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Towards ‘Green Learning’ enabled by AI-integrated LMS (AI-LMS) : A Survey-Based analysis of student perceptions on AI-LMS learning experience in a Malaysian University

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ABSTRACT

The research paper sheds light on the challenges students face in using traditional learning management systems (LMS) and the need for AI integration within the LMS to enrich the learning experience. Through a comprehensive literature review, it is evident that LMS plays a crucial role in the way the institutions can move towards green learning, reinforce sustainability in learning and enable students to learn with a profound effect on their learning experience. The study aims to understand university students' perceptions, preferences & expectations in integrating artificial intelligence (AI) tools within existing LMSs regarding their usability and effectiveness, as per the TAM (Technology Acceptance Model) and DOI (Diffusion of Innovation) model, focusing on enhancing learners' learning experiences at a private university in Malaysia. The researchers have gathered data from the Malaysian University's DBA, MBA, MSc, and PhD students. The study's findings show that most students of the selected institution perceive that an AI-integrated LMS is the need of the hour and can significantly improve their online learning experience by providing a personalized learning experience with enhanced assessments and feedback, which is beneficial in terms of resource optimization by eliminating the waste with minimizing the use of paper in comparison to traditional classroom-based learning. The research provides valuable insights informing the various aspects & features that should be prioritized while considering the development or implementation and enhancement of effective AI-integrated LMS solutions tailored to meet the evolving needs of online learners in higher education contexts, thereby aiming to optimize user experience and promote continued engagement in online learning environments, thus becoming an enabler to drive sustainable environments.

Keywords: AI-enabled LMS, Green learning, User experience, E-learning, Learning experience, Sustainability

INTRODUCTION

The evolution of education has been profoundly shaped by technological advancements, a journey that has been nothing short of remarkable. We witness this transformation daily as technology brings unprecedented convenience to various aspects of our existence. This convenience extends to education with the advent of eLearning and online education. E-learning may be characterized as an educational methodology that relies on using electronic media and technologies to enhance training accessibility, communication, and engagement and to ease the assimilation of novel approaches to comprehending and advancing learning (Sangrà et al., 2012).

Learning management systems (LMS) are platforms, generally a web-based centralized information system, used by educational institutes, organizations, and other independent businesses to provide continuous learning opportunities to students, teachers, and employees either as an academic mandate or as an enabler to upskill oneself. Artificial Intelligence (AI) has recently played a significant role in education. It offers many opportunities to enhance the four major domains within this field i.e., Administration, Teaching, Learning, and Assessment. While LMS platforms provide and manage online learning content, tracking, reporting, automation etc., integration with AI modules provides a wide range of opportunities to enhance the LMS platforms (Firat, 2023). AI-integrated LMS provides

personalized adaptive learning capabilities to learners based on their tool interaction pattern and preference analysis. Today there is a lack of understanding with reference to the integration implementation required to enable AI in the LMS, its implications on teaching and learning practices and the students' experiences/perceptions in using these systems.

PURPOSE

Traditional Learning Management Systems (LMS) have long been employed in education technology as essential tools for facilitating online learning experiences. However, despite their widespread use, traditional LMS often exhibit limitations that hinder their effectiveness in catering to modern learners' diverse needs and preferences in terms of high cost, inefficiency, and decreasing efficacy of the learning process (Tundrea et al., 2020). According to Essabari (2024), users frequently perceive traditional learning management systems as deficient in personalization, real-time insights, and adaptability to various learning styles. If we consider exams/assignment evaluation traditionally with one or more teachers going through every student, assessment is very time-consuming and administratively heavy.

A usable LMS reduces the time invested by academicians who develop and manage the online course and its content. Academicians can add value addition and focus on the quality of content to be delivered rather than managing the tool (de Kock et al., 2016). AI can transform education by tailoring teaching methodologies to meet the unique needs of each student, delivering timely feedback, and automating administrative duties (Slimi, 2023). Adopting traditional concepts of peer reviews is often used to assess research papers by renowned experts independently; modules available in LMS enable students to peer review assignments of each other. Students can be assessed based on criteria set by the professor and they need to review their peer's work with proper understanding of the assignments and provide significant feedback.

With the various challenges of a traditional learning management system, and the potential benefits offered by AI, there is a pressing need for developing and implementing AI-powered Learning Management Systems (AI-LMS). AI-LMS has the potential to revolutionize online learning by leveraging advanced technologies such as machine learning, natural language processing, and data analytics to offer personalized and adaptive learning experiences tailored to individual learner profiles. AI-powered LMS is also a significant step towards a sustainable learning platform in terms of digitising learning materials, assessments, and feedback systems, thus reducing waste by optimizing resource usage. Though the potential benefits are recognized, there remains a gap in understanding university students' perceptions regarding their learning management system and the impact of AI integration on their learning experiences within online higher education settings.

Research Questions:

- Does an AI-driven LMS impact the learners' learning experience in an online environment?
- What are the identified limitations of traditional learning management systems from the perspectives of students in higher education?
- What factors influence students' preferences for using AI-integrated LMS platforms over traditional LMS platforms in the context of online learning?

Research Objectives:

The objective of this study is to investigate the perceptions of students using learning management systems (LMS) for online learning on the effectiveness of integrating diverse AI-powered tools, including intelligent tutoring systems, discussion boards, peer reviews, automated grading, and feedback, learning assistants, and virtual labs, to enhance their engagement in the overall learning process. The research also aims to understand the challenges students face in using traditional LMS and, subsequently, the AI features they are looking for in the LMS to improve their

learning experience. The target participants are MBA/DBA/PhD students of Manipal GlobalNXT University in Malaysia. The research aims to gather insights into the various functionalities that could enhance the learner experience in an AI-driven LMS. The study thus aims to gather information regarding the different features to be considered that have the potential to contribute to providing an enhanced user experience for AI-driven LMS.

Research Significance

The significance of the study on the impact of an AI-driven Learning Management System (LMS) on enhancing learners' learning experience in the context of the higher education sector lies in several key areas. By providing personalized interventions and adaptive learning experiences, these platforms can help students overcome challenges, achieve better academic performance, and enhance student engagement and satisfaction. Insights gained from the study can inform educators and administrators about best practices for integrating AI-driven technologies into teaching and learning processes. By leveraging the capabilities of AI, institutions can optimize course delivery, curriculum design, and assessment practices and provide personalized feedback to better meet learners' diverse needs. The online content and assessment/feedback practices minimize the use of paper and enable content reusability across various courses. The study contributes to the growing body of research on the use of AI in education. Findings from the study can inform educational institutes and practitioners, policymakers, and researchers about the potential ways in which AI tools can be integrated into the LMS, as well as its benefits and challenges in the higher educational landscape. Integration of LMS in all educational institutions is a pathway towards enabling sustainability and providing a healthier, greener, and inclusive environment.

LITERATURE REVIEW

A literature review has been carried out on various aspects such as LMS, User experience, and the impact of LMS and AI on students' learning experience.

LMS (Learning Management System)

LMS is the comprehensive framework governing all facets of the learning journey. It functions as the infrastructure responsible for delivering and overseeing instructional content, ascertaining, and evaluating both individual and organizational learning or training objectives, monitoring progress toward these objectives, and aggregating data to facilitate the supervision of the overall learning process within an organization (Szabo & Flesher, 2002; Watson & Watson, 2007). Beyond content delivery, an LMS manages vital administrative tasks such as course registration, skills gap analysis, and comprehensive tracking and reporting functionalities (Gilhooly, 2001). In recent years, numerous tools have emerged for managing online learning in higher education yet Learning Management Systems (LMS) remain central. Raptivity, an interactivity-building tool, surveyed higher education personnel for their preferred LMS options. Four notable choices emerged: Blackboard, a long-standing leader offering seamless integration; Moodle, a robust open-source platform with extensive plugin support; Canvas by Instructure, gaining traction with its modern interface and extensive features; and D2L Brightspace, renowned for its integrated system and advanced analytics. Each LMS caters to distinct needs, with varying pricing models and features reflecting the diverse landscape of online education platforms (Sood, 2021).

User Experience and Impact of LMS

In general, user experience is all about the feelings / experience of people in the context of a product usage in terms of its usability, features, content, aesthetics etc. The prime factor for any Software application is to ensure customer satisfaction, effectiveness, and efficiency, be it in terms of its utility, design, usability, or sustainability. In recent times UX as in user experience / usability experience, has become one of the most important aspects for designing software products like LMS tools leading to significant efficiency and improved performance while using the software (de Kock et al, 2016). Kock et al. (2016) and Maslov et al. (2021) highlight the importance of user

experience, with Kock focusing on academic staff and Maslov on university students. Kock identifies factors such as system quality, service quality, and perceived usefulness, while Maslov emphasizes the role of e-learning as a sustainable solution. Goals of usability include - effectiveness, efficiency, safety, good utility, sustainability, reusability, optimization, ease of learning (learnability), to use, i.e., memorability, thereby increasing the user's engagement levels (Maslov, 2020). Almarashdeh et al. (2018) further underscore the significance of user satisfaction, linking it to service quality, system quality, ease of use, and information quality. In the context of AI-integrated LMS (AI-LMS), the tool needs to provide efficiency and effectiveness for a user to have a positive UX experience.

For an academician, a positive user experience from the AI-LMS system will be around the ease at which they can customize and maintain a transparent communication of the course details, criteria, and feedback pointers, which the AI tool can utilize to train itself. Dang and Robertson (2010) focused on the impact of LMS on learner autonomy in EFL (English as a foreign language) learning, suggesting that it can enhance students' engagement and confidence. These studies collectively suggest that LMS can positively impact the learner's experience, particularly when it supports student interaction and autonomy.

AI in LMS

The use of AI in education has several benefits, including a personalized learning experience for each student at their own pace based on their abilities and requirements, which can lead to improved learning outcomes with increased efficiency and student engagement. With AI, repetitive tasks such as grading, analyzing the data to provide insights on student performance and various other administrative tasks in managing the LMS platform and the assessment sections, etc., can be automated. This benefits the teachers and students, who can focus on more meaningful tasks in terms of content creation and delivery (Harry, 2023).

Student engagement can be improved with interactive and engaging learning experiences, viz. chatbots, virtual assistants and adaptive learning technologies. Data analysis with AI provides insights into student performance, enabling teachers to tailor their instructions; accordingly, here is where the Adaptive learning technologies come into the picture, which has the potential to help students stay engaged as these tools can get the learning content to the level of understanding of each student leading to improved learning & better performance (Harry, 2023). The AI trains itself based on the learner's progress and usage of the tool, which can further help provide personalized learning for the learner.

According to Kavitha and Lohani (2018), AI has been used in the following areas at different phases of the learning process:

- Determining the learner's current level of knowledge about the chosen course.
- Examining the pace and depth of learning during the course.
- Suggestions for modules that correspond with the prerequisite knowledge to advance through the course.
- Modifications to teaching and assessment methodology depending on the needs of the students.
- Continuous interval assessment and feedback of the learned material.
- Use tracking on and off the learning site to evaluate students' behaviour.
- Providing more in-depth explanations of challenging topics and a wide range of knowledge transmission methods.
- Adapting the different multimedia presentations to the learner's preferred learning method.

Chen et al. (2020) highlight some critical roles of AI in education within the framework of Learning Management Systems as below:

- *In Personalized Learning Paths:* AI algorithms analyze student data to create personalized learning paths to meet individual needs, preferences, and learning styles. This customization ensures that students receive content and activities most relevant to their learning goals.

- *Adaptive Content Delivery*: AI-powered LMS platforms deliver adaptive content that adjusts based on student performance and engagement levels. This dynamic content delivery helps to keep students motivated and engaged throughout their learning journey.
- *Intelligent Tutoring Systems*: AI-driven intelligent tutoring systems within LMS platforms provide students with personalized feedback, guidance, and support. These systems adapt to individual learning paces and styles, offering targeted assistance to help students master complex concepts.
- *Data Analytics and Insights*: AI tools integrated into LMS platforms analyze large volumes of data to provide valuable insights into student progress, performance trends, and areas for improvement. Educators can use these analytics to make data-driven decisions and interventions to support student learning.

Students' Perceptions/Attitudes Towards the Use of LMS/AI-integrated LMS

John Biggs underscored the significance of student perception in his 3P model (Presage–Process–Product) of teaching and learning (Biggs, 2011). As per Biggs, students' perceptions of their learning environment, self-efficacy, and the teaching and learning methods substantially influence their learning approach (Biggs, 1999), consequently shaping their learning outcomes. Students who view the learning environment favourably, including the curriculum, teaching methods, assessment techniques, resources, context, and support services, and have confidence in their abilities tend to engage in deep learning (Chan & Hu, 2023). Conversely, students having negative perceptions of their learning environment or lack confidence in their abilities may adopt a surface approach to learning, prioritizing rote memorization and meeting basic criteria (Biggs, 2011). In an educational setting, students' perceptions of technological innovation like AI-powered LMS, including their attitudes, apprehensions, and encounters with the technology, can influence their inclination to utilize the tool. Subsequently, this affects the degree to which the tool integrates into the learning process. Much research in this area mainly concerns students' general perceptions of AI in Education.

Implementing AI-powered chatbots for educational support enhanced students' academic performance, confidence in their abilities, attitudes towards learning, and motivation to learn (Chan & Hu, 2023; Essel et al., 2022; Lee et al., 2022). Research examining the implementation of chatbots in business education yielded positive user feedback, with students attributing their enhanced learning experiences to their quick responses, interactive nature, and discreet assistance with learning (Chen et al., 2023).

Ganeser and Robert (2021), as cited in (Furqon et al., 2023), investigated student perceptions of using the OpenLearning LMS through a questionnaire distributed via email using Google Forms. The questionnaire covered various aspects such as engagement, interest, ease of use, accessibility, flexibility, and compatibility. Descriptive statistics, including frequency and percentage, were used to analyze the data. Through semi-structured interviews, Kite et al. (2020), as cited in (Furqon et al., 2023), examined student perceptions of using the Canvas LMS. Participants were recruited using convenience sampling, and interview invitations were emailed. The interviews, lasting 45 minutes, delved into student experiences with Canvas, preferences for its features, comparisons with Blackboard, and experiences with technical and pedagogical support. Holmes & Prieto–Rodriguez (2018) used questionnaires and interviews to investigate student perceptions of the Blackboard LMS. The questionnaire assessed the effectiveness of various components of Blackboard using a 4-point rating scale. Interviews were conducted to explore the accessibility and interactivity offered by the platform.

Theoretical Models for The Study

Two underpinning models/theories that could guide the study in understanding user perspectives of integrating AI into the learning management system to enhance student learning experience in higher education are the technology acceptance model (TAM) and the Innovation Diffusion Theory. The combined application of TAM and DOI can provide a robust theoretical framework for studying users' perceptions of AI-integrated LMS on

enhancing learner engagement and offer valuable insights for educators, administrators, and developers seeking to leverage technology to enhance the student experience in educational settings.

Literature Gap

Though there is research that exists from user adoption/acceptance of LMS tools and user perceptions on the role of AI in Education, there is limited research available when it comes to understanding students' views and experiences of an AI-integrated LMS on their learning experiences and the AI features that they perceive will be useful in enhancing their engagement with the learning platform.

RESEARCH METHODOLOGY

The study on students' perceptions of AI employs a mixed approach of qualitative and quantitative methods via survey design (Bisdas et al., 2021). Several studies employed open-ended survey questions (Hew et al., 2023) and semi-structured interviews (Gillissen et al., 2022) to gather students' feedback and delve deeper into their perspectives on the research topic and responses to the survey questions. Quantitative research is important when exploring user perspectives, as it helps to minimize bias and subjectivity in the findings. This will also allow identifying the data's patterns, trends, and correlations. Qualitative research entails gathering data in the form of text or spoken words. By surveying a representative sample of users, more accurate inferences can be made about the broader population of higher education students and their perspectives on AI-integrated LMS.

This study employed a survey methodology to gather insights from Manipal GlobalNXT University students regarding their utilization and opinions on AI-integrated LMS in their learning experiences. The survey was conducted online. The questionnaire comprised closed-ended, Five-Point Likert scale, multiple-choice and open-ended inquiries to accommodate a broad spectrum of participant responses. The questionnaire design was crafted by adapting elements from prior research and established surveys concerning learners' attitudes toward educational technologies in higher education. The questionnaire has been reviewed by senior academics of MGNU before being opened and shared with the student community.

The quantitative survey is of a further cross-sectional design as data has been collected at a particular time. Qualitative study questions to understand perceptions and experiences of AI LMS used the phenomenological approach. These questions covered various aspects of the user experience, attitudes, and behaviours related to the AI-integrated LMS.

Dataset

The study population comprised students pursuing their higher education (MBA/MSc/DBA/PhD) at Manipal GlobalNXT University, Malaysia and using LMS platforms for online learning. There are 21 questions in the survey. The survey was sent to the participants through WhatsApp. A total of (n=25) students participated in the survey in the first wave of data collection from April 10, 2024, till April 17, 2024.

Data Analysis

The quantitative data collected in the first phase was analyzed using Microsoft Excel's descriptive statistics tools to focus on various aspects of the research. This includes the respondents' demographic information, familiarity with AI technology, current challenges in a traditional LMS, perceptions, viewpoints, and thoughts towards an AI-driven LMS in improving their learning experience and trust and reliability in an AI platform.

RESULTS & DISCUSSIONS

Demographic Information

To understand the participants’ demographic information, questions related to their gender and the program of study at the University were asked.

		Frequency	Proportion (%)
Gender	Female	6	24
	Male	19	76
Academic Discipline	DBA	22	88
	PhD	1	4
	MBA	1	4
	MSc	0	0
	MSc ITM	0	0
	MEd	1	4

Table 1: Summary of demographic information

The results show that 76% of respondents were male, and 24% were female. 88% of respondents are from the DBA programme, 4% are from the PhD, 4% from the MBA, and 4% from the M.Ed. Program. There were no participants from the MSc discipline. Students were also questioned on a scale of 1-5 on their frequency of using a learning management system, their familiarity with AI technology, and whether they have ever used an AI-based learning platform (multiple-choice). Table 2 summarizes the findings.

Question	Scale	Frequency	Proportion (%)
How often do you use a learning management system (LMS) for your academic activities?	1- Never	0	0
	2- Rarely	2	8
	3- Sometimes	4	16
	4- Often	8	32
	5- Always	11	44
How would you rate your familiarity with artificial intelligence (AI) technology?	1- Not Familiar	0	0
	2- Somewhat Familiar	1	4
	3- Moderately Familiar	6	24
	4- Familiar	12	48
	5- Very Familiar	6	24
Have you ever used an AI-Based Learning Platform?	No	16	64
	Yes	9	36

Table 2: Summary of usage and familiarity with an AI-LMS

From the results, it is understandable that 44% of students use an LMS regularly, 32% use it often, and 16% use it sometimes for academic activities. This indicates that an LMS plays a major role in fulfilling the learning needs of students. Regarding familiarity with AI technology, 48% of students reported being ‘familiar’, 24% reported that they are ‘very familiar’, whereas 24% and 4% reported ‘moderately familiar’ and ‘somewhat familiar’ with AI. This indicates that students are quite knowledgeable about AI technologies.

Challenges and Students’ perceptions of the effectiveness of Traditional LMS

Some of the issues indicated by students in using a traditional LMS model showed that 60% perceive a traditional LMS as ineffective or have a neutral opinion. In comparison, 40% find it effective or very effective. Following this question, learners were asked to indicate the effectiveness of a traditional LMS on a scale of 1-5 (1- Ineffective, 2- Somewhat Ineffective, 3- Neutral, 4 – Effective, 5 – Very Effective). Their responses are given in the chart below (Figure 1), and the results indicate that 60% perceive a traditional LMS as ineffective or have a neutral opinion. In comparison, 40% find it effective or very effective.

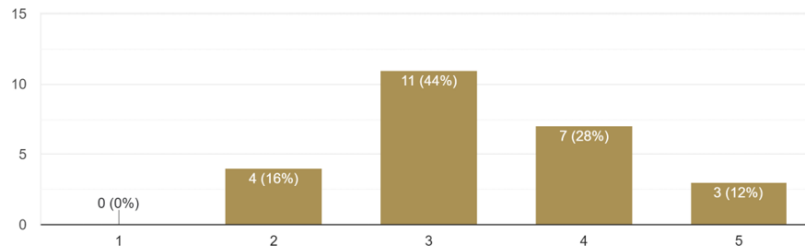


Figure 1: Summary of Effectiveness of Traditional LMS

The challenges students face in using traditional LMS are given in Appendix A.

Perceived Impact of AI Integrated LMS on the Learner’s Learning Experience

Students’ perceptions were also gathered on to what extent they believe that AI-integrated LMS can enhance their learning experience in an online learning environment compared to traditional LMS (1 – Significantly Decrease, 2- Decrease, 3 – Neutral, 4 – Enhance, 5 - Significantly Enhance). Table 3 gives the summary of the findings:

<i>On a scale of 1 to 5, how useful do you think AI would be in the learning process? (1- not useful at all, 5-extremely useful)</i>		<i>On a scale of 1 - 5, what extent do you believe that AI-integrated LMS can enhance your learning experience in an online learning environment compared to traditional LMS? (1 - Decrease, 5 - Significantly Enhance)</i>	
Mean	4.32	Mean	4.32
Standard Error	0.149666295	Standard Error	0.149666295
Median	4	Median	4
Mode	5	Mode	5
Standard Deviation	0.748331477	Standard Deviation	0.748331477
Sample Variance	0.56	Sample Variance	0.56
Kurtosis	-0.888319755	Kurtosis	-0.888319755
Skewness	-0.618352873	Skewness	-0.618352873
Range	2	Range	2
Minimum	3	Minimum	3
Maximum	5	Maximum	5
Sum	108	Sum	108
Count	25	Count	25

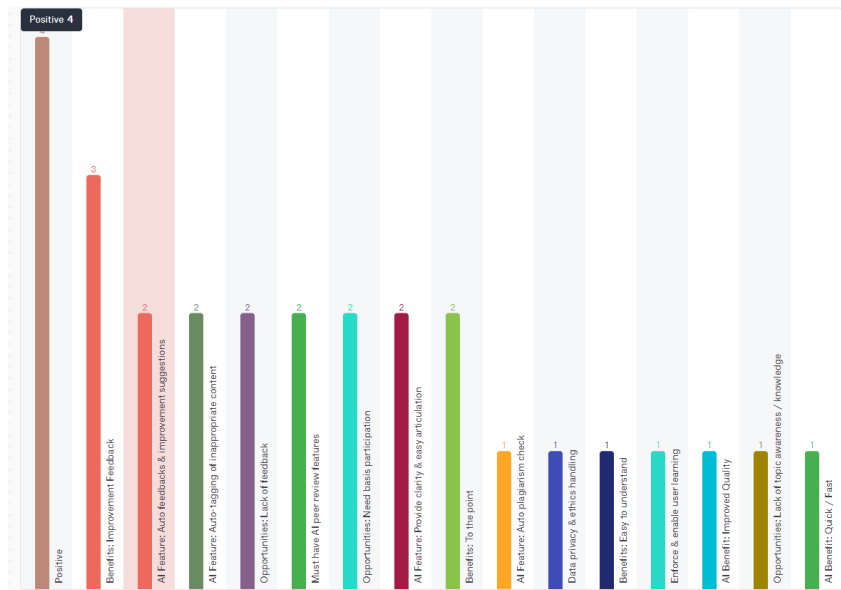
Table 3: Summary of Perceived Impact of AI-LMS on the Learning Experience

A mode value of 5 in both cases indicates that, on average, respondents perceive both AI's usefulness in the learning process and the extent to which AI-integrated LMS can enhance their learning experience in an online environment

as very useful and very high. In other words, respondents generally believe that AI is very useful in the learning process and that AI-integrated LMS can significantly enhance their learning experience compared to traditional LMS.

An open-ended question to understand students' perception of the advantages of AI-LMS revealed that they prefer an AI-powered learning management system over a traditional LMS for the more personalized learning experience, recommendations, content, real-time feedback, and accessibility (See Appendix B)

To study the mediating variable “User-friendliness” of an AI platform, respondents were asked to rate the user-friendliness of AI LMS if they had used one previously. Responses from 19 learners indicate that their satisfaction rate is 95%.



Features of AI-integrated LMS and Trust in AI Recommendations

The chart shows the features that respondents are looking for in an AI-LMS, the most popular ones being Personalized recommendations (76%), Intelligent Discussion Boards (68%), Adaptive Learning Pathways, Intelligent Tutoring systems and Virtual Learning Assistants being 64% each.

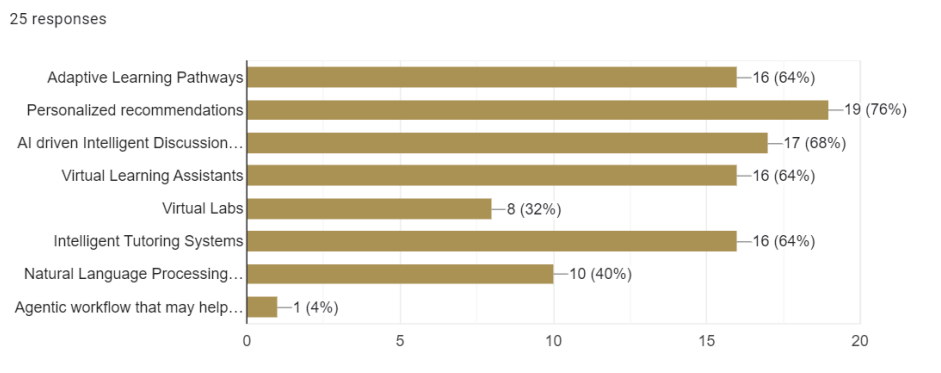


Figure 2: Summary of most desired AI features in LMS

Respondents were also asked to indicate their trust in the AI platform on a scale of 1-5. Results indicate that 56 % have trust in AI recommendations, while 32% prefer to stay neutral.

Personalized Learning Experience and Impact on Academic Performance

Respondents also provided their opinions on whether AI-integrated LMS can provide a more personalized learning experience tailored to individual needs and if such an LMS can positively impact their academic performance.

The graphs below, Figure 3 and Figure 4, indicate that 80% of respondents have a favourable opinion while 16% are still unsure.

Do you believe that AI-integrated LMS can provide a more personalized learning experience tailored to individual needs?
25 responses

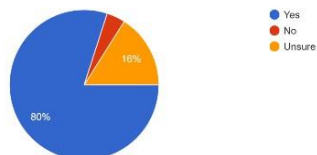


Figure 3

In your opinion, can AI-integrated LMS positively impact your academic performance?
25 responses

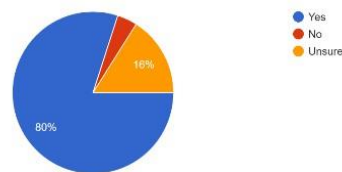


Figure 4

92% of the respondents are willing to use an AI-integrated LMS in future, which is a strong reason for the University to adopt AI-powered LMS to improve the student learning experience.

Concerns about using AI in LMS

Finally, students also expressed worries regarding the integration of AI in LMS. As a student noted, “*Ethical considerations and absence of government regulations*”. Using AI in educational technology introduces various ethical dilemmas, including data privacy issues, algorithmic biases, and the potential to escalate educational inequalities. Without stringent regulations, there is a risk of misuse or exploitation of student data and the perpetuation of biases within AI algorithms, which could inadvertently disadvantage certain student populations. Additionally, the lack of clear regulatory frameworks may lead to ambiguity regarding the responsibilities of educational institutions and technology providers in safeguarding student interests and ensuring equitable access to AI-driven educational resources. Thus, addressing ethical considerations and establishing robust regulatory frameworks are imperative for AI’s responsible and equitable integration in LMS platforms.

CONCLUSION

To summarize, based on the data analysis, it is obvious that most students positively perceive an AI-integrated LMS as enhancing their learning experience. The LMS can tailor educational content and experiences to meet individual learners' diverse needs and preferences by leveraging AI-powered tools such as personalized recommendations, adaptive learning algorithms, automated assessment, enhanced peer reviews, and real-time feedback. Students' interest in using AI-LMS paves a path for the Government to direct educational institutions and universities to develop and implement AI-LMS systems across. The AI-LMS is a technological enabler for ‘Green Learning’ with various benefits that can align with government initiatives. AI-LMS can align curriculums with sustainability and renewable energy topics, along with certifications offered in green technologies. The interactive and adaptive nature of AI-driven features within the LMS likely contributes to higher student participation, interaction, and active learning levels, leading to more fulfilling educational experiences. Tracking and reward systems incorporated with AI-LMS for students completing and participating in sustainability or environment-related initiatives, training, courses, etc., can motivate the students and users of LMS to build care about Mother Earth. The favourable perceptions expressed by students towards AI-integrated LMS platforms suggest a readiness and willingness among learners to embrace technological innovations in education. As students recognize the benefits of AI in enhancing their learning experiences, there may be greater encouragement for the University and other educational institutions to adopt and integrate AI technologies into their online learning environment to enhance students' digital learning experiences within the LMS. Universities and education institutions adopting AI-LMS can

effectively optimize their resources by minimizing the use of paper, eliminating waste, and powering servers or infrastructure with renewable sources, thereby positively impacting the environment. The research highlights the potential of AI integration to create a more dynamic and personalized learning environment for students, which is beneficial not only for the students or users of LMS but also for the universities, Government, Countries, and universe holistically. However, specific concerns about ethics, security, and bias must be addressed effectively to use AI-LMS efficiently.

Limitations of this study and future scope of work

The limitation of the study is that a small sample (n=25) from which data was obtained, though the questionnaire was shared with the entire student community at MGNU. The perceptions observed within the student sample may not fully represent the broader spectrum of the population's perceptions. The research can be further extended to include a larger sample size. The Krejcie and Morgan table is well known for determining sample size among behavioural and social science researchers. The KMT suggests that a sample of 384 is sufficient for a population of 1,000,000 or more. For this reason, 384 has been regarded as the 'magic' number in research and has consequently been used in hundreds and thousands of articles and theses. In addition, a sample must represent the population under study when using the KMT. The KMT should determine sample size when probability sampling (e.g., simple random, systematic, stratified) is appropriate. Inferential statistics metrics, such as correlation and regression analysis, could be used to explore the predictive power of AI integration on students' perceptions while controlling for other relevant variables. Future studies could delve deeper into the effectiveness of various AI-driven features, their optimal implementation strategies, and their long-term effects on student outcomes and academic performance.

RECOMMENDATIONS

Some recommendations for academicians, educational institutions and policymakers are given below: To ensure 'Green Learning', Universities and other educational institutions should invest in implementing AI-LMS platforms. The infrastructure required for an AI-integrated LMS, which would require higher processing tasks and high-speed internet connectivity or cloud services, can use renewable energy sources to reduce the carbon footprint further. External or internal collaboration with AI technology experts is needed to integrate AI tools within the learning platform successfully. Faculty, students and mid to senior level management should be trained in using AI ethically and correctly to make the most out of an AI-LMS. Robust data security and privacy measures should be implemented to protect sensitive information stored in the LMS. Policies and guidelines should be set up by the stakeholders for the ethical and responsible use of AI in the learning journey of students.

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APPENDIX A (Challenges faced by students in using traditional LMS)

Would like to understand more on grading & appropriate feedback to improve my work

Learning or adapting to LMS interface. Some do not have a proper guide or ways to navigate. Also it needs regular updates and maintenance.

Not enough content

Lack of goal setting options and personalised lesson plans

Some of them covers all the aspects of the learning while some are very native with limited features.

Nothing

Search relevant topics

Connectivity failure due to poor internet

Sometimes it's not available

Not enough user-friendly, the process of searching for information appears complicated

Sometime it is complicated

Server down

Speed

Personalization

Responsiveness is slow ,UX design can be better

Getting clarifications and ease of use

Not user friendly

All activities are end user driven.

Usually links don't open to the preferred destination.

User experience

Ability to effectively link with research papers and Books

Not easy to use.

Lack of suggestions.

Managing/misunderstanding the time line due to various time zones

You keep getting logged out

APPENDIX B (Respondents’ perceived advantages of an AI LMS)

Personalization and realtime feedback

It can automate content management, create personalized curricula and training sessions, improve student engagement

AI can understand the expectation of the student and suggest the organisation on content gap

Instant feedback and recommendations

The content will be very latest.

Yes

Interactive

Effective imparting of knowledge will be enhanced fully

It allows me to work at my own pace and concentrate on areas I need to improve.

It should be able to intuitively: (a) identify my learning preferences, (b) time of the day/ week I prefer for online learning, (c) help me organize better and (d) seek relevant sources/ topics/ papers

Simplify the learning process

Easy to get information

Saving time

Tracking learning progress real-time

Good recommendation for learning

More efficient learning experience and focussed on relevance

User experience

Certain end user activities can be driven by AI, including recommendations etc.

Easy to extract the activities performed on LMS, can give an overall summary, can alert on due dates and notifications

Metadata processing capabilities

Real time help regarding doubts, guidance on access to relevant research papers, help in generating better content, real-time feedback, personalised learning, etc

Ease of learning with targeted information.

Focused topics

Customized learning experience

It customizes the replies as per what exactly you are searching for