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Impact of Ai-Driven Adaptive Learning Platforms in Science and Mathematics in Secondary Education

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Abstract:
This study explores the integration of AI-driven adaptive learning platforms in secondary education, focusing on the appropriateness of the current curriculum, educators' experiences, and the challenges faced in implementation. A survey was conducted among educators to gather data on their perceptions of curriculum suitability, experiences with adaptive platforms, and frequency. Descriptive statistical analysis was used to examine the distribution of responses, providing insights into the effectiveness and challenges of implementing AI-driven methods. The results show that whereas 57% of respondents believe the curriculum is acceptable for AI-driven methodologies, 16% feel it does not represent the need for curriculum improvement. Eighty-five percent of respondents strongly support the broader deployment of adaptive learning platforms; nevertheless, the low frequency of use shows obstacles to regular implementation. The educators noted some obstacles, such as inadequate training, trouble integrating the curriculum, and problems with student involvement. Numerous educators reported having a good experience using adaptive learning platforms. By addressing these problems, secondary schools may use adaptive learning platforms more frequently and effectively, which would improve student outcomes.
Keywords: *AI-driven learning; adaptive platforms; curriculum integration; teacher experiences; educational technology*

I. Introduction

Artificial intelligence (AI) and machine learning (ML) in educational settings have transformed traditional teaching methods, particularly in secondary education. Adaptive learning platforms powered by AI and ML have shown promising potential in enhancing science and mathematics instruction by personalizing the learning experience to meet individual student needs (Pardo et al., 2019; Zawacki-Richter et al., 2019). These platforms leverage sophisticated algorithms to tailor educational content, addressing diverse learning styles and pacing requirements (Knewton, 2020).

Adaptive learning platforms provide real-time feedback and personalized learning paths, which can significantly impact student engagement and achievement (Siemens, 2013). DreamBox and Carnegie Learning are notable examples of adaptive learning tools that utilize AI to adjust problem difficulty based on students' responses and progress (DreamBox Learning, 2022; Carnegie Learning, 2021; Ramalan and Goshu, 2025). Its methodology is opposite to conventional, one-size-fits-all teaching strategies that might not accommodate the range of skills and learning preferences (Pane et al., 2015).

In the domains of science and mathematics, adaptive learning technologies offer unique benefits. They facilitate individualized instruction by diagnosing students' strengths and weaknesses and providing targeted resources to address learning gaps (Woolf, 2010). Furthermore, these platforms often incorporate interactive simulations and gamification elements, which enhance student motivation and engagement (Hattie & Timperley, 2007; Goshu

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and Ridwan, 2024). As educational technologies continue to evolve, understanding the impact of AI-driven adaptive learning platforms in secondary education becomes crucial for educators, policymakers, and researchers (Wang et al., 2021).

The approval of technology in education has been a focal point of research for several years. However, the rapid evolution of Artificial Intelligence (AI) technologies presents an uncharted territory worth exploring, especially in the context of Ethiopian classrooms. While Ethiopia has shown significant enthusiasm for integrating AI into its educational system, there is still a lack of conclusive evidence concerning the effectiveness of AI-powered adaptive or technology-based learning platforms on student performance. These platforms, which adjust the difficulty and type of learning materials based on each student's needs, promise to revolutionize individualized learning. However, one has to ask whether these platforms deliver on their promise and to what extent (Zawacki-Richter et al. 2019; Luo et al. 2023).

A key challenge in assessing the impact of AI adaptive or technology-based learning platforms is the diverse nature of Ethiopian classrooms, with varying socioeconomic backgrounds and student performance levels. The Ethiopian education system is known for its rigorous academic demands and highly competitive environment. However, it's crucial to consider how AI affects high-achieving pupils and those who have difficulty keeping up. Understanding this can provide insights into whether AI can indeed bridge educational inequalities or exacerbate them (Chen, Wang, & Chen, 2020; Chen and Zheng, 2020; Luo et al. 2023; Ramalan and Goshu, 2025).

Another aspect of the problem lies in the teachers' role and professional development in AI-assisted classrooms. Teachers in Ethiopia, like elsewhere, have varying degrees of comfort and familiarity with technology. Introducing AI-powered platforms necessitates an adaptation in teaching strategies and classroom management. While many believe AI can be a tool for teachers rather than a replacement, the reality is often not so straightforward. How teachers adapt, or fail to adapt, to this technology could significantly influence its efficacy in improving student performance (Wang, 2019; Davis et al. 2020; Luo et al. 2023; Ramalan and Goshu, 2025).

Traditional methods of teaching science and mathematics in secondary schools often address the diverse learning needs of students. Conventional educational approaches typically apply a uniform curriculum to all students, which can lead to varying degrees of effectiveness due to individual differences in learning pace and style (Pane et al., 2015; Goshu and Ridwan, 2024). As educational technology advances, there is a growing interest in exploring how AI-driven adaptive learning platforms can offer personalized educational experiences. Is needed. Understanding these impacts is crucial for determining the effectiveness of adaptive learning platforms and guiding their implementation in educational settings.

In the last few years, e-learning has grown, and become a powerful approach that offers flexibility, scalability, and personalized learning experiences. Adaptive e-learning is the intelligent and dynamic modification of learning materials, activities, and content to match specific needs and preferences. Adaptive learning systems can provide tailored learning experiences, maximize learning outcomes, and raise student engagement using learner data analysis and interpretation to make well-informed judgments (Gligorea et al., 2023).

Therefore, the general objective of this study is to evaluate the Impact of AI-driven adaptive Learning Platforms and assess how adaptive learning technologies influence student performance and engagement in secondary school science and mathematics.

The specific objectives of this study are to:

a. Analyze the Effectiveness of Personalization Features: Examine how the personalization capabilities of adaptive learning platforms address individual learning needs and improve educational outcomes.
b. Identify Best Practices for Implementation: Investigate successful case studies and implementation strategies for integrating adaptive learning platforms into secondary education.
c. Explore Challenges and Limitations: Identify potential challenges and limitations associated with AI-driven adaptive learning platforms in secondary education.
d. Provide Recommendations based on the study's findings to guide future research and practical applications of adaptive learning technologies in education.

By addressing these objectives, the study contributes to understanding AI's impact on secondary education and sheds light on the ethical, social, and educational dynamics.

1.1 Research Questions

To achieve the goals of the research project "Impact of AI-Driven Adaptive Learning Platforms in Science and Mathematics in Secondary Education," it is necessary to develop research questions that delve into different aspects of the platforms' use and effects. The following are the goals, along with the related research questions:

1. How do AI-powered adaptive learning systems affect science and math performance in secondary school?
2. How do the personalized elements of adaptive learning platforms meet the specific demands of each learner in math and science?
3. Which are the most effective applications of AI-driven adaptive learning systems for math and science in secondary education?
4. What are the drawbacks and restrictions of using AI-driven adaptive learning tools for science and math in secondary schools?
5. What recommendations would you make for additional study and practical applications of adaptive learning technologies in secondary education?

These research questions are meant as a basis for the study's inquiry and analysis, helping to accomplish its objectives and providing educational technology and secondary education with useful information.

The significance of this study lies in its potential to provide valuable insights into the effectiveness of AI-driven adaptive learning platforms in secondary education. Through evaluation of how these platforms affect students' performance in science and math, the research can help develop more potent teaching methods and resources. Findings from this study could inform educators, policymakers, and technology developers about the benefits and limitations of adaptive learning technologies, ultimately leading to improved educational practices and student achievement. Furthermore, the research can help to address the gap between technology advancements and practical application in the classroom, ensuring that innovations in educational technology are utilized effectively to meet the needs of all learners.

1.2 Definition of Key Terms

Adaptive learning platforms (ALP) are educational technologies that use artificial intelligence (AI) and data analytics to personalize learning experiences for individual students.

Artificial Intelligence (AI): The human-like intelligence exhibited by machines or software. The science and engineering of making intelligent machines, and computer programs.

Machine learning (ML) is a subset of artificial intelligence (AI) that involves the development of algorithms and statistical models that enable computers to learn from and make decisions based on data.

II. Review of Literatures

AI and ML have emerged as transformative technologies in various fields, including education. In the context of adaptive learning, AI and ML play a crucial role in enabling personalized and tailored learning experiences. AI refers to the progress of intelligent machines that can simulate human intelligence and perform tasks that typically require human intelligence, such as perception, reasoning, and decision-making Moreno-Guerrero et al. (2020); Gligorea, et al. (2023).

2.1 Length and organization Adaptive Learning Technologies

Adaptive learning technologies have gained prominence for their potential to enhance educational outcomes by personalizing learning experiences. These platforms use AI algorithms to analyze student performance data and adjust instructional content accordingly. Research indicates that adaptive learning can significantly improve student engagement and achievement by providing customized learning paths and immediate feedback (Pardo et al., 2019). By customizing information to meet each student's unique learning needs, Knewton's adaptive learning technology, for example, has been demonstrated to improve student performance (Knewton, 2020).

2.2 Impact on Science and Mathematics Education

In science and mathematics education, adaptive learning platforms offer several advantages. For example, DreamBox Learning provides personalized math instruction that adjusts in real-time based on student responses, leading to improved math proficiency (DreamBox Learning, 2022). Similarly, Carnegie Learning's adaptive tools have demonstrated efficacy in improving student learning outcomes by using data to modify arithmetic education (Carnegie Learning, 2021). Studies have shown that students using these adaptive platforms often perform better on assessments associated with traditional instruction (Pane et al., 2015).

2.3 Personalization and Learning Outcomes

Personalization is a significant feature of adaptive learning platforms, which addresses the diverse needs of students. Woolf (2010) emphasizes that personalized learning can cater to different learning styles and paces, making education more effective. Hattie and Timperley (2007) found that feedback and adaptive instruction significantly contribute to student learning gains. Moreover, adaptive learning technologies can identify and address individual learning gaps, particularly beneficial in complex subjects like science and mathematics (Siemens, 2013).

2.4 Challenges and Limitations

Despite their potential, adaptive learning platforms face challenges in practical implementation. Zawacki-Richter et al. (2019) highlight that integrating these technologies into existing curricula can be complex and resource-intensive. Additionally, concerns about data privacy and the potential for algorithmic biases need to be addressed to ensure equitable educational experiences (Wang et al., 2021). According to Wolf (2010), the content quality and algorithmic accuracy also affect how successful adaptive learning platforms are.

III. Research methods

The study will involve secondary school students from various institutions using AI-driven adaptive learning platforms in their science and mathematics curricula. A sample size of 174 teachers was selected to ensure a diverse representation of educational contexts and learning levels, and their consent was obtained before participation.

3.1 Materials

Adaptive Learning Platforms: The primary materials for this study will be AI-driven adaptive learning platforms, including DreamBox Learning for mathematics and Carnegie Learning for both mathematics and science (DreamBox Learning, 2022; Carnegie Learning, 2021). These platforms offer personalized learning experiences through real-time adjustments based on student performance data.

DreamBox Learning is an adaptive online learning environment created to give students in kindergarten through eighth grade individualized arithmetic training. The system adapts lessons and activities to each student's unique needs, learning style, and pace using sophisticated algorithms and machine learning approaches. It provides an exciting and dynamic learning environment with the following main characteristics:

Adaptive Learning: DreamBox continuously evaluates pupils' comprehension and modifies the exercises' level in real time. Its paths can be customized to ensure that each student receives the appropriate challenges to support and points of interest where they excel or need more practice.

Embedded Assessments: DreamBox incorporates assessments into its classes so teachers and students can see real-time progress reports.

Teacher Insights and Analytics: The technology gives teachers thorough reports and performance data on their students.

Curriculum Alignment: DreamBox conforms to several state and federal requirements and the Common Core State Requirements (CCSS).

DreamBox may be accessed and used on various devices, such as PCs, tablets, and interactive whiteboards.

DreamBox Learning is extensively utilized in homes, schools, and districts throughout the United States and Canada.

Assessment Tools: Standardized tests and quizzes aligned with the curriculum will be used to measure student performance. Additionally, diagnostic tools integrated within the adaptive platforms will provide insights into individual learning progress (Knewton, 2020).

Data collection was based on primary and secondary data. The preliminary data was collected through a qualitative survey and secondary data was collected by investigating previous studies.

Surveys and Questionnaires: To assess student engagement and satisfaction, surveys and questionnaires will be administered. These instruments will evaluate students' perceptions of the

adaptive learning platforms, their perceived effectiveness, and their overall learning experience (Pardo et al., 2019).

3.2 Methods

Experimental Design: The study will employ a quasi-experimental design to evaluate the impact of AI-driven adaptive learning platforms. The participants were divided into two groups, one using adaptive learning platforms and the other following traditional instructional methods.

Academic performance data from assessments and quizzes will be analyzed to compare the outcomes of students using adaptive platforms versus those in traditional settings.

Engagement and Feedback: Surveys and questionnaires were distributed to gather qualitative data on student engagement, satisfaction, and perceived effectiveness of the adaptive learning tools (Hattie & Timperley, 2007).

Statistical analysis was conducted to compare the academic performance and engagement levels. Data was analyzed thematically to identify common trends and insights (Creswell & Creswell, 2017).

The study adhered to ethical guidelines, including obtaining informed consent from participants and ensuring the confidentiality of their data. Ethical approval will be sought from the institutional review board before data collection (American Psychological Association, 2020).

IV. Result and Discussion

The results of this study explore the demographic distribution of secondary school teachers involved in using AI-driven adaptive learning platforms for teaching science and mathematics. The focus was on the impact of these platforms on educational outcomes, teaching methodologies, and teacher perceptions based on gender, qualifications, and subject areas taught.

The study revealed a significant gender disparity among teachers using AI-driven adaptive learning platforms, with 109 male participants and only 12 female participants. As shown in Figure 1, this gender discrepancy (F = 22, M = 159) is noteworthy because it emphasizes the underrepresentation of female educators using technology-enhanced teaching approaches, especially in science and mathematics. This finding aligns with previous studies indicating that female participation in science, technology, engineering, and mathematics (STEM) fields tends to be lower than male participation in many regions (Wang & Degol, 2017). Encouraging greater gender diversity in AI-driven platforms could help close the gender gap in STEM teaching, fostering a more inclusive learning environment.

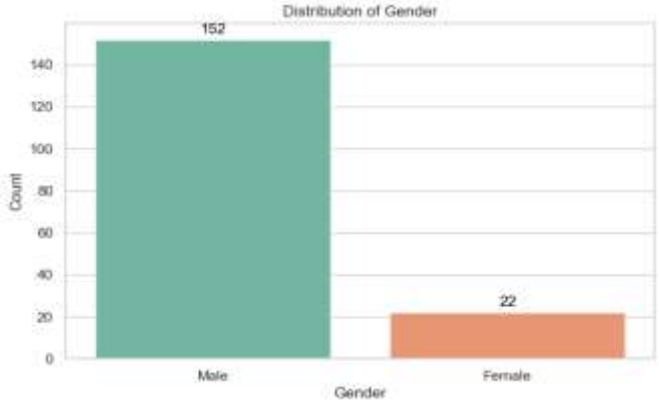


Figure 1. The distribution of gender

The majority of participants in the study held a Bachelor of Science (BSc) degree (n = 123), while a smaller group had attained a Master of Science (MSc) degree (n = 51) shown in Figure 2. This distribution suggests that most teachers engaging with AI-driven adaptive learning platforms have foundational qualifications to introduce such tools in the classroom. However, those with MSc degrees may be more adept at utilizing the full potential of these platforms. Research shows that teachers with higher qualifications are often more confident in adopting innovative technologies and implementing them effectively in their teaching (Blazar & Kraft, 2017). Thus, the findings imply that professional development and additional training could help BSc holders maximize their use of AI-based platforms in science and mathematics instruction.

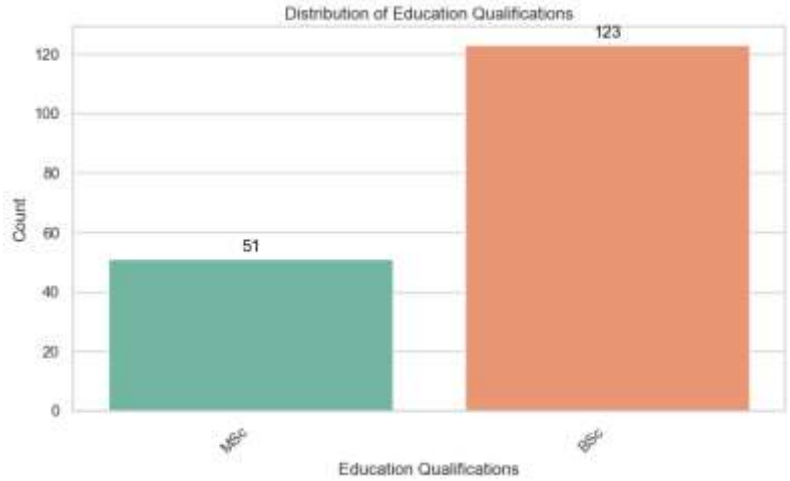
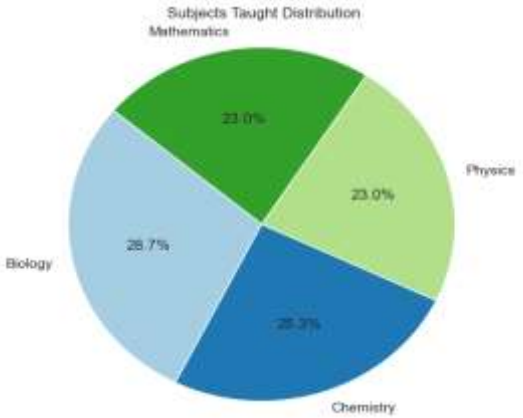


Figure 2. Distribution of respondents in education qualifications.

4.1 Adoption of AI-Powered Learning Platforms by Subject

The allocation of subjects was as follows: chemistry (n = 44), biology (n = 50), mathematics (n = 40), and physics (n = 40). According to the statistics, chemistry, biology, mathematics, and physics are the professionals who use AI-driven adaptive learning platforms the most frequently. These differences might indicate how to integrate AI tools into various topic areas. In contrast to physics and mathematics, which need more specialized tools for abstract notions, chemistry and biology, for instance, might have easier access to AI-based resources for simulations and interactive content (Holmes et al., 2018).



The distribution of subjects taught by respondents is depicted in the pie chart above, providing significant details on the teaching priorities of the surveyed group shown in Figure 3.

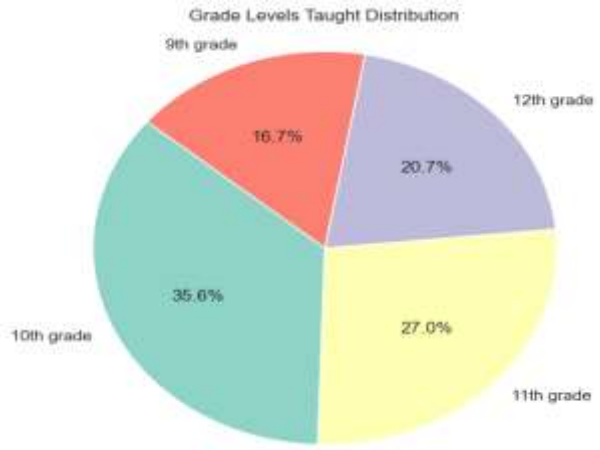


Figure 4. Grade level taught by teachers in secondary school

The distribution of grade levels taught by the respondents depicted in Figure 4 is illustrated in the pie chart above. The information reveals fluctuations in the number of educators allocated to every grade, offering valuable perspectives on the distribution of teaching personnel among various grade levels:

The most common grade level taught by respondents 62 (35.6%) was 10th grade. This suggests that most teachers focus their efforts on teaching this grade level. This could show a pivotal moment in the kids' education, brought on by upcoming national or regional exams, curriculum requirements, or the significance of acquiring core knowledge this year.

Eleventh grade 47 (27.0%) and twelfth grade 36 (20.7%) are the largest groupings, indicating a continuous emphasis on upper secondary education. This argues that teachers should be present throughout the last years of education to help students for either higher education or the workforce.

The lowest percentage 29 (16.7%), is in 9th-grade education. This can mean that the first year of secondary school receives less attention or fewer teachers assigned to the summer training program at Dire Dawa University in 2024. It can point to a chance to provide instructors at this level with more resources or support to facilitate students' seamless transitions to higher grades.

Enhancing science and math education outcomes through AI-driven adaptive learning platforms is promising. The platforms were well-received by the teachers in this study, who mentioned improved student engagement and the capacity to offer individualized learning experiences. To ensure all instructors can effectively use these platforms, targeted professional development programs are likely necessary, given the uneven distribution of platform usage across different subject areas and teacher demographics.

A more equitable proportion of male and female teachers in STEM education may also result from resolving the gender gap in platform usage. Efforts to support female involvement in technology-driven teaching methods can help to advance campaigns for gender parity in STEM (Beede et al., 2011).

The distribution of responses to the question regarding training in technology-based or AI-driven teaching methodologies reveals a significant disparity in the levels of training among

educators as shown in Figure 5. Of the respondents, 148 (85.5%) reported not having received any formal training in these methodologies, while only 13 (7.5%) confirmed that they had received training, and another 13 (7.5%) were uncertain, responding with "Maybe."

Figure 5. Training of teachers in technology or/ AI-driven teaching methodology before

Given the increasing significance of technology and artificial intelligence (AI) in improving educational outcomes. By tailoring learning experiences, AI-driven adaptive learning platforms have been shown to enhance student engagement. For example, these platforms have also been demonstrated to improve student performance (Lu et al., 2021). Insufficient training could make it difficult for teachers to incorporate this technology into their lessons leading to missed chances to improve student learning.

Additionally, research has shown that adequate training in technology-based teaching approaches is essential for teachers to feel competent and confident (Zawacki-Richter et al., 2019). Given the high proportion of responders who have never received training, it appears that greater chances for professional development are required to give teachers the skills they need to adapt to contemporary, AI-driven teaching resources.

The data shows a considerable lack of training in applying technology and artificial intelligence. This demonstrates the necessity of expanding training initiatives to guarantee that teachers can make the most of these potent resources to improve instruction and, eventually, student learning results.

Figure 6 illustrates the considerable underutilization of adaptive learning platforms among instructors based on statistics on how frequently they are used in courses. Of the participants, 167 (95.4%) said they used adaptive learning platforms infrequently, and only 7 (4%) said they used them occasionally. This distribution indicates that adaptive learning platforms are still not commonly used in regular teaching practices.

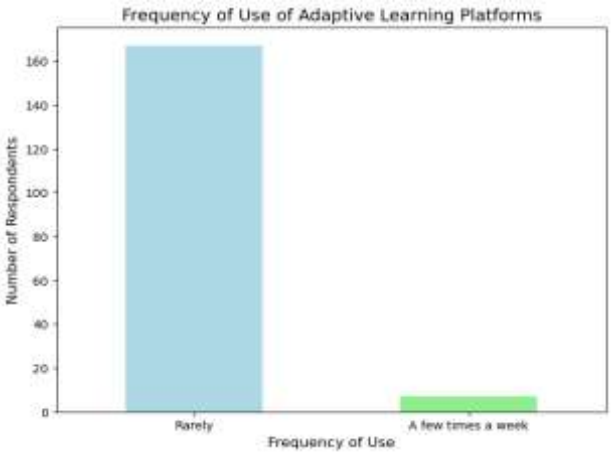


Figure 6. Incorporate adaptive learning methods into teaching science and mathematics subjects

According to research, personalized learning experiences that may be tailored to each student's needs are provided via adaptive learning platforms, which improves academic achievement and student engagement (Pane et al., 2014). The existing data's sparse usage of these platforms could point to potential obstacles, such as technological access, insufficient training, or ignorance of the advantages of these resources. The large proportion of teachers who utilize these platforms seldom is consistent with research by Zawacki-Richter et al. (2019), which showed that teachers frequently feel unprepared or undertrained to incorporate AI-driven technologies into their lessons.

Relative to other studies, this data aligns with the findings of Lu et al. (2021), where educators expressed similar challenges in adapting to new technology, despite the evidence that regular usage of adaptive learning platforms improves learning outcomes. In contrast, a study by Dabbagh et al. (2018) found that institutions with extensive professional development programs showed higher integration of adaptive technologies in classrooms, underscoring the importance of continuous teacher training.

In conclusion, this dataset shows that although the advantages of adaptive learning platforms are widely known, there is still a lack of integration of these tools into regular teaching. More work is required to give educators the tools and training they need to fully utilize new technologies, improving the educational experience for students.

Table 1. The rate of effectiveness of adaptive learning platforms in enhancing student understanding of science and mathematics

Item	Very Effective	Effective	Neutral	Ineffective
How would you rate the effectiveness of adaptive learning platforms in enhancing student understanding of science and mathematics?	36	73	42	22

The effectiveness rating distribution of adaptive learning platforms indicates a generally positive perception among educators regarding their impact on student understanding of science and mathematics as shown in Table 1. Specifically, 73 respondents (38.5%) rated these platforms as effective, while 36 (19.0%) deemed them very effective. Conversely, a notable portion, 22

respondents (11.5%), rated the platforms as ineffective, and 42 (22.0%) remained neutral. This distribution suggests a diverse range of experiences and opinions regarding the implementation of adaptive learning technologies in the classroom.

Positive evaluations, especially those that show efficacy, are consistent with research by Pane et al. (2014), which found that adaptive learning platforms' individualized learning environments can greatly increase student engagement and accomplishment. The focus on individualized learning enables teachers to adjust course material to meet the needs of each unique student, fostering a deeper comprehension and mastery of the subject (Kara et al., 2020).

However, the ineffectual and neutral ratings advocate that not all teachers use these platforms. The efficient application of adaptive learning technologies can be hampered by a lack of training, insufficient resources, or resistance to change (Zawacki-Richter et al., 2019). Furthermore, to optimize the advantages of adaptive learning technology, educators must get continual support and proper implementation, as demonstrated by the research conducted by Shute and Rahimi (2017).

Educational institutions have vital professional development and training because of the varied effectiveness ratings. Schools may create an environment where adaptive learning platforms are fully utilized by attending to these areas and ultimately improve student outcomes in mathematics and science.

4.2 Challenges in implementing technology-based adaptive learning platforms

The distribution of difficulties educators have when utilizing technology-based and adaptable learning platforms points to some grave concerns. A significant number of respondents, 65 (53.2%), identified "training and support" as a major challenge. This suggests that many educators may feel incompetent to integrate these technologies into their teaching practices. The need for comprehensive training programs is supported by research, which highlights that the successful implementation of adaptive learning technologies often hinges on adequate training and ongoing support (Zawacki-Richter et al., 2019). Without this foundational support, educators may struggle to utilize these tools to their full potential.

Table 2. Challenges to implement technology-based learning platforms

Types	Training and support	Integration with the curriculum	Student's access and management	Technical issues
What challenges have you encountered while using technology-based/ adaptive learning platforms?	65	26	25	7

Furthermore, "integration with existing curriculum" was identified by 26 respondents (21.0%) as a concern, suggesting a possible gap between adaptive learning platforms and the current educational frameworks. This coincides with research by Baker et al. (2016), who contend that seamless integration of adaptive technologies into the curriculum per standards and learning objectives is necessary for their effectiveness. The efficacy of the platforms may be lowered if educators encounter obstacles to this integration.

Moreover, "student access and engagement" was noted as a challenge by 25 respondents (20.2%). This highlights the ongoing issue of digital equity, where disparities in student access to

technology can hinder engagement with adaptive learning tools (Lai & Hwang, 2016). When students lack access to necessary devices or reliable internet connections, the effectiveness of these platforms diminishes, ultimately impacting learning outcomes.

Finally, technical issues were identified by only 7 respondents (5.6%) as a challenge. While this may appear to be a minor concern, it is essential to recognize that even small technical barriers can disrupt the learning process and affect the user experience (Friedrich et al., 2019). Educators must be equipped to troubleshoot and resolve technical problems to maintain a smooth instructional flow.

In conclusion, solving these issues is essential to the deployment of technology-based adaptive learning platforms implemented successfully. Strong training initiatives, curriculum integration plans, and steps to guarantee fair access to technology should be given by educational establishments to maximize the overall potency of these cutting-edge teaching aids.

4.3 Educators' experiences with AI-driven adaptive learning platforms

The ratings of educators regarding their overall experiences with AI-driven adaptive learning platforms reveal significant insights into the effectiveness and acceptance of these technologies in educational settings as shown in Table 3. The data indicates that a substantial majority, 101 respondents (57.4%), rated their experiences as "poor," while only 2 respondents (1.1%) reported their experiences as "excellent." This disparity suggests a prevalent dissatisfaction with these platforms among educators.

Table 3. Teachers experience with AI-driven adaptive learning platforms

Item	Poor	Neutral	Good	Excellent
Overall, how would you rate your experience with AI-driven adaptive learning platforms?	101	22	49	2

Educators' lack of support and training may be a major reason for the low evaluations. A study by Kizilcec et al. (2017) found that teachers are more likely to have positive experiences and outcomes in their teaching practices when they obtain thorough training in adaptive learning technologies. On the other hand, people who are not well-trained can find it difficult to use these platforms, which could cause them to feel frustrated and ineffectual. Institutions should prioritize professional development programs that improve teachers' use of adaptive learning resources.

Moreover, the "good" rating received by 49 respondents (28.3%) highlights that while a segment of educators recognizes the potential of AI-driven adaptive learning platforms, their experiences are mixed. This aligns with findings from Almeida et al. (2020), who noted that the effectiveness of adaptive learning systems varies significantly depending on the implementation context and the extent to which these technologies are tailored to meet the needs of both educators and students. Therefore, developers and educational institutions must ensure developers and educational institutions must ensure that adaptive learning platforms are designed with user feedback in mind and are adaptable to diverse educational contexts.

Furthermore, the 22 respondents (12.6%) who gave a "neutral" rating for their experiences indicate a lack of a strong opinion, which could indicate ambivalence or ambiguity about the platforms. This can point to the necessity for further explanations and exchange of ideas regarding the uses and advantages of these instruments. According to research by Johnson et al.

(2020), instructors' attitudes and readiness to include adaptive learning technology in their lessons can be greatly influenced by effective communication about the benefits of these tools.

Conclusively, the ratings generally suggest a need for enhanced communication, training, and assistance for AI-powered adaptive learning systems. Educational institutions can improve the overall efficacy of these technologies in the classroom by attending to these areas and creating a more positive experience for teachers.

4.4 Opinions on the Expansion of AI-Driven Adaptive Learning Platforms in Secondary Education

Table 4 displays a substantial propensity toward support for initiatives outlined in the data on educators' perspectives regarding the spread of AI-driven adaptive learning systems in secondary school. In particular, 92 respondents (79.3%) agreed that these platforms should be available to more people, while only 16 respondents (13.6%) disagreed. Furthermore, seven respondents (6.0%) indicated uncertainty using the word "maybe." This resounding endorsement indicates that AI-driven technologies are beginning to be recognized as potentially beneficial in educational environments.

Table 4. Expansion of AI-driven adaptive learning platforms

Item	Yes	No	Maybe
Do you believe that Technology-based/ AI-driven adaptive learning platforms should be expanded in secondary education?	92	16	7

Positive attitudes regarding growing AI-driven platforms are mostly due to their ability to offer individualized learning experiences catered to the requirements of each learner. Adaptive learning systems can dramatically improve student performance and engagement by modifying the material and pacing in real-time based on data analysis of students' learning behaviors, according to research by Baker and Inventado (2014). Secondary school kids have a variety of learning styles and speeds, so this individualized approach is very supportive in this setting. Teachers will be able to meet the diverse needs of their pupils and ultimately achieve more successful learning outcomes by growing these platforms.

Moreover, the increasing reliance on technology in education underscores the necessity of integrating AI-driven platforms into secondary education. A report by Zawacki-Richter et al. (2019) emphasizes that technology is reshaping educational landscapes, making it imperative for institutions to adopt innovative approaches. The support for expansion among educators aligns with the broader educational trend toward incorporating technology to enhance teaching and learning. Failure to expand these platforms may risk leaving students unprepared for a technology-driven world, where digital literacy and adaptability are essential skills.

Conversely, the 16 respondents (13.6%) who oppose the expansion highlight concerns that should be addressed to ensure successful implementation. These concerns may include issues related to the adequacy of training for educators, the need for reliable infrastructure, and potential resistance from stakeholders who may fear technology's impact on traditional teaching methods. Research by Means et al. (2013) indicates that effective technology requires addressing such challenges through strategic planning and stakeholder engagement. This approach ensures that the expansion of AI-driven platforms is met with informed support and constructive feedback.

In conclusion, the data suggests an endorsement among educators to expand AI-driven adaptive learning platforms in secondary education. To capitalize on this momentum, educational institutions must prioritize addressing related to training, infrastructure, and stakeholder engagement to foster an environment conducive to innovative educational practices.

4.5 Appropriateness of Curriculum for Technology-Based Adaptive Teaching Methods

The distribution of responses regarding the appropriateness of the curriculum and student textbooks for implementing technology-based and AI-driven adaptive teaching methods reveals a mixed but generally positive sentiment among educators as shown in Figure 7. Specifically, 57 respondents (42.2%) affirmed that the curriculum is "fully appropriate," while 50 respondents (37.6%) indicated it is "somewhat appropriate." Conversely, 16 respondents (12.0%) deemed it "not appropriate." This variation in responses highlights both the potential and the challenges in aligning educational content with emerging technology-enhanced teaching methodologies.

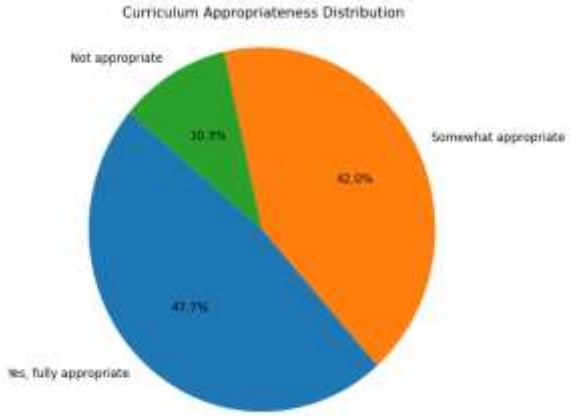


Figure 7. Appropriateness of curriculum for technology-based adaptive teaching

The proportion of respondents who indicated that the curriculum is fully appropriate suggests that the existing educational frameworks and resources are well-suited to integrate technology effectively. This alignment is crucial, as research shows that the successful implementation of technology-based adaptive learning hinges on the compatibility of curricular materials with adaptive methodologies. According to Hwang and Chen (2017), when curricula are designed to incorporate technology, it facilitates more personalized and engaging learning experiences for students, thus enhancing overall learning outcomes. The positive response from educators reflects a recognition of the potential benefits of such integration in fostering student engagement and mastery of content.

Nonetheless, there is a clear need for improvement, as indicated by the 50 respondents who thought the curriculum was moderately acceptable. While this group acknowledges the potential benefits of technology-enhanced learning, it also sees weaknesses in the current textbooks and curriculum that may prevent broad deployment. The results are consistent with the research of Zheng et al. (2020), who contend that to fully benefit from adaptive learning technologies, curricula, even those that are only partially appropriate, may need to be modified. Teachers may believe that to get the most out of these adaptive teaching strategies, they require more funding, updated materials, or training.

The curriculum presents significant issues that require attention, as indicated by the 16 respondents (12.0%) who deemed it inappropriate. They can be worried about out-of-date material, a lack of technology integration, or assistance for teachers switching to adaptive learning settings. Resolving these issues is crucial to ensuring that the curriculum complies with

the demands of modern teaching techniques, according to research by Rienties et al. (2016). The comments indicate that to make the curriculum more compatible with AI-driven teaching approaches, stakeholders in education, including legislators and curriculum authors, need to have regular conversations with educators to identify specific areas for improvement.

In conclusion, while a significant proportion of educators view the curriculum as appropriate for implementing technology-based and AI-driven adaptive teaching methods, a notable percentage express concerns regarding its effectiveness. To maximize the benefits of adaptive learning technologies, educational institutions should invest in curriculum development, resource allocation, and professional training that aligns with contemporary teaching practices.

4.6 Overall satisfaction with support and training for adaptive learning platforms

Figure 8 illustrates the generally good feeling among educators regarding the support and training provided for adopting adaptive learning platforms at Dawa University in the summer of 2024, based on the distribution of replies. Fifty-seven (53.2%) of the respondents said they were "satisfied," while thirty-two (25.2%) said they were "very satisfied." Furthermore, 9 respondents (7.1%) said they felt "dissatisfied," while 15 respondents (11.8%) said they were neutral. This distribution emphasizes how crucial efficient support and training systems are to adaptive learning technology.

The high percentage of satisfied and very satisfied respondents (a combined total of 78.4%) suggests that the training provided was beneficial in equipping educators with the necessary skills and knowledge to utilize adaptive learning platforms effectively. According to Garrison and Kanuka (2004), effective professional development programs in technology training are essential for enhancing educators' pedagogical practices. The positive response from participants indicates that the training sessions likely addressed their needs and facilitated their understanding of how to leverage adaptive learning technologies to enhance student engagement and learning outcomes.

Nonetheless, the existence of indifferent and unsatisfied answers calls for more research. Given that 9 respondents (7.1%) expressed displeasure and 15 respondents (11.8%) remained neutral, it is clear that some educators may not have felt that the support or training was enough or pertinent to their particular needs. The necessity of follow-up training and continuous assistance is emphasized by research conducted by Darling-Hammond et al. (2017) to fulfill the various demands of educators in different circumstances. To raise satisfaction levels, educational institutions should ask participants for feedback and modify their training programs so teachers feel empowered and supported to use adaptive learning.

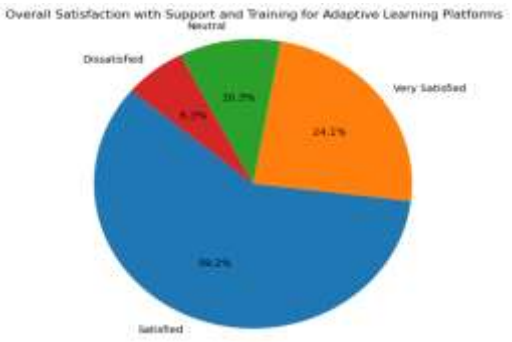


Figure 8. The overall satisfaction of training for adaptive learning platforms

Furthermore, the dissatisfaction reported by a small percentage of respondents could stem from various factors, including inadequate resources, a lack of hands-on experience, or insufficient follow-up support. A study by Schiller and Mandinach (2018) found that ongoing professional development including practical applications and mentoring, significantly influences educators' attitudes toward new technologies. Therefore, addressing the concerns of the neutral and dissatisfied groups may require an emphasis on continuous improvement in training delivery and the provision of additional resources to facilitate the successful adoption of adaptive learning platforms.

V. Conclusion

The data shows that while a high proportion of respondents believe the curriculum is either fully or somewhat appropriate for implementing technology-based and AI-driven adaptive teaching methods a significant portion (16%) find it unsuitable. This highlights the need for further curriculum adjustments to better align with the integration of AI-driven platforms, ensuring all educators feel supported in their use.

There is strong support for expanding AI-driven adaptive learning platforms in secondary education, with 85% of respondents agreeing that these platforms should be more widely implemented. However, challenges such as inadequate training, integration issues with the current curriculum, and student engagement should be addressed to facilitate smoother adoption and usage of these technologies in classrooms.

In conclusion, while the overall satisfaction with the training and support for adaptive learning platforms at Dire Dawa University is encouraging, the presence of neutral and dissatisfied responses highlights areas for improvement. By actively engaging with educators to gather feedback and tailor support programs, institutions can enhance the effectiveness of training initiatives and foster a more positive perception of adaptive learning technologies among educators.

Finally, while many educators have neutral or positive experiences with adaptive learning platforms, the low frequency indicates that these tools are not fully leveraged. To maximize the potential of adaptive learning platforms, schools provide more consistent training and encourage regular use, ensuring that educators feel confident and supported in incorporating these technologies into their teaching routines.

Recommendations

It is recommended that educational policymakers revise or augment the current curriculum including technology-based adaptive teaching methods to address concerns about suitability. Updates to curricula should guarantee compatibility with AI-powered learning environments and give teachers the resources and direction they need to integrate new technologies.

Due to strong support for their expansion, schools and other educational institutions should prioritize deploying AI-driven platforms. To guarantee that all students and instructors can utilize these tools effectively, investments in infrastructure, technical support, and platform accessibility should be made. Forming alliances with suppliers of instructional technology could make this growth easier.

Comprehensive and continuous professional development programs should be implemented to provide educators with the tools to use adaptive learning platforms with self-assurance, as training and support were noted as major obstacles. These training courses shall incorporate practical training, troubleshooting assistance, and opportunities for educators to learn collaboratively. Studies indicate that teachers are more willing to include new technology in their lessons when they have received sufficient training and support.

By guaranteeing dependable access to technology and providing technical help, schools must also address technical problems and obstacles to student engagement. Furthermore, it is crucial to think students are being introduced to adaptive learning platforms since successful onboarding and long-term engagement techniques can improve learning results.

Schools should cultivate a culture that supports the regular integration of these technologies into the classroom to enhance the frequency of usage of adaptive learning platforms. This might be accomplished by showing success stories, providing incentives for usage, and incorporating adaptive learning into class plans. Teachers shall give examples of integrating adaptive platforms into their regular teaching activities.

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