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# Ai-Enabled Adaptive Learning Platforms And Their Effects On Student Autonomy And Academic Engagement: A Quantitative Investigation

**Article History:**

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**Abstract**: The present research aims to explore how AI-based adaptive learning platforms in education can significantly improve and personalise the learning experience for every student. Integrating AI in education has changed the learning environment, making adaptive learning systems a vital innovation. This paper will also let us understand how AI-based adaptive learning platforms improve student participation and academic performance. Because of personalised learning paths and instant feedback from the AI platforms, the study found that most participants showed better productivity, motivation, engagement, and noticeable improvement towards learning and academic results of students. Adaptive learning platforms and artificial intelligence are changing the modern education system by making it more personalised, accessible, and effective, while also helping people as well as students understand, accept, and support sustainable development. Therefore, the present findings can help towards the future growth of adaptive education and can be used by different policymakers, educators, and researchers to improve learning systems and strategies. Although the study concludes that AI-based adaptive learning platforms cannot replace human teaching, they have great potential to enhance personalised learning and boost students' academic performance. The factors of AI-enabled adaptive learning platform on students' autonomy and academic engagement are Real-time or timely feedback, Personalized pacing and content, Choice and control over learning paths and Motivation through adaptive challenge.

**Keywords**: Adaptive learning platforms, Academic performance, Artificial Intelligence, Sustainable development, Education system

## INTRODUCTION

Over time, education has always played a significant role in the progress of every society. Education has undergone many significant changes in recent years to adapt to new challenges like technological growth, global warming, and climate change. Adaptive learning platforms are educational systems that use Artificial Intelligence and data analysis to customise the learning experiences. In the present times, the fast-paced growth of Artificial Intelligence (AI) is changing many fields, and education is one of them. Integration of AI has a crucial role in both school and higher education, thereby shaping both students' learning experiences and bringing new opportunities and some challenges. They automatically adjust how content is delivered based on every student's performance, learning speed, and personal preferences. Therefore, according to Strielkowski et.al. (2025), using artificial intelligence (AI) in adaptive learning systems transforms the education system by offering personalised and flexible student learning experiences. Using AI-based adaptive learning platforms has positively boosted student engagement and enhanced learning outcomes. To gather and examine large amounts of data, AI offers tools like machine learning, predictive analytics, and natural

language processing, which potentially help adaptive learning platforms adjust content, teaching methods and feedback to match each learner's individual needs. Ezzaim et.al. (2024) mentioned that AI-based adaptive learning systems' primary objective is to enhance learning by customising it to fit each student's needs and learning style. Such platforms boost students' interest, motivation, and overall performance by adjusting the content, speed, and difficulty level. This paper will let us understand the features of AI-enabled adaptive learning platforms, such as personalised learning paths, which help students find their strong and weak areas through developing personalised routes and recommend them with study materials and activities. Sari et.al. (2024) asserted that Intelligent Assessments through AI-enabled adaptive platforms use AI algorithms to evaluate students' knowledge and skills, providing them instant feedback while adjusting the test according to their answers. Data Analytics allows these systems to gather and study information about the students' performance and participation, by

learning habits to understand their progress better. Many adaptive learning platforms often include game-like features, interactive activities, simulations, and multimedia content through gamification and interactive elements to make the learning more engaging. Many more features will be discussed later, where AI-enabled systems constantly observe and record the learner's progress, giving insights into their development and areas that need improvement. Tutors can use such data to step in and offer extra help when required. These AI-enabled adaptive systems can transform education by providing and engaging students through personalised, data-driven teaching and support. Vesin et.al. (2018) mentioned that adaptive learning systems can provide instant and personalised feedback to students, by helping them find the correct answers or providing explanations and extra learning materials. Learners can use these platforms from any location with an internet connection, because they can serve many students simultaneously, making it more flexible and easier to access, allowing for more remote and convenient learning. Furthermore, to make sure the technology is available to all students and appropriately incorporated into the curriculum, several challenges must be addressed to implement adaptive learning successfully.

## LITERATURE REVIEW

This detailed literature review gives us a summary of the current status of AI-enabled adaptive platforms. According to Zaman & Akhter. (2023), the integration of AI-based learning platforms was introduced with the need for personalised education to improve students' learning efficiency and the desire towards wider accessibility. Mobile internet, cloud computing, big data, and major advancements taking place in Artificial Intelligence (AI) have greatly changed the education system. During recent years, many more advancements like AI-powered learning systems have emerged, thereby becoming popular for their ability to deliver content and adjust to each student's unique learning needs. Colchester et.al. (2017) stated that Artificial Intelligence (AI) and advancements in data analytics have helped to create more effective learning systems in the field of education. The education sector has also seen a major rise towards interest and investment in Artificial Intelligence (AI) technologies, as suggested by a report of Market Research Future, which predicts that the growth of AI in the educational market will grow to around $7 billion by 2025, with an annual growth rate of 39.3% between 2018 and 2025. With the growing interest in AI in the education sector, it is therefore driven by strong research results, teachers' increasing interest, and the rising demand for new and innovative learning solutions. A study conducted by Stanford University found that AI-powered tutoring systems helped to lower the dropout rates and increase graduation rates. Therefore, a survey conducted by the Consortium for School Networking (CoSN) resulted in 83% of school technology leaders believing AI will have an important impact towards the future of education. Such advanced tools and technologies lead to providing many provisions towards improving students' performance by also creating more personalised learning experiences and helping learners gain skills needed for future careers. Sajja et.al. (2024) mentioned that AI-enabled adaptive learning systems offer personalised teaching which matches each and every student's individual needs, strengths and weaknesses. These learning platforms make sure that learners get the right and most suitable learning materials by adjusting their lesson content, speed, and difficulty levels. AI-enabled learning platforms find areas of misconceptions and weaknesses amongst the learners by using ongoing assessments and data analysis. Such platforms offer focused support and extra practice in these areas, helping students solve problems and strengthen their understanding. Students gain instant feedback through AI-based adaptive platforms because they immediately show whether the answers are correct and provide explanations or hints when mistakes are made. This quick real-time feedback helps students to understand their errors, fix their misunderstandings and improve their learning. For example, Duolingo, DreamBox Learning, and ALEKS are some of them that personalise lessons for each learner to help them build confidence and improve understanding. The above-mentioned platforms make learning more interesting and effective than traditional methods. Duolingo offers learners a flexible, self-paced learning space that supports limited classroom teaching and keeps students motivated even with their busy routines. Independent learning with the help of the Duolingo app is very effective for teaching vocabulary, as it encourages learners to become more self-reliant and responsible for learning English without needing assistance from others. This is one of the most popular language learning apps in the world, which is known for its easy-to-use design with game-like features such as streaks, leaderboards, and XP points that keep learners motivated and engaged. Especially those who find traditional and structured learning methods difficult, such an approach with its game-like features, makes Duolingo very effective towards keeping them motivated. For students who are not majoring in English, the flexibility of time offered by Duolingo is very crucial because they usually have busy schedules with their main subjects and get little time to study languages. Duolingo makes learning fun and motivating by mixing flexibility with game-like features, helping students stay focused and improve their language skills even when they have limited time. Kabudi. (2023) mentioned that AI-enabled learning systems handle everyday tasks and processes them automatically, allowing learners to focus on learning and development activities

that need human involvement. After using AI automation, more than 45% of business leaders have reported higher productivity. Artificial Intelligence tools in a learning platform can suggest to students personalised skill-building courses based on employees' work activities, helping them learn new skills and fill knowledge gaps within the organisation. EdApp is one of the mobile-based learning platforms that was created to make training easy and accessible for working professionals anytime, anywhere and on any device. According to Halkiopoulos & Gkintoni. (2024), these AI-enabled learning platforms offer an AI create feature, a course builder that allows us to generate training courses with just one quick click. Using these AI tools helps students move faster towards the creative design stage, where learners are able to add interactive elements to make learning more engaging. Leading Indian edtech companies such as Vedantu, BYJU's and Unacademy are at the forefront of offering AI-enabled personalised and interactive learning. These platforms use AI for personalised tutoring, content creation, performance tracking and examination preparation. Physics Wallah, which is known for making test preparation for competitive exams like JEE and NEET, is accessible to everyone. Their app uses Artificial Intelligence to offer personalised practice sets, video lessons, and doubt-solving features at an affordable price. “Doubtnut is an AI-enabled learning platform, especially known for its feature that provides instant video answers to questions.” Students are able to snap a picture of a question and get a step-by-step video explanation. Platforms such as “Great Learning, Simplilearn, and upGrad use AI to help working professionals improve their skills through industry-relevant courses in machine learning and data science.” These platforms offer features like personalised mentoring, career support, and AI-based resume-building tools. Therefore, AI's adaptive learning systems greatly influence how education is delivered to students. The majority of Indian edtech platforms are constantly working towards the integration of AI to use AI's flexibility, to study learners ' performance and recommend personalised learning experiences that target specific areas for improvement. Mejeh, M., & Rehm, M. (2024) mentioned that advanced adaptive learning platforms can automatically change the difficulty level of lessons to keep the students interested without making them feel stressed. They also offer various types of content like infographics, videos, and quizzes to match various learning preferences. Countries like Finland have encouraged a strong and bold move toward AI-based education by offering free online courses to their citizens. Around half of the educational students now use the VILLE platform, which provides instant feedback and detailed analysis regarding the student work to both teachers and students. AI-based preparation tools and data analysis offer learners real-time information, such as course-completion rates, allowing them to track the effectiveness of your reskilling programs. The above-mentioned advantages of such integrated AI solutions lead to major benefits while saving both time and money. Chen & Chang. (2024), asserted that through game-based activities and simulations, AI can make learning more engaging and fun, which can help boost students' motivation and involvement. These platforms help build a more interactive and collaborative learning environment inside and outside the classroom, by saving teachers time and offering learners useful data insights. Students might rely too much on AI, which might reduce their ability to think critically because adaptive learning platforms can support learning, but cannot completely take the place of face-to-face interaction with teachers. Despite so many benefits, the use of AI in adaptive learning platforms comes with some challenges and important considerations. The protection of learners' and students' information and the careful management of data privacy must be carefully managed to meet data protection rules and keep user information safe. Mahamad et.al. (2025) mentioned that with the changing of educational goals, regular monitoring and updation of algorithms are needed to keep them accurate and relevant to be in line with AI-enabled learning platforms. Thus, the knowledge and input of teachers and curriculum designers are still very crucial for using AI effectively and maintaining the quality and integrity of education in adaptive learning platforms. Learners' personal data must be kept safe using secure storage, restrictive access, and data anonymisation methods because privacy and security should always be the top priority. Such platforms must also get informed consent from learners, students, parents of minors, and other involved parties before the collection, usage, or sharing of any data. Okafor (2025) stated that while designing, developing and using AI-powered adaptive learning platforms, teachers and educational institutions must focus towards ethical practices, following established ethical standards and guidelines. But, in this digital era, with the usage of AI to tailor adaptive learning, providing equal access towards quality learning, by meeting the varied needs and potential of students, offers excellent opportunities for improvement.

**Objective**

To ascertain effects of AI-enabled adaptive learning platform on students’ autonomy and academic engagement

**Methodology**

A sample of 227 participants were collected from entrepreneurs of different institute type. The method of sampling was “Random sampling” for collection of data and examination was done by “Explanatory Factor Analysis” for results.

**Findings**

Table 1 demonstrates demographic details, it shows that 52.86% are Male, 47.14% are female. Looking at the age, 34.80% are between 18 to 20 years of age, 29.52% are between 20 to 22 years of age, and 35.68% are above 22 years of age. With regards to Institute type, 30.40% are Government institute, 38.33% are private institute, and 31.27% are Others.

**Table 1 Respondent’s Details**

| Variables | Participants | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 120 | 52.86% |
| Female | 107 | 47.14% |
| **Total** | **227** | **100** |

| **Ages in years** | | |
|---|---|---|
| 18 to 20 | 79 | 34.80% |
| 20 to 22 | 67 | 29.52% |
| Above 22 | 81 | 35.68% |
| **Total** | **227** | **100** |
| **Institute type** | | |
| Government institutes | 69 | 30.40% |
| Private institutes | 87 | 38.33% |
| Others | 71 | 31.27% |
| **Total** | **227** | **100** |

**"Factor Analysis"**

***"KMO and Bartlett's Test"***

**Table 2 "Kaiser-Meyer-Olkin Measure of Sampling Adequacy"**

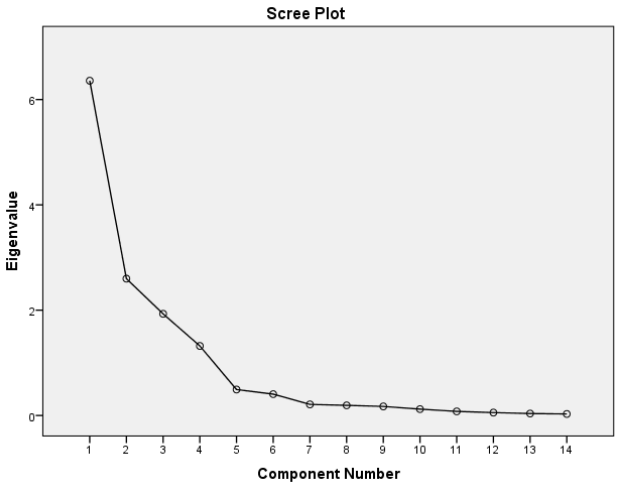
| "Kaiser-Meyer-Olkin Measure of Sampling Adequacy" | | .766 |
|---|---|---|
| "Bartlett's Test of Sphericity" | "Approx. Chi-Square" | 3802.220 |
| | df | 91 |
| | Significance | .000 |

"KMO and Bartlett's Test", value of KMO is .766 (Table 2).

**Table 3 "Total Variance Explained"**

| **"Component"** | **"Initial Eigenvalues"** | | | **"Rotation Sums of Squared Loadings"** | | |
|---|---|---|---|---|---|---|
| | **"Total"** | **"% Of Variance"** | **"Cumulative %"** | **"Total"** | **"% Of Variance"** | **"Cumulative %"** |
| 1. | 6.357 | 45.410 | 45.410 | **3.804** | 27.173 | 27.173 |
| 2. | 2.598 | 18.559 | 63.969 | **3.641** | 26.005 | 53.178 |
| 3. | 1.931 | 13.791 | 77.760 | **2.470** | 17.640 | 70.818 |
| 4. | 1.321 | 9.435 | 87.195 | **2.293** | 16.377 | **87.195** |
| 5. | .493 | 3.518 | 90.713 | | | |
| 6. | .405 | 2.896 | 93.609 | | | |
| 7. | .210 | 1.503 | 95.112 | | | |
| 8. | .192 | 1.373 | 96.485 | | | |
| 9. | .173 | 1.232 | 97.718 | | | |
| 10. | .121 | .863 | 98.580 | | | |
| 11. | .078 | .555 | 99.135 | | | |
| 12. | .055 | .393 | 99.528 | | | |
| 13. | .037 | .268 | 99.796 | | | |
| 14. | .029 | .204 | 100.000 | | | |

The four factors contribute towards explaining total 87.195% of variance. Variance explained by Real-time or timely feedback is 27.173%, Personalized pacing and content is 26.005, Choice and control over learning paths is 17.640%, and Motivation through adaptive challenge is 16.377%. (Table 3).




**Scree Plot**

**Table 4 "Rotated Component Matrix"**

| **S. No.** | **Statements** | **Factor Loading** | **Factor Reliability** |
|---|---|---|---|
| | **Real-time or timely feedback** | | **.952** |
| 1. | Help students see where they are, helps self-regulation | .950 | |
| 2. | Students can correct errors and stay on track | .907 | |
| 3. | They can see their own progress and can make decisions | .857 | |
| 4. | It helps students fix their misunderstandings and improve their learning | .845 | |
| | **Personalized pacing and content** | | **.962** |
| 1. | Students can learn at their own pace, move ahead or pause when | .958 | |

| | | | |
|---|---|---|---|
| | needed | | |
| 2. | Content is adapted to their prior knowledge or learning gaps | .904 | |
| 3. | Content can be personalized based on student's performance | .901 | |
| 4. | Adaptive learning platform adjusts content, and teaching methods | .874 | |
| | **Choice and control over learning paths** | | **.873** |
| 1. | System offers students to choose what topic to study next | .907 | |
| 2. | Students can choose resources and when to attempt assessment | .841 | |
| 3. | It enhances intrinsic motivation, autonomy and engagement | .792 | |
| | **Motivation through adaptive challenge** | | **.823** |
| 1. | Platform boost student's motivation, interest and performance | .924 | |
| 2. | Keeps tasks in the zone of "proximal development" that are not too hard not too easy | .917 | |
| 3. | Helps emotional engagement and perseverance | .638 | |

**Factors of the study and its related variables**

The first factor of the study is Real-time or timely feedback, the variables it includes are Help students see where they are, helps self-regulation, Students can correct errors and stay on track, they can see their own progress and can make decisions, and it helps students fix their misunderstandings and improve their learning. Personalized pacing and content is the second factor, it includes variables like Students can learn at their own pace, move ahead or pause when needed, Content is adapted to their prior knowledge or learning gaps, Content can be personalized based on student's performance, and Adaptive learning platform adjusts content, and teaching methods. Choice and control over learning paths is the third factor, the variables it includes are System offers students to choose what topic to study next, Students can choose resources and when to attempt assessment, and it enhances intrinsic motivation, autonomy and engagement. The last and fourth factor is Motivation through adaptive challenge, the variables are Platform boost student's motivation, interest and performance, keeps tasks in the zone of "proximal development" that are not too hard not too easy, and helps emotional engagement and perseverance.

**Table 5 "Reliability Statistics"**

| "Cronbach's Alpha" | "Number of Items" |
|---|---|
| .896 | 14 |

Total reliability of 14 items that includes variables for effects of AI-enabled adaptive learning platform on students' autonomy and academic engagement 0.896 (Table 5).

## CONCLUSION

The research work concludes that AI provides many advantages, with the inclusion of a customised learning environment, which offers better academic results and a better learning environment for students. However, it also brings several challenges, such as dependency on technology amongst students, a reduction in critical thinking skills amongst students, and potential academic dishonesty. Study also shows that Artificial Intelligence has become an essential part of today's education system, thereby providing key benefits like customised learning, increased student involvement and better access towards learning materials. Though Yaseen et.al. (2025) concluded that AI-powered adaptive platforms combine interactive learning, gamified elements and instant feedback, thereby resulting towards higher student engagement. These platforms use Artificial Intelligence and machine learning to create a personalised data-based and flexible learning environment for each student, meeting their specific needs, learning styles and skill levels. Demartini et.al. (2024), overall, "AI-based adaptive learning platforms have become a powerful change in education, reshaping how students interact with learning materials, and improving students' overall experience as well as performance." The above-mentioned platforms can completely change the learning experience by helping students become engaged, motivated, and successful in their studies. The factors of AI-enabled adaptive learning platform on students' autonomy and academic engagement are Real-time or timely feedback, Personalized pacing and content, Choice and control over learning paths and Motivation through adaptive challenge.

## REFERENCES


1. Strielkowski, W., Grebennikova, V., Lisovskiy, A., Rakhimova, G., & Vasileva, T. (2025). AI-driven adaptive learning for sustainable educational transformation. Sustainable Development, 33(2), 1921-1947.
2. Ezzaim, A., Dahbi, A., Aqqal, A., & Haidine, A. (2024). AI-based learning style detection in adaptive learning systems: a systematic literature review. Journal of Computers in Education, 1-39.
3. Sari, H. E., Tumanggor, B., & Efron, D. (2024). Improving educational outcomes through adaptive learning systems using AI. International Transactions on Artificial Intelligence, 3(1), 21-31.
4. Vesin, B., Mangaroska, K., & Giannakos, M. (2018). Learning in intelligent environments: user-centred design and analytics of an adaptive learning system. Smart Learning Environments, 5(1), 24.
5. Zaman, M. A. U., & Akhter, E. (2023). Adaptive learning systems for English literature classrooms: A review of AI-integrated education platforms. International Journal of Scientific Interdisciplinary Research, 4(3), 56-86.
6. Colchester, K., Hagras, H., Alghazzawi, D., & Aldabbagh, G. (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.
7. Sajja, R., Sermet, Y., Cikmaz, M., Cwiertny, D., & Demir, I. (2024). Artificial intelligence-enabled intelligent assistant for personalised and adaptive learning in higher education. Information, 15(10), 596.
8. Kabudi, T. (2023). Towards designing AI-enabled adaptive learning systems. Interactive Technology and Smart Education, 20(3), 422-445.
9. Halkiopoulos, C., & Gkintoni, E. (2024). Leveraging AI in e-learning: Personalised learning and adaptive assessment through cognitive neuropsychology—A systematic analysis. Electronics, 13(18), 3762.
10. Mejeh, M., & Rehm, M. (2024). Taking adaptive learning in educational settings to the next level: Leveraging natural language processing for improved personalisation. Educational technology research and development, 72(3), 1597-1621.
11. Chen, C. H., & Chang, C. L. (2024). Effectiveness of AI-assisted game-based learning on science learning outcomes, intrinsic motivation, cognitive load, and learning behaviour. Education and Information Technologies, 29(14), 18621-18642.
12. Mahamad, S., Chin, Y. H., Zulmuksah, N. I. N., Haque, M. M., Shaheen, M., & Nisar, K. (2025). Technical review: Architecting an AI-driven decision support system for enhanced online learning and assessment. Future Internet, 17(9), 383.
13. Okafor, N. C., Nwachukwu, C. I., & Ugwueze, C. C. (2025). DEVELOPING ETHICAL GUIDELINES FOR AI-POWERED ADAPTIVE LEARNING IN EDUCATION. Ayden Journal of Engineering and Applied Sciences, 13(1), 43-56.
14. Yaseen, H., Mohammad, A. S., Ashal, N., Abusaimeh, H., Ali, A., & Sharabati, A. A. A. (2025). The impact of adaptive learning technologies, personalised feedback, and interactive AI tools on student engagement: The moderating role of digital literacy. Sustainability, 17(3), 1133.
15. Demartini, C. G., Sciascia, L., Bosso, A., & Manuri, F. (2024). Artificial intelligence bringing improvements to adaptive learning in education: A case study. Sustainability, 16(3), 1347