

## Transforming Higher Education with Adaptive AI Driven-Learning: Challenges and Opportunities

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### Abstract

Artificial Intelligence (AI) for adaptative learning is revolutionizing higher education by offering personalized learning experiences tailored to individual student needs. By leveraging real-time data analysis, AI-driven platforms can adapt content delivery, provide targeted feedback, and suggest customized learning paths based on each student's strengths and weaknesses. In this context, this study investigates the effectiveness and perceptions of adaptive AI-driven learning systems among nursing faculty at a private university in Chile ( $n= 66$ ). Using a quantitative, non-experimental design, a Likert-type questionnaire with 20 items was administered to a group of instructors to find out the systems' impact on student engagement, motivation and learning outcomes. Results reveal that adaptive AI-driven learning is highly regarded for improving conceptual understanding and information retention. The findings highlight strengths in enhancing student engagement and motivation, while identifying areas for further refinement. These insights contribute to understanding the practical implications of integrating adaptive AI into higher education and offer recommendations for optimizing system design and implementation.

## Introduction

The advent of AI has brought about significant transformations across various sectors, and education is no exception (Kamalov *et al.*, 2023; Vera, 2023a; Vera, 2023b). Specifically, in higher education, adaptive AI-driven systems are increasingly adopted to personalize learning experiences, improve student outcomes, and streamline administrative processes (George & Wooden, 2023). Moreover, these systems leverage real-time data analysis to tailor educational content, providing targeted feedback and suggesting learning paths aligned with individual student strengths and weaknesses. This allows adaptive learning systems to dynamically adapt content, strategies, and feedback to learners' individual needs. The implementation of AI-powered adaptive learning platforms has shown promising results in increasing engagement and improving learning outcomes.



Beyond personalized learning, adaptive AI-driven systems contribute to creating a more dynamic and interactive educational environment (Grassini, 2023). These systems can identify learning patterns and predict future performance, allowing for proactive support and customized intervention plans. For instance, if a student is struggling with a particular concept, the system can provide additional resources and exercises tailored to help them overcome their difficulties. This level of customization not only helps in addressing individual student needs, but also fosters a sense of ownership and motivation among learners, as they receive support that is specifically designed for their unique learning journey. Furthermore, adaptive AI can facilitate collaborative learning by forming groups based on complementary skills and learning styles, enhancing peer-to-peer interaction and collective problem-solving.

On the one hand, students benefit from a more engaging and effective learning environment. Additionally, adaptive AI assists in identifying at-risk students early, enabling timely interventions and support. This proactive approach ensures that students receive the help they need before falling significantly behind. Furthermore, AI-driven platforms provide instant feedback, which is crucial for keeping students motivated and on track (Kamalov *et al.*, 2023). By offering personalized learning paths and resources, these systems cater to individual learning paces and styles, making education more inclusive and accessible. Consequently, students experience a more tailored educational journey that meets their specific needs and fosters a deeper understanding of the material.

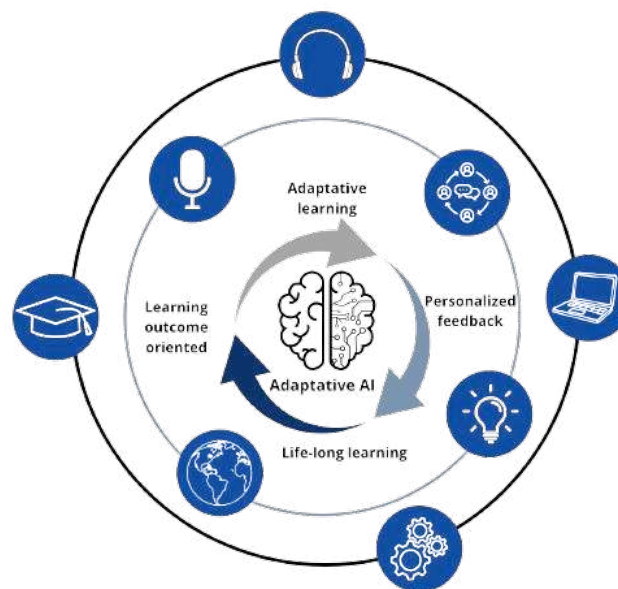
On the other hand, instructors, equipped with data-driven insights from adaptive AI systems, can refine their teaching strategies and curriculum design. This data-driven approach enables educators to understand the diverse learning needs of their students better and adapt their instructional methods accordingly. For instance, real-time analytics can reveal which teaching materials are most effective or which topics require more attention. This iterative process of continuous improvement, guided by AI, ensures that the educational content remains relevant and engaging. Additionally, by automating routine administrative tasks such as grading and attendance tracking, AI allows instructors to dedicate more time to mentoring and supporting students, thereby enhancing the overall quality of education (Karimi & Khawaja, 2023).

Moreover, the integration of AI in higher education also facilitates lifelong learning and professional development (Barnes & Hutson, 2024). In this context, adaptive AI platforms can provide personalized learning experiences not only for current students but also for alumni and professionals seeking to update their skills or gain new knowledge. This continuous learning model is essential in today's rapidly evolving job market, where the ability to acquire new skills quickly is highly valued. As a result, higher education institutions can offer more flexible and relevant educational programs that cater to the needs of a diverse learner population. Despite the potential challenges, such as ensuring ethical AI use and maintaining human oversight, the transformative impact of adaptive AI in fostering a more effective and inclusive educational environment is undeniable.

### What is adaptive AI?

Adaptive AI refers to artificial intelligence systems designed to dynamically and continuously adjust and evolve in response to new data and changing environments (Håkansson *et al.*, 2023, Webisoft, 2024). It is the latest form of artificial intelligence that learns, adapts and improves as it encounters changes, both in data and the environment (Lange, 2023). Unlike traditional AI, which operates based on pre-defined rules and static algorithms, adaptive AI continually learns, provides personalized feedback and refines its performance over time. This adaptability allows these systems to improve their decision-making processes and predictive capabilities by leveraging real-time feedback and new information. As a result, adaptive AI can offer more personalized and accurate responses, making it particularly valuable in dynamic and complex scenarios where conditions are frequently shifting (Figure 1).

Figure 1: Adaptive AI



Source: Own elaboration.

One of the key features of adaptive AI is its ability to self-optimize through mechanisms such as machine learning and reinforcement learning. In machine learning, the system analyzes vast amounts of data to identify patterns and make predictions, continuously updating its models as new data becomes available. Reinforcement learning, on the other hand, involves the AI learning optimal behaviors through trial and error, receiving feedback from its actions, and adjusting accordingly. These processes enable adaptive AI to become more proficient over time, allowing it to handle a wide range of tasks from customer service automation to advanced medical diagnostics, ultimately enhancing efficiency, accuracy, and user satisfaction.

### *The role of adaptive AI-driven systems in higher education*

Adaptive AI-driven systems in education refers to the use of algorithms and machine learning to tailor educational experiences to the individual needs of students. By analyzing data from various sources such as student performance, behavior, and preferences, adaptive AI systems can provide personalized learning paths, real-time feedback, and targeted interventions. This personalization aims to optimize student engagement and achievement.

Firstly, adaptive AI systems in higher education offer a transformative approach to personalized learning by leveraging sophisticated algorithms to analyze extensive datasets. These datasets encompass various aspects of student engagement, including performance metrics, behavioral patterns, and individual learning preferences. Consequently, by processing this data, AI-driven platforms can develop tailored learning experiences that address the unique needs of each student. For instance, if a student demonstrates a particular learning style or struggles with specific concepts, the AI system can adjust the instructional material and methods accordingly. This dynamic adaptation not only enhances comprehension and retention but also fosters a more engaging and motivating educational environment.

Moreover, real-time feedback provided by these systems allows students to understand their progress and areas needing improvement immediately, enabling them to adjust their study strategies effectively and efficiently. This instantaneous feedback mechanism is crucial in maintaining student engagement and motivation. For instance, when students receive prompt feedback on their assignments or quizzes, they can quickly identify and correct mistakes, thereby reinforcing their learning and understanding of the subject matter. Furthermore, real-time feedback can highlight students' strengths, giving them confidence in areas where they excel, while also pinpointing specific areas that require more focus.

This process of immediate feedback and adjustment creates a continuous loop of learning and improvement, fostering a growth mindset among students. Additionally, adaptive AI systems can track the progress of students over time, providing a comprehensive view of their development. This longitudinal data allows students to see their growth trajectory, which can be highly motivating and encourage sustained effort. By continuously adapting to the students' needs and providing ongoing feedback, these systems help students develop effective study habits and self-regulation skills.

In addition to benefiting students, adaptive AI also provides significant advantages for educators and institutions. For educators, these systems offer valuable insights into student performance and learning behaviors, facilitating more informed and responsive teaching strategies. For example, instructors can quickly identify students who may be at risk of falling behind and implement timely interventions to support them.

Furthermore, the automation of administrative tasks such as grading and attendance tracking frees up valuable time for instructors, allowing them to focus more on interactive and personalized instruction (George & Wooden, 2023, Vera, 2023a; Kamalov *et al.*, 2023). Consequently, for Higher Education Institutions (HEIs), the integration of adaptive AI systems can lead to more efficient resource allocation, improved student outcomes, and a more streamlined educational process.

However, the implementation of these technologies also raises important considerations regarding data privacy and ethical use. Therefore, HEIs must ensure that AI systems are transparent, secure, and designed to support equitable access to quality education. Transparency is crucial because students and educators need to understand how these systems make decisions and use data. Moreover, robust security measures must be in place to protect sensitive student information from breaches and unauthorized access. Equally important is the need to address potential biases within AI algorithms to prevent any form of discrimination and to promote fairness.

Despite these challenges, the potential of adaptive AI to revolutionize higher education by creating more personalized, effective, and inclusive learning environments is immense. By leveraging AI, HEIs can tailor educational experiences to individual needs, thereby enhancing student engagement and outcomes. Consequently, as institutions navigate these ethical and technical challenges, the transformative benefits of adaptive AI in fostering a more dynamic and inclusive educational landscape become increasingly evident. In this context, this study seeks to understand the implications of adaptive AI-driven learning systems in higher education, by investigating the following research questions:

- RQ1: What are the nursing faculty's overall perceptions of adaptive AI-driven learning environments?
- RQ2: How do adaptive AI-driven learning systems impact student engagement and motivation from the perspective of nursing faculty?
- RQ3: What challenges do nursing faculty identify regarding the usability of adaptive AI-driven learning platforms?

#### *Adaptative learning platforms*

Adaptive learning platforms are sophisticated educational technologies designed to customize the learning experience to meet the unique needs of each student (Joshi, 2024). By leveraging data-driven algorithms, these platforms meticulously analyze students' performance and learning behaviors, allowing them to adjust content, pace, and instructional methods dynamically. This personalized approach ensures that each learner receives a tailored educational experience, catering to their individual strengths and weaknesses. In other words, these platforms gather and interpret a wealth of data, including quiz scores, response times, interaction patterns and learning styles to profile students. This information enables the adaptive learning system to provide just-in-time feedback and modify the learning path in real-time.

For example, if a student struggles with a particular concept, the platform might offer additional resources or practice problems to help them master it before moving on. This could include providing step-by-step tutorials, visual aids, or supplementary reading materials tailored to address the student's specific difficulties. The system might also suggest interactive exercises or quizzes that focus on the troublesome area, allowing the student to practice until they achieve a satisfactory level of understanding. Additionally, the platform can adjust the pace of instruction, slowing down to give the student more time to grasp complex topics, and incorporating periodic reviews to reinforce learning.

Conversely, students who demonstrate a strong grasp of the material can be presented with more challenging content to keep them engaged and progressing. This might involve introducing advanced topics, offering problem-solving activities that require higher-order thinking skills, or engaging the student in project-based learning that applies the concepts in real-world scenarios. These students might also receive opportunities to participate in peer teaching, where they can explain concepts to their classmates, further solidifying their own understanding while assisting others. The adaptive learning platform can track their progress and provide accolades or badges to recognize their achievements, fostering a sense of accomplishment and motivation to continue excelling. By continuously adapting the learning path to suit each student's needs, these platforms ensure that all learners remain challenged and supported, promoting continuous growth and academic success.

Therefore, one of the primary goals of adaptive learning platforms is to enhance student engagement. By providing content that is neither too easy nor too difficult, these systems maintain students' interest and motivation. Real-time feedback is another critical feature, allowing students to understand their progress and areas that need improvement instantly. This immediate response helps to keep students on track and prevents the accumulation of learning gaps. Furthermore, adaptive learning platforms can address a wide range of educational needs, from remedial support to advanced enrichment, ensuring that all students have the opportunity to succeed.

In addition to improving engagement and outcomes, adaptive learning platforms offer significant benefits to educators and institutions. Teachers can use the data generated by these systems to gain insights into individual and class-wide learning trends, enabling them to tailor their instruction more effectively. This data can also highlight common areas of difficulty, allowing for targeted interventions that can benefit the entire class. Moreover, adaptive learning platforms can help to alleviate some of the workload associated with grading and monitoring progress, giving educators more time to focus on instructional planning and student support. This proactive approach not only enhances the learning experience for students but also supports teachers in creating a more responsive and adaptive educational environment. Consequently, adaptive learning platforms contribute to a more efficient and effective educational process, ultimately benefiting both students and educators.

From an institutional perspective, the implementation of adaptive learning platforms can lead to improved retention and graduation rates by ensuring that students receive the support they need to succeed. These systems can also facilitate a more inclusive learning environment by accommodating diverse learning styles and needs, thus promoting equity in education. As adaptive learning technologies continue to evolve, they hold the potential to transform the educational landscape, making learning more personalized, engaging, and effective for all students.

Figure 1: Adaptative AI-driven learning platforms



Source: Own elaboration.

Examples of adaptive AI-driven learning platforms used in higher education:

- **Knewton:** This platform provides adaptive learning technologies that customize educational content based on students' strengths and weaknesses. It uses data analytics to offer personalized recommendations and resources, ensuring that students receive targeted support tailored to their learning needs. (<https://support.knewton.com/>)
- **Pearson's MyLab and Mastering:** These platforms offer adaptive learning solutions across various subjects, including mathematics, science, and humanities. They adjust the difficulty of exercises and provide personalized feedback based on students' performance, helping to address individual learning gaps. (<https://www.pearson.com/>)

- **Smart Sparrow:** This platform offers adaptive elearning tools that focus on personalized learning pathways. It allows educators to create adaptive lessons and assessments that adjust in real-time according to student interactions and progress. (<https://www.smartsparrow.com/>)
- **McGraw-Hill Education's ALEKS:** ALEKS (Assessment and Learning in Knowledge Spaces) uses adaptive learning to provide individualized instruction in subjects such as mathematics and chemistry. The platform identifies knowledge gaps and delivers tailored practice to help students master concepts at their own pace. (<https://www.aleks.com/>)
- **DreamBox:** This platform is an adaptive math program designed for students in K-8. It uses real-time data to personalize lessons and instructional approaches, catering to each student's unique learning style and pace. (<https://www.dreambox.com/>)

These platforms are increasingly adopted in higher education to provide a more personalized and effective learning experience, leveraging technology to address the varying needs of students and improve educational outcomes.

#### *What is adaptive learning*

Adaptive learning is an educational methodology that leverages advanced technologies to personalize the learning experience for individual students (Gligorea *et al.*, 2023; Vera, 2023c). Also known as adaptive teaching, it involves creating tailored educational experiences that meet the specific needs of each learner by offering timely feedback, personalized learning paths, and appropriate resources, rather than adopting a uniform approach for all students (Smartsparrow, n. d.). This approach uses data-driven insights to tailor the content, pace, and instructional strategies to meet the unique needs of each learner.

By continuously collecting and analyzing data on student performance, adaptive learning systems can identify areas where students struggle and provide targeted support to help them overcome challenges. These systems can adjust the difficulty level of tasks, recommend specific learning resources, and offer personalized feedback, creating a dynamic and responsive learning environment. The goal is to enhance student engagement, improve learning outcomes, and ensure that each student progresses at an optimal pace.

The implementation of adaptive learning has shown significant promise across various educational settings, from K-12 to higher education and professional training. In K-12 education, adaptive learning tools can address diverse learning styles and paces, ensuring that no student is left behind. In higher education, these tools support self-directed learning, allowing students to focus on areas that require more attention and move quickly through concepts they have mastered.



Professional training programs also benefit from adaptive learning by providing customized learning paths that align with individual career goals and competencies. Despite its potential, adaptive learning faces challenges, including the need for substantial initial investment in technology and training, concerns about data privacy, and the necessity of integrating these systems seamlessly into existing educational frameworks. Operationally, “AI applications that directly support student learning show early promise with the development of adaptive learning systems, including intelligent tutoring systems” (OECD, 2023, p. 5). Nonetheless, the ongoing advancements in technology and growing recognition of the importance of personalized learning, especially regarding the integration of AI, continue to drive the adoption and evolution of adaptive learning methodologies.

#### *Benefits of integrating adaptive AI*

The integration of adaptive AI in higher education offers numerous benefits for both students and educators. These benefits include:

- **Personalized learning:** Adaptive AI tailors educational experiences to meet individual student needs by analyzing their performance, behavior, and preferences. This personalization enhances engagement and facilitates better learning outcomes.
- **Real-time feedback:** Students receive immediate feedback on their work, allowing them to understand their strengths and areas for improvement. This helps them to adjust their study strategies promptly and efficiently, fostering continuous learning and development.
- **Early identification of at-risk students:** AI systems can identify students who may be struggling or at risk of falling behind. This enables timely interventions and support from educators, ensuring that students receive the help they need to succeed.
- **Efficient resource allocation:** AI optimizes administrative tasks such as grading and attendance tracking, freeing up educators to focus on personalized instruction and mentorship. This leads to a more efficient allocation of institutional resources.
- **Enhanced teaching strategies:** Instructors gain valuable insights into student performance and learning behaviors through AI analytics. This information allows them to refine their teaching methods and curriculum design, ensuring that educational content remains relevant and engaging.

- **Lifelong learning and professional development:** Adaptive AI platforms support continuous learning by providing personalized educational experiences for alumni and professionals seeking to update their skills or acquire new knowledge. This adaptability is crucial in today's rapidly evolving job market.

#### *Challenges and ethical considerations*

While the benefits of adaptive AI in higher education are evident, its implementation comes with significant challenges and ethical considerations. These aspects include concerns about data privacy and security, as adaptive AI systems collect and analyze vast amounts of student data to personalize learning experiences. Ensuring this data is protected from breaches and misuse is paramount. Additionally, there is the challenge of algorithmic bias, where AI systems might inadvertently reinforce existing inequalities if they are trained on biased data. This can lead to unfair treatment of certain student groups. Another ethical consideration is transparency; students and educators need to understand how AI-driven decisions are made and have the ability to question or appeal these decisions.

Moreover, there are concerns about over-reliance on technology, which might diminish the role of human educators and lead to a less personalized touch in teaching. Addressing these challenges requires robust policies, ongoing monitoring, and a commitment to ethical AI practices, as explained below:

- **Data privacy and security:** One of the primary concerns with the use of AI in education is data privacy. Adaptive AI systems require access to vast amounts of personal data to function effectively, raising concerns about how this data is collected, stored, and used. Consequently, higher education institutions must ensure robust data protection measures are in place to safeguard student information and comply with relevant privacy laws and regulations. This includes implementing advanced encryption, secure data storage solutions, and clear policies on data access and usage.
- **Algorithmic bias:** Another significant challenge is the potential for algorithmic bias. AI systems are only as good as the data they are trained on, and if this data is biased, the AI's recommendations and decisions may also be biased. This can lead to unfair treatment of certain student groups and perpetuate existing inequalities. Therefore, it is essential for HEIs to regularly audit their AI systems and ensure that they are free from bias. This involves using diverse and representative datasets, employing fairness-enhancing techniques, and continuously monitoring AI outcomes for signs of bias.

- **Continuous improvement and updates:** Adaptive AI systems need to be continuously updated and improved to remain effective. This requires ongoing investment in research and development, as well as collaboration between educators, AI experts, and policymakers. Institutions must be committed to staying abreast of the latest advancements in AI and incorporating them into their systems. Regular updates and improvements are crucial to address emerging issues, enhance system capabilities, and ensure that the AI remains aligned with educational goals and ethical standards. This commitment to continuous improvement will help institutions maximize the benefits of adaptive AI while mitigating potential risks.
- **Transparency:** Another ethical consideration is transparency, which involves ensuring that the processes and decisions made by adaptive AI systems are clear and understandable to all stakeholders. This includes providing students and educators with insights into how the AI algorithms work, what data is being used, and how personalized recommendations or adjustments are determined. Transparency is crucial to build trust in the technology, allowing users to see the rationale behind AI-driven decisions. It also empowers students and educators to question, understand, and potentially contest decisions that affect their learning experiences. Ensuring transparency helps in maintaining accountability and can prevent misuse or misinterpretation of AI-generated data.

## Method and Materials

To evaluate the effectiveness and perceptions of adaptive AI-driven learning systems, a quantitative approach with a non-experimental design was utilized. According to Salmons (2023), nonexperimental research designs explore social phenomena without directly altering the conditions experienced by the subjects. In these designs, subjects are not randomly assigned to various groups, which significantly limits the evidence supporting cause-and-effect relationships. This section outlines the research design, instrumentation, and procedures used to collect and analyze data from a survey administered to 66 participants.

### *Participants*

Of the 66 participants, 29 were men and 37 were women, representing 44% and 56% of the sample, respectively. The average age of the participants was 47 years ( $SD = 9$ ). Considering the highest academic qualifications, 36 faculty members hold a doctoral degree and 24 hold a master's degree (55% and 36%, respectively), while 6 instructors have a bachelor's degree (9%). Participants The study involved instructors from a private university in Chile, specifically from the Nursing program. This demographic distribution provides a diverse perspective on the perceptions and experiences of adaptive AI-driven learning systems within the context of nursing education.

### *Instrument*

The study employed a Likert-type questionnaire consisting of 20 specific items, each rated on a 1-to-5 scale, where 1 denotes "Strongly Disagree" and 5 denotes "Strongly Agree." This instrument was meticulously designed to evaluate multiple dimensions of adaptive AI-driven learning systems, including their impact on student engagement, motivation, and overall learning outcomes. The questionnaire aimed to capture nuanced insights from faculty members about how these systems influence the learning process. Items on the questionnaire were crafted to cover a broad range of factors, such as the perceived effectiveness of personalized feedback, the ability of the AI to adjust learning pathways based on individual progress, and the overall user-friendliness of the platform.

By encompassing a variety of aspects, the questionnaire sought to provide a comprehensive understanding of the strengths and potential areas for improvement in adaptive AI-driven learning systems. The inclusion of questions related to both positive impacts and potential challenges ensured that the data collected would reflect a balanced view of the faculty's experiences and perceptions. Administered via a self-report method, the questionnaire facilitated an in-depth exploration of the faculty's perspectives, thereby contributing valuable data to the ongoing discourse on the integration of AI in higher education.

The survey aimed to capture nuanced insights into how these systems affect various aspects of the adaptive AI-driven learning environments. The questionnaire was administered electronically via Google Forms, providing an accessible and user-friendly platform for participants to complete their responses. This method ensured efficient data collection and ease of access for the respondents. The structured format of the questionnaire facilitated systematic data analysis and allowed for a comprehensive assessment of participants' perceptions regarding adaptive AI-driven learning.

### **Results**

The following results present the descriptive statistics for key aspects of adaptive AI-driven learning systems, as assessed through a survey of 66 participants. The table provides insights into how these systems are perceived in terms of their impact on engagement, motivation, learning effectiveness, and usability.

The data reveals variations in perceptions across different dimensions, including the effectiveness of adaptive AI-driven learning in enhancing student engagement, motivation, and overall academic performance. Additionally, the results highlight areas where the systems excel, such as improving understanding of complex concepts and retaining information, as well as areas needing attention, such as assignment completion rates and user interface intuitiveness.

The following table outlines the mean scores and standard deviations for each item assessed, providing a comprehensive overview of the strengths and challenges associated with adaptive AI-driven learning systems. The data presents a detailed analysis of various dimensions, such as user satisfaction, learning efficiency, and adaptability to individual needs. By examining these metrics, we can gain insights into how well these systems are performing and identify areas that require improvement.

**Table 1:** Descriptive Statistics

	Valid	Mean	SD
1. Adaptive AI-driven learning helps students stay more engaged compared to traditional methods.	66	4.000	1.177
2. Students seem more motivated to learn when using adaptive AI-driven learning platforms.	66	4.697	0.764
3. The personalized feedback from AI-driven learning increases students' interest in the subject.	66	3.864	1.226
4. Students are more likely to complete their assignments when using adaptive AI-driven learning tools.	66	3.424	1.278
5. The interactive elements of AI-driven learning make the learning experience enjoyable for students.	66	4.061	0.926
6. Adaptive AI-driven learning helps students understand complex concepts better.	66	4.909	0.290
7. Students achieve better grades when using adaptive AI-driven learning systems.	66	4.364	0.888
8. The adaptive nature of AI-driven learning allows students to learn at their own pace effectively.	66	4.273	1.060
9. Students retain information longer when they use adaptive AI-driven learning tools.	66	4.727	0.621
10. Students' problem-solving skills have improved through adaptive AI-driven learning.	66	4.000	1.215
11. Adaptive AI-driven learning platforms are easy for students to use.	66	3.909	1.173
12. Students can easily access adaptive AI-driven learning tools from any device.	66	4.682	0.559
13. The user interface of adaptive AI-driven learning platforms is intuitive for students.	66	3.909	1.003
14. Students encounter few technical issues when using adaptive AI-driven learning systems.	66	3.909	1.003
15. Adaptive AI-driven learning platforms provide helpful tutorials and support for students.	66	4.364	0.777
16. The AI-driven system accurately identifies students' strengths and weaknesses.	66	4.364	0.777
17. Students receive personalized recommendations that are relevant to their learning needs.	66	4.212	0.795
18. The adaptive AI adjusts the difficulty level based on students' progress.	66	4.515	0.662
19. The personalized learning paths help students achieve their academic goals.	66	4.530	0.661
20. Adaptive AI-driven learning tailors the educational experience to students' individual preferences.	66	4.197	0.863

Source: Own elaboration.

### *High mean scores*

The analysis of high mean scores reveals that instructors overwhelmingly perceive adaptive AI-driven learning systems as highly beneficial in several key areas. Notably, the highest-rated item, "Adaptive AI-driven learning helps students understand complex concepts better" (Mean = 4.909; SD = 0.290), indicates a near-unanimous agreement on the system's effectiveness in enhancing conceptual comprehension. Similarly, "Students retain information longer when they use adaptive AI-driven learning tools" (Mean = 4.727; SD = 0.621) and "Students seem more motivated to learn when using adaptive AI-driven learning platforms" (Mean = 4.697; SD = 0.764) highlight the perceived positive impact on information retention and student motivation. These high scores suggest that instructors believe these systems significantly contribute to deeper learning and sustained engagement. The low standard deviations further imply a strong consensus among educators, underscoring the potential of adaptive AI-driven learning to transform educational outcomes. This consensus may be attributed to firsthand experiences or observed improvements in student performance and engagement.

### *Low mean scores*

Conversely, the low mean scores in certain areas suggest that there are perceived limitations and challenges associated with adaptive AI-driven learning systems. The item "Students are more likely to complete their assignments when using adaptive AI-driven learning tools" (Mean = 3.424; SD = 1.278) received the lowest mean score, indicating skepticism about the system's ability to enhance assignment completion rates. Additionally, "The personalized feedback from AI-driven learning increases students' interest in the subject" (Mean = 3.864; SD = 1.226) and "Adaptive AI-driven learning platforms are easy for students to use" (Mean = 3.909; SD = 1.173) received relatively lower scores, suggesting mixed feelings about the effectiveness of personalized feedback and the user-friendliness of the platforms. The higher standard deviations for these items reflect significant variability in instructor experiences and perceptions, which may be due to differing levels of familiarity with the technology, varying implementation contexts, or inconsistent support and training. Addressing these areas of concern through improved training, support, and user interface design could help enhance the overall effectiveness and acceptance of adaptive AI-driven learning systems.

## Conclusions

The data underscores a strong positive perception of adaptive AI-driven learning systems, particularly in their ability to enhance learning outcomes. Instructors generally view these systems favorably, especially for their effectiveness in improving students' understanding of complex concepts and aiding in information retention. This positive feedback indicates that adaptive AI-driven learning tools are valued for their role in deepening conceptual comprehension and supporting long-term retention.

Moreover, these systems are perceived as effective in boosting student motivation and making the learning experience more enjoyable. Such improvements in motivation and engagement are crucial, as they contribute to a more immersive and interactive educational environment. This heightened level of engagement often translates into increased participation and a more active learning process, where students are more likely to invest time and effort into their studies. Consequently, the enhanced engagement and enjoyment associated with adaptive AI-driven learning systems may lead to better overall academic performance. By creating a dynamic and responsive learning environment, these systems help maintain student interest and encourage consistent academic effort, ultimately fostering a deeper understanding of the subject matter and promoting long-term educational success.

However, despite these advantages, there are notable areas of concern. Specifically, the systems seem less effective in improving assignment completion rates and delivering personalized feedback. The mixed reviews regarding the ease of use of these platforms further highlight some limitations. These issues suggest that while adaptive AI-driven learning systems have significant strengths, there are critical areas that require attention to maximize their effectiveness.

Furthermore, the variability in experiences and perceptions among instructors indicates that certain aspects of adaptive AI-driven learning systems could benefit from further refinement. Differences in user experiences suggest that enhancements tailored to address specific needs and challenges could improve the overall effectiveness and acceptance of these systems.

In summary, while adaptive AI-driven learning systems are generally well-regarded for their impact on learning outcomes and student engagement, addressing concerns related to assignment completion, personalized feedback, and usability will be crucial for optimizing their overall effectiveness.

## Recommendations

Based on the analysis of current perceptions and identified areas for improvement, the following recommendations are proposed to enhance the overall effectiveness of adaptive AI-driven learning systems:

- Simplify the user interface and improve the overall design of adaptive AI-driven learning platforms to make them more intuitive and user-friendly. Regularly update the platform based on user feedback to address any usability issues.
- Develop more effective algorithms for personalized feedback to ensure that it is relevant and genuinely enhances students' interest in the subject matter.
- Include features that allow students to easily track and respond to feedback, making it a more interactive and engaging process.
- Integrate features that help students manage their assignments better, such as reminders, progress tracking, and additional resources for completing tasks.
- Offer tools that facilitate better organization and time management to help students stay on track with their assignments.
- Implement thorough training programs for both educators and students to ensure they can effectively use adaptive AI-driven learning systems.
- Establish robust support systems to address technical issues and provide guidance on maximizing the platform's benefits.
- Conduct regular evaluations and surveys to monitor the effectiveness of the system and identify areas for improvement.
- Engage with a diverse range of users to understand different perspectives and tailor enhancements to meet varying needs.

These recommendations aim to address usability concerns, optimize feedback mechanisms, support assignment completion, and ensure comprehensive training and support for users. By implementing these strategies, the goal is to maximize the benefits of adaptive AI-driven learning and address the existing challenges, thereby improving the overall educational experience for both students and educators.

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