compliance with privacy policies are also a major concern, given the importance of protecting students' personal information in a digital environment. Lack of training for teachers and limited resources in some educational institutions exacerbate these challenges.

Therefore, to realize effective adaptive learning, it is important to ensure that all parties involved-teachers, students and educational institutions-have equal access to the necessary technology. Providing adequate training for teachers, as well as strengthening student data protection policies, is necessary to create a safe and efficient learning environment. Educational institutions also need to pay more attention to the technology access gap by providing solutions that can reach various groups, including by considering the provision of more affordable devices and more equitable internet access. With these steps, adaptive learning can be implemented more effectively, making education more inclusive and improving the quality and equity of learning for all students.

REFERENCES

Ally, M. (2008). Foundations of Educational Theory for Online Learning. *In T. Anderson (Ed.), The Theory and Practice of Online Learning*. Athabasca University Press, Athabasca.

Bates, A. W. (2015). *Teaching in a Digital Age: Guidelines for Designing Teaching and Learning*. Tony Bates Associates Ltd, Vancouver.

Cohen, D. K. & D. L. Ball. (2015). Reform by the Book: What is – or might be – The Role of Curriculum Materials in Teacher Learning and Instructional Reform?. *Educational Researcher*, 32(1), 3-14.

Colchester, K., H. Hagras, D. Alghazzawi, & G. Aldabbagh. (2017). A Survey of Artificial Intelligence Techniques Employed for Adaptive Educational Systems within E-Learning Platforms. *Journal of Artificial Intelligence and Soft Computing Research*, 7(1), 47-64.

Collis, B. & J. Moonen. (2001). *Flexible Learning in a Digital World: Experiences and Expectations*. Kogan Page, London.

Dabbagh, N. & A. Kitsantas. (2012). Personalized and Adaptive Learning: The Role of Instructional Technology in the Development of Collaborative and Individual Skills. *Educational Technology Research and Development*, 60(6), 973-989.

Garmston, R. J. & B. M. Wellman. (2016). *The Adaptive School: A Sourcebook for Developing Collaborative Groups*. Rowman & Littlefield, Lanham.

Graham, C. R., K. Cagiltay, B. Lim, J. Craner, & T. M. Duffy. (2019). Survey of Graduate Students and Faculty Regarding the Effectiveness of an Interactive Multimedia Environment for Teaching and Learning. *Educational Technology Research and Development*, 47(4), 5-22.

Hattie, J. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. Routledge, Oxfordshire.

Kizilcec, R. F., M. Pérez-Sanagustín, & L. Sritanyaratana. (2017). Data Privacy and Learning Analytics: A Critical Review. *Journal of Educational Data Mining*, 9(2), 30-60.

Krasny, M. E. & B. DuBois. (2019). Climate Adaptation Education: Embracing Reality or Abandoning Environmental Values. *Environmental Education Research*, 25(6), 883-894.

Levin, T. & R. Wadmany. (2008). Teachers' Beliefs and Practices in Technology-Based Classrooms: A Critical Review. *Journal of Research on Technology in Education*, 40(3), 1-17.

MacMahon, S., J. Leggett, & A. Carroll. (2020). Promoting Individual and Group Regulation Through Social Connection: Strategies for Remote Learning. *Information and Learning Sciences*, 121(5/6), 353-363.

Morrow, L. & R. Haase. (2017). Ensuring Privacy in the Digital Age: The Importance of Data Protection in Educational Technology. *Journal of Educational Technology Development*, 26(3), 200-215.

Peng, H., S. Ma, & J. M. Spector. (2019). Personalized Adaptive Learning: An Emerging Pedagogical Approach Enabled by a Smart Learning Environment. *Smart Learning Environments*, 6(1), 1-14.

Puentedura, R. R. (2014). SAMR: A Model for the Integration of Technology in the Classroom. *In K. A. Green & S. L. Mehaffey (Eds.), Proceedings of the 15th International Conference on Education and Technology*, 106-118.

Schwartz, M. & K. Heider. (2018). Understanding Privacy in the Age of Digital Learning. *Technology in Education Journal*, 14(2), 23-36.

Selwyn, N. (2016). *Education and Technology: Key Issues and Debates.* Bloomsbury Publishing, London.

Siemens, G. (2014). Connectivism: A Learning Theory for the Digital Age. *International Journal of Instructional Technology and Distance Learning*, 4(5), 3-10.

Smith, J., D. Williams, & T. Ball. (2019). Managing Student Data in Educational Technology: Best Practices for Protecting Privacy. *Journal of Educational Privacy Law*, 18(4), 55-78.

Truong, H. M. (2016). Integrating Learning Styles and Adaptive E-Learning System: Current Developments, Problems and Opportunities. *Computers in Human Behavior*, 55, 1185-1193.

Van Dijk, J. A. G. M. (2017). *The Digital Divide: The Internet and Social Inequality in International Perspective*. Sage Publications, London.

Warschauer, M. (2011). *Learning in the Cloud: How Digital Technologies are Transforming Education*. Harvard Education Press, Cambridge.

Zhu, Z. T., M. H. Yu, & P. Riezebos. (2016). A Research Framework of Smart Education. *Smart Learning Environments*, 3, 1-17.

Kurniawan, Y., & D. Darmawan. (2021). The Adaptive Learning Effect on Individual and Collecting Learning, *Journal of Social Science Studies* 1(1), 93 – 98.