



# A Critical Appraisal of Adaptive Learning Systems and their Effective Integration within School Environments

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DOI: <https://doi.org/10.70333/ijeks-03-12-031>

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Article Info: - Received : 06 October 2024

Accepted : 25 December 2024

Published : 30 December 2024



Adaptive learning systems have emerged as promising tools in education, offering personalised learning experiences that cater to individual student needs. This paper critically examines the potential and challenges of integrating ALS into school systems. The paper investigates the practical considerations for successful implementation, including teacher training, equitable access, data privacy and security, and the ethical implications of AI-driven education. By examining empirical evidence and addressing the limitations of current adaptive learning systems, this paper aims to provide valuable insights for educators, policymakers, and researchers in designing and implementing effective and equitable adaptive learning solutions within the evolving educational landscape.

**Keywords:** *Adaptive Learning Systems, Personalised Learning, Advantages of Adaptive Learning, Disadvantages of Adaptive Learning, Integration in Schools.*



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## 1. INTRODUCTION

Adaptive learning is an educational method that uses technology to personalise the learning experience of each student. It adjusts the difficulty level, content and pace of learning based on individual student's performance and needs. Instead of a one-size-fits-all approach, adaptive learning systems provide customised learning paths that cater to each student's strengths and weaknesses. Adaptive learning technologies got widespread acceptance during the Covid-19 pandemic when schools adopted a study from home approach relying on information technology. There are no formal definitions for adaptive learning technologies. According to Ekowo and

Palmer (2016, p.7), adaptive learning technologies "take a sophisticated, data-driven, and in some cases, nonlinear approach to instruction and remediation, adjusting to each learner's interactions and demonstrated performance level and subsequently anticipating what types of content and resources meet the learner's needs at a specific point in time". According to Rachmad (2022), adaptive learning is "an approach that utilises technology and methodologies to tailor the learning process according to the needs, pace, and preferences of each individual". Some of the commercially available adaptive learning tools are StockBox, Mindspark, Duolingo and Embibe.

Artificial Intelligence (AI) and Machine Learning (ML) are the driving forces behind the modern adaptive learning systems. They enable the system to analyse vast amounts of data and make intelligent decisions about how to personalise the learning experience. This data-driven approach enables this technology to adapt by providing varied content suitable for every student according to their ability.

The core idea behind adaptive learning is that it provides a personalised learning experience. Imagine a student learning algebra. In a traditional classroom, everyone might get the same lesson on solving linear equations. But some students might already grasp the basics, while others struggle with pre-algebra concepts. Adaptive learning changes this by using technology to assess (figure out what each student knows and does not know) and adjust by providing different content, practice problem and support based on that assessment. Through these assessment and adjustment, the student who already understands linear equations might get more challenging problems or move on to more advanced topics. The student who struggles might get extra practice with pre-algebra or simpler examples of linear equations.

Adaptive learning is more effective in enhancing student achievement in different ways. While traditional learning has fixed pace for all students, adaptive learning provide personalised pace for each student. While the content is same for all students in traditional learning, content adapts to individual needs in adaptive learning. While traditional learning use summative (end of unit tests) assessment, a continuous formative assessment is provided in adaptive learning. The role of technology is limited to delivery of content in traditional learning but in adaptive learning, it is integral for personalisation and adaptation.

## 2. HOW ADAPTIVE LEARNING SYSTEM WORKS?

Here are some ways adaptive learning systems adapt:

- **Branching Logic:** If a student answers a question correctly, they move to a more challenging one. If they answer incorrectly, they might get a simpler question, a hint, or a review of the relevant concept.
- **Content Sequencing:** The order in which topics are presented can change based on student performance. For example, if a

student struggles with fractions, the system might provide extra practice on fractions before moving on to decimals.

- **Difficulty Level Adjustment:** The difficulty of questions or tasks can be adjusted in real-time based on the student's responses.
- **Personalised Feedback:** Feedback is not just 'right' or 'wrong'. It can provide specific explanations, hints or links to relevant resources.

Data is the fuel of adaptive learning. The system collects data on student responses (which questions they answer correctly or incorrectly), time spent on tasks (how long they take to complete different activities) and patterns of errors (identifying common mistakes or misconceptions). This data is used to adjust the learning path and provide the most appropriate content and activities which also provide insight to teachers by helping them to understand where students are struggling and provide targeted support.

## 3. ADVANTAGES OF ADAPTIVE LEARNING

Adaptive learning has benefits beyond academic achievement. It increases student engagement by providing a more personalised and challenging experience, boost motivation by igniting a sense of progress and accomplishment and develop self-regulated learning by encouraging students to take ownership of their learning. In short, adaptive learning aims to create a learning experience that is personalised to suit the needs of each student by constantly adjusting based on student performance and effectively leading to deeper understanding and better learning outcomes. Adaptive learning has several advantages compared to traditional learning. For example, adaptive learning provides personalised pace for each student instead of the fixed pace for all students in traditional learning. While traditional method employs same content for all students, content adapts to individual needs in adaptive learning. These systems pinpoint areas where students struggle and provide targeted exercises and explanations to address those specific challenges. Through targeted practice and feedback, students gain a deeper understanding of the material and are better able to apply their knowledge. Studies have shown that students who use adaptive learning tools often demonstrate improved academic performance, such as higher

test scores and better grades (de Santana et al., 2016, Mojarad, Essa & Baker, 2018).

Another advantage of adaptive learning is that it focuses on weakness of the student. These systems pinpoint areas where students struggle and provide targeted exercises and explanations to address those specific challenges. This results in improved learning outcomes. By making learning more interactive and personalised, adaptive learning can significantly boost student engagement and motivation. Through targeted practice and feedback, students gain a deeper understanding of the material and are better able to apply their knowledge.

Since it is data driven, adaptive learning systems can provide real time feedback to both students and teachers allowing for immediate adjustments to the learning plan. The data collected by these systems can help teachers identify struggling students and provide them with the necessary support. It can also help educators understand overall class performance and make informed decisions about curriculum and instruction.

Adaptive learning systems also result in increased efficiency. By focusing on individual needs, adaptive learning can help students learn more efficiently and effectively, potentially saving time and resources. Teachers can use the data from adaptive learning platforms to allocate resources more effectively, such as providing extra support to students who need it most.

Adaptive learning systems can increase student engagement by providing a more personalised and challenging experience, enhance student motivation by providing a sense of progress and accomplishment and develop self-regulated learning skills by encouraging students to take ownership of their learning.

#### 4. DISADVANTAGES OF ADAPTIVE LEARNING

While adaptive learning offers many benefits, it is important to acknowledge its limitations and potential drawbacks. One foremost disadvantage is the overreliance on technology and infrastructure. Adaptive learning relies heavily on technology, which can be a disadvantage in areas with limited internet access or insufficient devices. Unequal access to technology can exacerbate educational inequalities. Adaptive learning often involves less direct interaction with teachers and peers, which

can be a disadvantage for students who thrive in social learning environments. While adaptive systems provide data, they may not fully capture the nuances of student understanding or the social-emotional aspects of learning that a teacher can observe in a traditional classroom. Adaptive learning systems collect a significant amount of student data, raising concerns about privacy and security which may result in risk of data being misused or shared without proper consent.

There are also development and implementation challenges in adaptive learning systems such as high development costs and non-availability of experts in content creation. Some adaptive systems may focus too narrowly on specific skills or knowledge, neglecting broader learning goals like creativity, critical thinking, and collaboration.

These disadvantages can be mitigated through careful planning and implementation. For example, implementing a blended learning approach by combining adaptive learning with traditional instruction can provide a balance of personalised learning and human interaction. Providing adequate training and support for teachers can help them effectively use adaptive learning tools and address student needs. For data privacy and security measures, implementing strong data privacy and security measures can protect student data. Also, choosing platforms that are well-designed, evidence-based, and transparent can help avoid some of the potential pitfalls. It is important to remember that adaptive learning is a tool and like any tool, it can be used effectively or ineffectively. By being aware of the potential disadvantages and taking steps to address them, educators can maximise the benefits of adaptive learning and create a more personalised and effective learning experience for all students.

#### 5. INTEGRATION OF ADAPTIVE LEARNING IN CLASSROOMS

The advantages of using adaptive learning are manifold for student development. Educators and educational policymakers should formulate strategies to integrate adaptive learning systems in schools to reap its benefit in student progress. Integrating adaptive learning in classrooms can be a transformative step towards personalised education. A study by Divanji et al. (2023) revealed that adaptive learning technologies with

its adaptive learning content and real time student data helped teachers in completing learning management tasks efficiently.

The following strategies may be utilised for effective deployment of this learning practice in schools. Schools should start with clear goals and objectives. This can be done by clearly defining the learning objectives for each subject and grade level. This will help in selecting appropriate adaptive learning tools and content. Identifying areas for adaptive learning is also crucial. Determine which subjects or topics would benefit most from adaptive learning. This could be areas where students typically struggle or where personalized practice is particularly valuable.

Next step is choosing the right adaptive learning platform and tools. Ensure that the chosen platforms align with the school's curriculum and learning standards. Select tools that are age-appropriate and engaging for the students. Consider the features offered by different platforms, such as adaptive assessments, personalized practice, progress tracking, and reporting. It is also important to choose platforms that provide adequate training and support for teachers to effectively use the technology. It is also important to provide professional development for teachers. Teachers need to understand the principles of adaptive learning and how it can benefit their students. According to [Bingham et al. \(2018\)](#), preparation and professional development opportunities for teachers to use adaptive learning technologies is scarce.

According to [Keuning and Van Geel \(2021\)](#), teachers often face challenges in interpreting and using student data collected by adaptive learning technologies. Teachers should be provided training on how to use the chosen platforms and tools effectively. Training should also be imparted to teachers on how to integrate adaptive learning activities with their existing lesson plans and teaching strategies. They should also be provided training on how to interpret the data generated by the platforms and use it to update their instruction and provide personalized support to students. Since interaction with teachers and peers is essential for student development, creating a blended learning environment in schools is also very important while embracing adaptive learning practices in schools. Adaptive learning should be used as a supplement to traditional classroom instruction

not as a replacement. Teachers can use the data from adaptive learning platforms to identify areas where students are struggling and adjust their teaching accordingly. It is also vital to encourage students to collaborate and learn from each other even when using adaptive learning tools.

Teachers should also monitor student progress and provide support to them. Regularly monitoring student progress on the adaptive learning platforms, using the data to identify students who need extra support and providing them with personalized interventions and communicating with parents by informing them of their child's progress and how adaptive learning is being used in the classroom are some measures for reaping the full benefits of adaptive learning. Schools should also address infrastructure and access issues. Ensure that the school has adequate devices (computers, tablets) and internet connectivity to support the use of adaptive learning platforms. Also ensure that all students have equal access to the technology and resources, regardless of their background or socio-economic status.

Students can use adaptive learning platforms to practice concepts learned in class and to review material before tests. They can also use adaptive platforms to work on personalised learning paths that are tailored to their individual needs and learning styles. Teachers can use adaptive assessments to quickly identify areas where students are struggling and adjust their instruction accordingly. By carefully planning and implementing these strategies, schools can successfully integrate adaptive learning into their classrooms and create a more personalized and effective learning experience for all students.

## 6. CONCLUSION

Adaptive learning technologies hold immense potential to revolutionise education by providing personalized and engaging learning experiences for every student. Effective integration requires careful planning, teacher training and ongoing evaluation. Schools must invest in robust infrastructure, ensure equitable access for all students and foster a collaborative environment where teachers and technology work together to support student learning and achieve optimal outcomes. By embracing these technologies and leveraging their power, schools can create a more equitable and effective learning



environment that empowers all students to reach their full potential.

## REFERENCES

- Bingham, A.J., Pane, J.F., Steiner, E.D., Hamilton, L.S.. (2018), *Ahead of the curve: Implementation challenges in personalized learning school models*. Educational Policy 32(3), 454–89. <https://doi.org/10.1177/0895904816637688>.
- De Santana, S.J., Paiva, R., Bittencourt, I.I., Ospina, P.E., De Amorim Silva, R., & Isotani, S. (2016). *Evaluating the impact of Mars and Venus effect on the use of an adaptive learning technology for Portuguese and mathematics*. Proceedings - IEEE 16th International Conference on Advanced Learning Technologies, ICALT 2016. <https://doi.org/10.1109/ICALT.2016.58>
- Ekowo, M., & Palmer, I. (2016). *The promise and peril of predictive analytics in higher education: A landscape analysis*. Policy Paper, New America.
- Keuning, T., & Van Geel, M. (2021). *Differentiated teaching with adaptive learning systems and teacher dashboards: The teacher still matters most*. IEEE Transactions on Learning Technologies, 14(2):201–10. <https://doi.org/10.1109/TLT.2021.3072143>.
- Kopcha, T.J., Neumann, K.L., Ottenbreit-Leftwich, A., Pitman, E. (2020). *Process over product: the next evolution of our quest for technology integration*. Educational Technology Research and Development, 68(2), 729–49. <https://doi.org/10.1007/s11423-020-09735-y>.
- Mojarad, S., Essa, A., & Baker, R.S. (2018). *Studying adaptive learning efficacy using propensity score matching*. Proceedings of the 8th International Conference on Learning Analytics and Knowledge (LAK18); 2018.
- Rachmad, Y.E. (2022). *Adaptive learning theory*. La Paz CostaneraPublicacionesInternacionales, Edición Especial 2022. <https://doi.org/10.17605/osf.io/vfz38>
- Riddhi A. Divanji, R.A., Bindman, S., Tung, A., Cehn, K., Casaneda, L., & Scanlon, M. (2023). *A one stop shop? Perspectives on the value of adaptive learning technologies in K-12 education*. Computers and Education Open, 5, 1-14. <https://doi.org/10.1016/j.caeo.2023.100157> <https://stockboxtech.com/> <https://learn.mindspark.in/> <https://www.embibe.com/> <https://www.duolingo.com/>

**Cite this article as:** Dr. Surya Chandra Mohan, (2024). A Critical Appraisal of Adaptive Learning Systems and their Effective Integration within School Environments, International Journal of Emerging Knowledge Studies. 3(12), pp.1120-1124. <https://doi.org/10.70333/ijeks-03-12-031>