



The Use of Adaptive Learning Technology in the Malaysian School Classrooms

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Abstract:

Using adaptive learning technology in Malaysian classrooms marks a major change in the educational system of the nation. Children from many backgrounds should be able to study more effectively and on their own free will thanks to this technology. Thanks to data-driven algorithms, adaptive learning systems conduct constant review of student performance. This is done to ensure that every student receives individual teaching materials tailored to their own strengths, limits, and learning speed. These findings will help to clarify the degree of adaptive learning technologies usage in Malaysian primary and secondary schools as well as the effects these tools have on the dynamics of the classroom, the degree of student involvement, and the final grades. The findings suggest that classroom performance is much enhanced by adaptive learning systems. These strategies also help instructors to conduct customized instruction and give more time to concentrate on students who want additional assistance. Still, certain components are necessary if such technologies are to be employed sensibly. These elements include digital infrastructure, teacher training, curriculum integration, and academic stakeholder support. Among the issues still standing as obstacles to general adoption are worries about data security, a reluctance to innovative educational approaches, and restricted access to technology in remote areas. The research suggests that in Malaysia adaptive learning may result in a more inclusive, fair, and responsive educational system. This commitment shows even in the present difficulties. Teachers and legislators might discover ideas in this part on how to more include adaptive learning technology into classrooms by means of investments in digital infrastructure, continual professional development for educators, and strategic planning. The results of this study validate the corpus of current knowledge on educational technology and show how adaptive learning may transform the Malaysian educational system.

1. Introduction

Adaptive learning technology has emerged as one of the most exciting new tools for enhancing academic performance and tailoring education to each and every unique student. This is a direct result of the widespread use of digital resources in the classroom. This technology came into being as a result of the

increased acceptance of digital materials and resources in educational settings. The use of adaptive learning technology in Malaysian classrooms has grown more widespread as the country seeks to modernize its educational system and accomplish the goals outlined in the Malaysia Education Blueprint. The term "adaptive learning platforms" refers to a set of technological solutions

that make use of AI and data analytics in order to personalize educational materials according to the different levels of knowledge, progress, and skill levels of individual learners. The degree of difficulty, the pace of the lesson, and the kind of information that is being taught are all altered as a result of these technologies since they are able to accurately reflect the actual growth of the students. This makes it feasible to have a learning experience that is both individualized and efficient. Because of the wide range of learning skills, backgrounds, and needs that students in Malaysia possess, adaptive learning is becoming an increasingly significant aspect of the educational system in Malaysia[1]. As a result of the fact that national priorities are always shifting to place a higher priority on education access, this is the case. In terms of education in the classroom, it provides an approach that is inclusive. Nevertheless, there are a few challenges that need to be overcome before such technology may be used. Some of these challenges include inadequate infrastructure, low levels of digital literacy among educators, and disparities in access across colleges located in urban and rural parts of the country. Ongoing concerns surrounding professional development and education for teachers continue to have a significant amount of importance. This is a consequence of the fact that adaptive learning technologies are required in order to fulfill the requirements of a shift in educational strategies and technological expertise. In spite of these challenges, recent studies have shown that adaptive learning systems, when implemented appropriately, have the potential to enhance the effectiveness of learning, provide a more individualized education, and increase the level of student participation. It has been possible for adaptive learning solutions to be adopted and extended in the educational institutions of Malaysia as a result of the growing availability of educational technology resources and the support provided by the government of Malaysia for digital learning. The purpose of this study is to determine the existing position of adaptive learning technology in Malaysian classrooms, analyze the benefits and drawbacks of this technology, and make precise proposals on how it may be introduced into the educational system of the nation[5].

2. Background of the Study

It has been shown that technology that enables adaptive learning has proven to be revolutionary in the constantly evolving educational environment of the twenty-first century. It has significantly altered the manner in which the researcher approach teaching our children and has resulted in an improvement in their performance in a variety of

educational settings. In adaptive learning, data-driven algorithms and AI are used to modify instructional materials in real time so that they are in accordance with the needs, performance, and chosen learning style of each and every individual learner. A tailored learning route is provided by adaptive systems, which are based on a continuous assessment of the interactions and development experiences of students. When compared to conventional ways, these strategies are more effective in filling in knowledge gaps, encouraging active engagement, and placing an emphasis on mastery in education. In light of the fact that educational systems all over the globe are becoming more dependent on digital transformation, Malaysia has begun to see the potential of adaptive learning technology in terms of facilitating a shift in the national classroom setting[3]. One of the primary objectives of the Malaysia Education Blueprint 2013–2025 is to aim for the improvement of educational accessibility, equity, and quality via the deliberate use of information and communication technology (ICT) into educational institutions. In spite of the fact that there has been progress made in updating the national digital infrastructure and campaigning for learning that is improved by technology, the actual implementation of adaptive learning aids in schools is still uncommon and uneven. Despite the fact that many urban classrooms have begun to experiment with platforms that track student progress using these systems, rural and underfunded schools in Malaysia continue to face major challenges. These challenges include a lack of digital resources, slow internet, and teachers who are not qualified to properly use systems that offer data analytics and differentiated instruction. Despite the fact that many schools in urban areas are beginning to investigate technology, these challenges continue to exist. In addition, adaptive technologies are either not used to their full potential or are utilized in an unproductive manner because teachers do not have sufficient opportunities for professional development to provide them with the knowledge necessary to properly apply these instruments in the classroom. With the appropriate integration, adaptive learning has the potential to significantly increase student participation, self-directed learning, and academic success, according to preliminary research. This is despite the fact that there are hurdles associated with its implementation. According to research conducted in the domains of science, technology, engineering, and mathematics (STEM), it has been shown that learning environments that are interactive and adaptable have a good impact on the levels of motivation, retention, and understanding of Malaysian students. Furthermore, flexible platforms are excellent for

inclusive education because they enable teachers to rapidly identify students who are having difficulty by way of continuous feedback loops and they enable students with a broad variety of learning capabilities to participate in the learning process[12]. To put it another way, they are an excellent choice for inclusive education. It is possible that adaptive learning might lead to a more personalized educational experience for a country like Malaysia, which is both cosmopolitan and multilingual. In order to do this, formative evaluation and curriculum adaptation are helpful. One must, however, have a comprehensive plan in order to make good use of adaptive learning. This strategy should include the participation of stakeholders, the alignment of the curriculum, and ongoing research to evaluate the scalability and effectiveness of the program. In order for Malaysia to achieve its objective of being a regional leader in digital education, it is imperative that the country develop a more comprehensive grasp of the benefits and drawbacks associated with adaptive learning. By assessing the acceptance rate, the impacts on student learning, and the hurdles to more broad and effective adoption, the purpose of this article is to explore the current state of adaptive learning technology in Malaysian classrooms. Specifically, the intention is to investigate the current scenario. In specifically, the adoption rate will be investigated in this research. In order to allow their system to conform to the most recent international standards, the purpose of this study is to provide clarity on the ways that legislators, educators from Malaysia, and technology developers should take into consideration in order to include adaptive learning[16].

3. The Purpose of the Research

Among the primary objectives of this research is to investigate the use of adaptive learning technology in Malaysian classrooms and to evaluate the effectiveness of this technology. During the process of adapting its educational institutions to meet the requirements of the digital era, Malaysia has used a variety of strategies to make use of technological innovation in order to enhance the quality of teaching and learning. The purpose of this article is to investigate the current state of adaptive learning platforms in elementary and secondary schools. The study will focus on the impact that these platforms have on student engagement, academic accomplishment, and the ability to modify teaching. In addition, the purpose of this research is to investigate the challenges that educators have while attempting to use latest technological advancements in the classroom. Infrastructure problems, inadequate preparation, and a curriculum that does

not correspond to the needs of the students are some of the new challenges. In order to assist lawmakers, school administrators, and developers of educational technology in increasing the adoption of adaptive learning solutions and the efficiency with which they are implemented, this study is being carried out. In order to accomplish this goal, it is helpful to weigh the benefits and drawbacks of a number of different possibilities. In summary, the findings of the research provide credence to the continuing national initiative to enhance educational equity and quality via the use of technologically driven techniques that are specifically designed to satisfy the many needs of Malaysian students.

4. Literature Review

The potential of adaptive learning technology to revolutionize classroom education by making it more exciting, relevant, and efficient for individual students has been increasingly well known in recent years. Growing numbers of educational institutions all throughout the world are using technology that can instantly adapt to the needs and developments of pupils. Customized feedback and learning paths catered to the particular talents and interests of every individual learner supplied by this technology. Research on adaptive learning is under way in Malaysia as a potential fix for problems with digital inequality, student-centered instruction, and a wide range of learning demands in both urban and rural schools. Adaptive learning systems help instructors to track student development, pinpoint areas where their knowledge is lacking, and provide targeted training based on these areas. Real-time data collecting by these systems generates algorithmic changes[2]. The Malaysia Education Blueprint 2013–2025 aims to ensure that every student has fair access to high-quality education and to stimulate digital innovation. Using these technologies helps both of these objectives to be supported. Adaptive learning technologies are still in their infancy in Malaysian schools, even although legislators promote them very heavily. Most installations are either concentrated on certain cities or trial initiatives with an eye toward other areas. The results of research indicate that adaptive learning systems—which include data-driven learning management systems, intelligent tutoring systems, and customized learning software—have the potential to raise academic performance especially in the domains of mathematics and science. Essential elements in the process of tackling Malaysia's persistent concerns with the diminishing degrees of student involvement and performance are the facilitation of continuous formative evaluation, the promotion of autonomous learning, and the growth

of student motivation. Some of the obstacles that have to be removed if the researcher is to effectively include new technologies are insufficient teacher training, issues with regionally customized material in line with the national curriculum, and a poor technical infrastructure—especially in rural regions. Research shows that two of the most crucial elements in guaranteeing the effective use of adaptive learning systems are the willingness of teachers and their access to professional development programs. Many teachers struggle to effectively use technology into their teaching plans in the absence of sufficient help[15]. Furthermore adding to the digital gap between rural and urban schools are pupils from less developed regions who have limited access to technical support, internet connections, and technological equipment. Legislators should keep an eye on AI-driven educational platforms and solve problems with data privacy and ethical ramifications so that their usage is both safe and successful. Though several negative aspects have been noted, new experimental installations and pilot studies have shown favourable findings. In terms of both retention and performance in certain learning modules, adaptive learning systems—for example—showed themselves above more traditional approaches of instruction. Apart from helping teachers to run their classes, dashboard analytics added into adaptive systems have given them greater understanding of the learning patterns of their students. Apart from their technical operation, Malaysia has to investigate adaptive learning systems to determine their instructional value, cultural relevance, and long-term sustainability. This is so because Malaysia wants to lead in the area of digital education and requires cooperative efforts across government agencies, technology developers, and educational institutions to scale effective models and remove structural obstacles to adoption. The results of the research indicate that adaptive learning technology might greatly improve the standard of conventional classroom instruction in Malaysia. To enable this, nevertheless, it is essential to carry out it deliberately with the help of improved infrastructure, more teacher agency, more policy alignment, and ongoing assessment efforts. Integration of adaptive learning is not just a technological update but also a paradigm change in education stressing customization, inclusiveness, and skill development for lifetime learning. Integration of adaptive learning is essentially about this[14].

5. Research Question

What kind of technological infrastructure are available in Malaysian school classroom?

6. Methodology

6.1 Research Design:

The quantitative data analysis was conducted using SPSS version 25. The odds ratio and 95% confidence interval were used to ascertain the strength and direction of the statistical link. The researchers developed a statistically significant criterion at $p < 0.05$. A descriptive analysis was performed to determine the key characteristics of the data. Quantitative approaches are often used to evaluate data obtained from surveys, polls, and questionnaires, as well as data modified by computational tools for statistical analysis.

6.2 Sampling:

The Rao-soft program estimated a sample size of 620. A total of 720 questionnaires were issued, 685 were returned, and 36 were discarded due to incompleteness. A total of 649 individuals from China were approached and surveyed for the research.

6.3 Data and Measurement:

A questionnaire survey served as the principal tool for data gathering in the study. The survey had two sections: (A) General demographic information and (B) Responses on online and offline channel variables assessed using a 5-point Likert scale. Secondary data was obtained from many sources, mostly on internet databases.

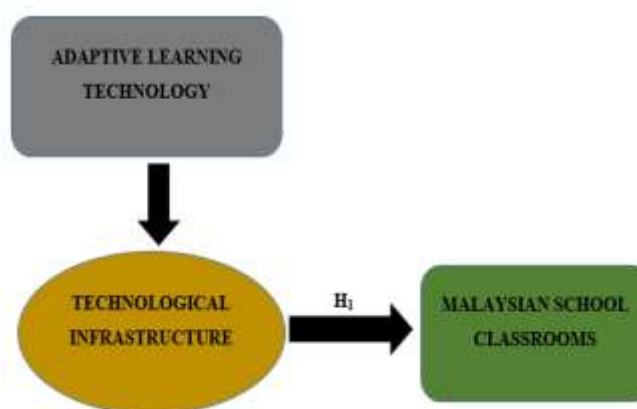
6.4 Statistical Software:

MS-Excel and SPSS 25 were used for Statistical analysis.

6.5 Statistical tools:

To grasp the fundamental character of the data, descriptive analysis was used. The researcher is required to analyse the data using ANOVA.

7. Conceptual Framework



8. Results

Factor Analysis

The process of verifying the underlying component structure of a set of measurement items is a widely used application of Factor Analysis (FA). The observed variables' scores are believed to be influenced by hidden factors that are not directly visible. The accuracy analysis (FA) technique is a model-based approach. The primary emphasis of this study is in the construction of causal pathways that connect observable occurrences, latent causes, and measurement inaccuracies.

The appropriateness of the data for factor analysis may be assessed by using the Kaiser-Meyer-Olkin (KMO) Method. The adequacy of the sampling for each individual model variable as well as the overall model is assessed. The statistics quantify the extent of possible common variation across many variables. Typically, data with lower percentages tends to be more suited for factor analysis.

KMO returns integers between zero and one. Sampling is deemed adequate if the KMO value falls within the range of 0.8 to 1.

It is necessary to take remedial action if the KMO is less than 0.6, which indicates that the sampling is inadequate. Use the researcher best discretion; some authors use 0.5 as this, therefore the range is 0.5 to 0.6.

- If the KMO is close to 0, it means that the partial correlations are large compared to the overall correlations. Component analysis is severely hindered by large correlations, to restate.

Kaiser's cutoffs for acceptability are as follows:
A dismal 0.050 to 0.059.

- 0.60 - 0.69 below-average

Typical range for a middle grade: 0.70–0.79.

Having a quality point value between 0.80 and 0.89.

The range from 0.90 to 1.00 is really stunning.

Table 1: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.958
Bartlett's Test of Sphericity	Approx. Chi-Square	3252.968
	df	190
	Sig.	.000

The overall significance of the correlation matrices was further confirmed by using Bartlett's Test of Sphericity. A value of 0.958 is the Kaiser-Meyer-Olkin sampling adequacy. By using Bartlett's sphericity test, researchers found a p-value of 0.00. A significant test result from Bartlett's sphericity test demonstrated that the correlation matrix is not a correlation matrix.

Independent Variable

Adaptive Learning Technology:

Using artificial intelligence (AI), machine learning (ML) algorithms, and real-time data analytics, the term "adaptive learning technology" describes a method of teaching and learning that adjusts the style, pace, and content of courses in line with the particular requirements, capabilities, and constraints of every and every individual student. Conversely, adaptive learning systems may dynamically change the course of instruction in response to personal interactions, degrees of knowledge, and response patterns. Conversely, this is not the case with stationary learning systems, which provide every learning person the identical course of instruction[11]. These systems maximize learning results and improve the degree of individualized learning by means of focused assistance, knowledge gap identification, and proper degree of difficulty adjustment. Adaptive learning techniques have proliferated in classrooms all across all grade levels and subject areas—including elementary and secondary education—during the last several years. Teachers' use of this technology might enable them to enhance tailored instruction, increase student involvement, and direct curricular choices motivated by data. Adaptive learning technology might help level the playing field for students' academic performance, promote diversity and inclusion in the classroom, and make the national curriculum in Malaysian schools current. It is essential that it be carried out properly if one wants to match educational strategy. This goes in addition to giving educators infrastructure to support them and chances for professional development. Among the

innovations made to adaptable learning include gamification, interactive multimedia, and real-time feedback systems. For students in many different environments, these developments make learning more fun and useful. Adaptive learning technologies are based on the idea that they might help to create a more responsive, efficient, student-centered educational system. Thanks to this approach, students would be able to study at their own speed but still have a strong basis in the topic they need[4].

Factor

Technological Infrastructure:

Technical infrastructure refers to the physical and digital systems enabling the effective and successful use of information and communication technologies in a variety of settings, including educational contexts. Among the many types of technologies used in schools are projectors, interactive whiteboards, laptops, tablets, and fast internet. Included also are tools like software, cloud services, data storage, cybersecurity systems, and learning management systems (LMS). Apart from that, it consists of technical support services and maintenance systems to ensure continuous and reliability of digital instruments. Strong technological infrastructure is required to allow virtual classrooms, adaptive learning, and AI to be integrated together[6]. Moreover necessary for enabling current teaching approaches, fostering digital literacy, and therefore supporting digital literacy are these infrastructure. In Malaysia, many rural schools have far more strong technological basis than those in cities. Among the challenges these far-off classrooms face are insufficient bandwidth, limited equipment availability, and poor maintenance support. The differences in these sectors immediately lead to unequal use of digital learning technology. As educational institutions gradually move toward mixed and customized learning environments, one of the primary focus of national education initiatives has been to invest in scalable, sustainable digital infrastructure. Once appropriate infrastructure is in place, teachers and students will be able to fully use the benefits of digital learning tools. Furthermore, the design of technological systems determines how well administrative effectiveness and educational outcomes turn out. Simplifying data gathering, student monitoring, formative assessment administration, and stakeholder communication at various levels helps one to accomplish this. Finding and fixing any infrastructure flaws is very crucial to ensure the success of digital transformation projects in the educational field. Should the infrastructure be

lacking, even the most creative instructional strategies might become worthless or underutilized[13].

Dependent Variable

Malaysian School Classrooms:

The official learning environments within the Malaysian primary and secondary school systems are under regulation of the Ministry of Education Malaysia. Leading structured learning is responsibility of trained teachers present in these surroundings. In Malaysian institutions, classrooms are the labels used to characterize many types of activities. Based on concepts of academic achievement, moral standards, multicultural awareness, and technology integration, these classes follow the national curriculum. Children attending various kinds of schools in Malaysia might get instruction in Malay, English, Chinese, or Tamil. Furthermore, the classrooms themselves reflect the diverse character of the nation as they comprise students from a great spectrum of linguistic, socioeconomic, and cultural backgrounds. Urban classrooms often have interactive whiteboards, projectors, internet connectivity, and digital learning systems among the contemporary teaching materials used there[9]. On the other hand, rural schools may battle with outdated technology, limited resources, and unreliable connection. A relatively recent effort to meet objectives of incorporating ICT, encouraging student-centered learning, and arming students with skills relevant in the twenty-first century is the Malaysia Education Blueprint 2013–2025. A statewide effort in progress aims to standardize the quality of available educational possibilities. Notwithstanding all these changes, instructor degree of readiness, technology integration, and student interaction still show clear differences. Among the ways that global educational trends are affecting Malaysian classrooms are blended learning models, formative assessments, and adaptive learning technologies. These represent just a few of options. These shifting dynamics lead the focus to be shifting from teacher-directed education to more cooperative, customized, technology enabled learning possibilities. Against continually changing educational reform, Malaysian school environments are rising to the challenge of becoming incubators of creativity, diversity, and academic performance. Providing teachers with continuous support for their professional development as well as changes to physical learning spaces and innovative techniques of teaching and learning is crucial to solve this issue[10].

Relationship Between Technological Infrastructure and Malaysian School Classrooms:

If Malaysia's initiatives to use digital learning are to be effective, the state of its infrastructure and the technology applied in classrooms will be of major consequence. The present educational systems rely on the infrastructure supporting technology to be feasible. Stable power, internet connectivity, digital devices, software applications, and technical assistance comprise this infrastructure. The availability of such equipment and the quality of such infrastructure in Malaysian school classrooms directly impact the acceptability and usage of educational technologies such smart boards, learning management systems, adaptive learning platforms, and virtual learning environments. Good integration of technology into the learning process allows classrooms to provide students more options for interaction, tailored instruction, timely feedback, and dynamic content delivery. On the flip side of the coin, infrastructural problems like obsolete equipment, sluggish internet connections, and unequal maintenance confronting schools in undeveloped or rural areas worsen educational inequities. Students who attend schools in these locations therefore have less opportunities to engage in digital learning directly[7]. This mismatch in infrastructure hinders attempts to deliver an education that is both equal and of great quality as promised in policy documents like the Malaysia Education Blueprint. Studies reveal that schools with enough technology infrastructure have more data-driven and efficient classroom management; pupils exhibit better degrees of motivation and academic performance; and instructors feel more comfortable in their ability to utilize digital technologies into their education. Strong infrastructure linking administrative efficiency, continuous professional development, stakeholder communication, and a learning environment more generally and future-proof to also support continuing professional growth. Still, the long-term viability of the digital infrastructure in Malaysian institutions relies on constant funding, consistent policies, community engagement, and linkages to the corporate sector kept under maintenance. Moreover proving the transforming ability of digital infrastructure in altering classroom environments and learning results are 5G technologies, smart classrooms, and cloud-based systems used in pilot schools all around Malaysia. This was aided to demonstrate by the manner these technologies were used. Its surroundings for equal access, system-wide educational reform, and pedagogical innovation actually matter. For Malaysian school buildings, the

atmosphere that technology infrastructure creates is more crucial than its simple supply of hardware and communication[8].

On the basis of the above discussion, the researcher formulated the following hypothesis, which was analyse the relationship between Technological Infrastructure and Malaysian School Classrooms.

“H₀₁: There is no significant relationship between Technological Infrastructure and Malaysian School Classrooms.”

“H₁: There is a significant relationship between Technological Infrastructure and Malaysian School Classrooms.”

Table 2: H₁ ANOVA Test

ANOVA					
Sum					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39588.620	215	5655.517	1,055.922	.000
Within Groups	492.770	433	5.356		
Total	40081.390	648			

This investigation yields remarkable results. The F value is 1055.922, attaining significance with a p-value of .000, which is below the .05 alpha threshold. This signifies the “H₁: There is a significant relationship between Technological Infrastructure and Malaysian School Classrooms” is accepted and the null hypothesis is rejected.

9. Discussion

By enabling to satisfy the many learning styles and demands of students, adaptive learning technology has the ability to completely transform the educational system in Malaysian classrooms. Adaptive learning systems modify course of instruction, speed, and feedback in keeping with the development every student has attained over their academic career. Especially beneficial in courses where students' skill levels vary is this customizing, which results in benefits like more engagement, encouragement of self-directed learning, and easier delivery of tailored teaching. The basis for the implementation of digitalization of education in Malaysia has been built by the Malaysia Education Blueprint and other government projects in Malaysia, therefore enabling the usage of such technology there. On the other hand, the availability and quality of the technological infrastructure significantly influences either aiding or hindering the spread of adaptive learning systems.

The technical basis is fairly important for the implementation and maintenance of adaptive

learning systems. This addresses among other things the internet connection, digital devices, software access, and technical support. Technology-equipped educational institutions may help adaptive platforms—which in turn allow professors and students real-time data, interactive tools, and fast feedback—to work smoothly. However, the variations in infrastructure between urban and rural areas result in quite clear implementation variances. Schools located far away suffer in consistent usage of adaptive learning technologies and general impact of these technologies owing to problems like inconsistent internet, insufficient hardware, and lack of workers competent to provide IT aid.

Furthermore, the degree of digital literacy within the infrastructure support system directly relates with the level of teacher readiness. Depending on their lack of access to digital resources or sufficient training, users face the danger of underusing or misusing even very sophisticated adaptive systems. Therefore, in addition to continuous professional growth, it is crucial to have easily accessible and user-friendly platforms so that one may fully enjoy the benefits of adaptive learning in Malaysian classrooms. If one wants a long-lasting and positive influence, the technological infrastructure must be easily available and easily included into the processes of education and training.

The debate underlines how infrastructural expenditures, teacher capacity building, and intentional government backing determine how successful adaptive learning technologies are. These three components hence are vitally essential for the success of adaptive learning technology. Schools need to be equipped with the necessary tools, constant internet access, and technical assistance if the researcher is to ensure the efficient application and integration of adaptive learning technology into the conventional classroom setting. Governments should give top priority to ensure that access is equitable in all domains in order to prevent digital hurdles that can increase educational inequity.

10. Conclusion

By means of data-driven feedback, differentiated learning, and customized teaching, the use of adaptive learning technologies in Malaysian school environments has produced fresh methods to improve educational results. Adaptive learning technologies are one of the independent factors capable of changing classroom environments. This technology could raise student involvement, retention, and performance. Notwithstanding this, its performance depends totally on the internet, digital gadgets, software platforms, and continuous

technical assistance being available. Before adaptive learning systems to be used in Malaysian classrooms, all schools—especially those in rural and underdeveloped areas—had to have access to a strong, fair, and technologically advanced infrastructure first. The digital gap in education is growing as adaptive learning technologies are not being used successfully. This is result of the unequal and limited distribution of the advantages modern technologies provide. To guarantee that the technology is readily available and can be utilized efficiently in the classroom, it is essential to provide instructors with training and guarantee that they are technologically ready. Adaptive learning technologies cannot change Malaysian classrooms without a whole strategy including finance for infrastructure, teacher training, and laws supporting education. Successful technology depends on this approach if the researcher is to have it. All things considered, adaptive learning technology provides a lot of possibilities to improve the Malaysian educational system. But if this is to come true, the country has to give the development of its technological infrastructure top attention and work toward the building of an inclusive digital learning environment empowering teachers and students.

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- **Ethical approval:** The conducted research is not related to either human or animal use.
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References

- [1] Abdullah, R., Rahman, M. A., & Zainuddin, N. (2021). Technology-enhanced learning in Malaysian classrooms: Challenges and opportunities. *Education and Information Technologies*, 26(5), 5121–5139.
- [2] Ali, N. M., Yusof, N., & Ariffin, M. M. (2021). Technology integration in Malaysian classrooms: A focus on adaptive learning systems. *Malaysian Journal of Educational Technology*, 21(3), 45–57.
- [3] Chong, S. L., Lee, W. M., & Ng, A. H. (2022). Investigating teacher readiness for technology-enhanced learning in Malaysian schools. *Malaysian Online Journal of Educational Technology*, 10(3), 45–56.
- [4] Ismail, A., & Hashim, H. (2019). Exploring the role of teacher readiness in implementing adaptive technologies. *International Journal of Instruction*, 12(1), 113–130.
- [5] Ismail, H. N., & Khalid, M. S. (2020). The impact of adaptive learning systems on student achievement in secondary education. *Malaysian Journal of Learning and Instruction*, 17(3), 89–104.
- [6] Kamaruddin, M. F., & Hashim, R. (2021). Examining the readiness of technological infrastructure in Malaysian rural schools. *Education and Information Technologies*, 26(5), 6139–6157.
- [7] Noor, N. M., & Latif, H. A. (2020). Enhancing classroom learning through infrastructure investment: A Malaysian perspective. *International Journal of Instructional Technology*, 17(2), 48–63.
- [8] Salleh, M. I., & Yunus, M. M. (2022). Bridging the digital gap: Infrastructure and digital equity in Malaysian rural schools. *Asian Journal of Education and Social Studies*, 19(3), 67–79.
- [9] Sani, R., & Mohamad, M. (2021). Classroom transformation in Malaysia: Challenges and prospects for 21st-century learning. *Malaysian Journal of Learning and Instruction*, 18(1), 1–18.
- [10] Ibrahim, N. H., & Hussein, R. (2019). Equity and access in Malaysian school classrooms: The rural–urban divide. *International Journal of Educational Development*, 70, 102091.
- [11] Tan, L. H., & Mokhtar, M. Z. (2020). Adaptive learning and its impact on student performance in Malaysian secondary education. *Asia Pacific Journal of Education*, 40(4), 310–326.
- [12] Tan, M. H., & Aziz, A. A. (2021). Bridging the digital divide in Malaysian education: Adaptive learning and its role in equitable access. *Asian Journal of Distance Education*, 16(2), 101–114.
- [13] Yap, S. L., & Lau, C. H. (2020). Enhancing school digital capacity: A study on technological infrastructure in Malaysia. *Asian Journal of Education and e-Learning*, 8(3), 49–60.
- [14] Zain, M. S., & Che Omar, N. (2023). Barriers to digital transformation in Malaysian schools: Infrastructure and pedagogical perspectives. *Journal of Digital Learning and Education*, 5(2), 78–95.
- [15] Rahman, F., & Hamzah, M. (2022). Enhancing inclusive education through adaptive learning platforms: A Malaysian case study. *Journal of Educational Research and Practice*, 12(3), 105–120.
- [16] Zainal, N., & Samad, A. M. (2023). The integration of adaptive learning platforms in Malaysian primary education: Opportunities and constraints. *Journal of Educational Research & Practice*, 13(1), 65–78.