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Generative AI-Enabled MIS for E-Learning

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ABSTRACT : With the Kingdom of Saudi Arabia (KSA) progressing towards achieving its Vision 2030, the higher education sector has been of central interest in developing a diversified and knowledge- based economy. This national change is accompanied by an international movement of Generative Artificial Intelligence (GenAI), a technology that can transform the management and the pedagogy of education. This study discusses the strategic implementation of GenAI-powered Management Information Systems (MIS) into the KSA e-learning environment. The study summarises existing literature on the Saudi educational policy, GenAI applications, and MIS development through a systematic literature review. The results suggest that GenAI provides significant possibilities for developing individual learning routes, enhancing student advisory, and simplifying administration. Nonetheless, the potential to realise it is conditional upon overcoming important challenges, such as digital infrastructure gaps, the necessity to increase the level of digital literacy, and important ethical issues regarding academic integrity and the privacy of data. The study also offers recommendations that policymakers and university leaders should follow to negotiate this technological change and use GenAI to meet the Vision 2030 objectives.

KEYWORDS: *Generative AI; Management Information Systems; E-Learning; Higher Education; Saudi Vision 2030; Technology Adoption.*

I. INTRODUCTION

I.1 Background

In the modern educational environment, there is a rapid expansion of online learning platforms that have evolved, which has transformed higher education. However, this has also created some significant gaps within curriculum adaptability and tracking of students' performance (Bajaj, 2020). In this context, traditional management information systems (MIS) play a key role in managing important administrative and management tasks. But it often lacks the overall capacity of educational institutions in terms of delivering personalised and dynamic learning experiences to students. Further, the role of Artificial Intelligence (AI) has a significant impact in bridging the gap through enabling data-driven approaches such as predictive algorithms and analytics (Aslam et al., 2024). Several studies also highlighted that AI could enhance the development of curriculum in higher education by adaptive pathways and personalisation, mainly aligning with the evolving needs of students towards learning content. In the same manner, AI- driven MIS provides advanced predictive capabilities and certain behavioural factors for improving performance monitoring, which becomes a source of improving overall education standards. Although the successful implementation of AI-enabled MIS in curriculum designing demands addressing severe key challenges linked with ethical concerns, curriculum misalignment, technological infrastructure and issues in the adaptability of AI-generated content to the local context (Filiz et al., 2025). Within the Kingdom of Saudi Arabia (KSA) agenda of digital transformation in education has been created under Vision 2030, which reflects some key opportunities for integrating AI-enabled MIS within their higher education system.

I.2 Problem statement

The growing adaptation of e-learning platforms is continuously reshaping the infrastructure of higher education on a global platform by providing scalability and flexibility in the integration of modern-day technologies (Singh et al., 2023). Besides these limitations, advancements within traditional MIS have become a persistent challenge in which conventional MIS mainly relies on administrative and logical functions by providing restricted support linked with personalised learning. This particular lack of adaptability often results in reduced engagement of students and also weakens their learning outcomes. For this purpose, the current study focuses on analysing how AI-enabled MIS can be leveraged to improve various educational strategies and the design of curriculum in the context of KSA higher education.

I.2.1 Research gap

There are several studies available on highlighting personalisation benefits of MIS, but they do not sufficiently analyse how MIS can systematically integrate significant advancements within the development of higher education. Similarly, there is research on the prediction of student performance which emphasises learner analytics at the education level (Luo et al., 2023), yet lacks valuable insights linked with how MIS can interpret and aggregate certain predictions within the design of curriculum in higher education. For addressing these particular gaps, the current study relies on examining how AI-enabled MIS can positively contribute towards the curriculum optimisation, institutional transformation and predictive performance tracking in higher education in the KSA.

I.3 Research objectives

1. To evaluate how MIS integrated with AI can optimise curriculum design.
2. To analyse the effectiveness of MIS in tracking and predicting student performance.
3. To identify challenges and opportunities in deploying AI-enabled MIS in higher education in KSA

I.4 Research Question

How can AI-enabled MIS improve student performance tracking, curriculum designing, and address key challenges and opportunities faced by higher education within the KSA?

I.5 Contribution of the study

The study aims to contribute largely to the existing body of literature by offering a multi- theoretical analysis of GenAI implementation in higher education and, in particular, addressing the specific socio-economic and strategic context of Saudi Arabia. It will positively contribute towards both practice and theory by enhancing the understanding linked with the effective utilisation of AI-enabled MIS for transforming higher education in the KSA. Though much of the recent research on GenAI in education remains global or westernised in general, this study addresses a gap by contextualising the analysis directly in relation to Vision 2030 and the challenges and opportunities of the KSA e-learning environment. In terms of theoretical view, the study has advanced the existing information on MIS and severe educational technology by creating an interrelationship between student performance prediction, curriculum optimisation and institutional decision making under one combined framework. Furthermore, the study also had useful practical implications that can inform higher education policy makers and university leaders on making strategic decisions that integrate a theoretically informed but realistic roadmap to utilise GenAI to design a competitive and innovative higher education system. The study also outlines other critical issues, such as faculty willingness, infrastructural limitations and ethical issues, and presents important opportunities aligned with the KSA Vision 2030. The current study helps identify some gaps, which in turn contribute to the overall creation of more efficient and future- oriented higher education systems.

II. LITERATURE REVIEW

The existing literature suggests that the interaction between the national policy, technological implementation, and educational practice in the Kingdom of Saudi Arabia is complicated. The Vision 2030 is the driving engine of educational changes in society, placing education as a part of the economic diversification and development of a society (Saudi Vision 2030, 2017). The outcome of this national plan has been the enormous investments in the digital infrastructure and the push towards modernising educational technologies in universities (Alotaibi, 2021; U.S. International Trade Administration, 2024). The COVID-19 pandemic became an accelerating factor, and the shift to the online learning model became ubiquitous and ultimately made Learning Management Systems (LMS) like Blackboard an inseparable part of Saudi universities (Al-Hafdi and Alnajdi, 2023). It has established regulatory national organisations such as the National E- Learning Centre (NELC) to oversee and improve the quality of e-learning (SDAIA, 2024).

Despite this development, there are several unresolved issues that hinder the potential of e- learning. The digital divide is one of the key issues, as the disparity and restricted access to and quality of available internet services, in particular in rural areas, lead to inequalities in educational opportunities (Mahyoob, 2020; Tanmeya, 2024). Another factor of concern is the gap in digital literacy between the faculty and the students. Al Gamdi and Samarji (2016) mentioned in their study that the problem is that most teachers lack the necessary training to implement digital tools in their work successfully. Most of them are inclined to apply technology as a simple method of content storage rather than a tool of pedagogical innovation. This is further complicated by an inherent cultural reluctance towards change by some members of the faculty who prefer traditional teaching methods (Aljaber, 2018). In addition, there are significant concerns of data privacy and insecurity that accompany the use of digital platforms, and which are further aggravated by more advanced technologies (Almaiah et al., 2020).

Additionally, Generative AI brings new opportunities and challenges. GenAI has the potential to create personal learning paths, make learning materials, and offer automatic, thought-provoking questions that make you think. This might solve many of today's teaching limits (Al-Ali et al. 2024). It was discovered that Saudi Arabian students have a greater tendency to be positively inclined toward GenAI since they believe that the technology can help them gain a clearer vision of intricate issues and improve their academic performance (Aldossary et al., 2024). Nevertheless, certain important ethical issues are also associated with GenAI integration, especially those related to academic honesty and even the possibility of AI-giarism (Huang et al., 2025). Another major issue is the authenticity of the AI-created content, which is susceptible to factual inaccuracies or even hallucinations by making incorrect or misleading information (Emsley, 2023). In addition, the use of models based on data mainly from the West is also associated with the issue of cultural bias and the need to possess the ability to speak good Arabic to assure the applicability and utility within the KSA setting (Alzahrani, 2022). The literature gap that has been established in this review is the strategic integration of GenAI into an overarching MIS system as part of the Saudi higher education context, as opposed to the implementation of single tools within a systemic framework. Thus, study-by-study summaries have been shortened into thematic overviews.

II.1 Theme 1: Artificial intelligence-based customisation of e-learning systems.

As demonstrated in the literature by Merino-Campos (2025), AI-based learning management systems will be able to offer adaptive learning routes and real-time feedback, as well as deliver content tailored to each user. These tools are associated with increased student engagement, better completion of courses and premature detection of struggling students. However, Khan et al. (2025) addressed that outside of efficiency, personalisation also enables the customisation of learning methods, including visual, auditory, and text-based information, to the interests of individual students, which makes the process of learning much more inclusive. Training Industry (2024) also highlighted that with adaptive recommendation engines, it has been reported to decrease the dropout rates by recommending remedial content and pacing assistance. Faculty time in Saudi Arabia, where class sizes are often large, can be liberated with such tools, and faculty can use their time to mentor (AL Rousan, 2024). The fact that AI can produce culturally related samples in the Arabic language is especially noteworthy, as case studies are commonly a challenging aspect of foreign languages among students. Individualised chatbots and tutoring applications incorporated in a larger MIS can also establish perpetual loops of data to administrators so that institutional interventions are not only timely but evidence-based. The study was conducted under the following conditions (see Appendix B).

II.2 Theme 2: Governance, Ethics, and Data Protection

The study by Khan et al. (2025) indicated that privacy of data, transparency of algorithms, and integrity in academia are the major issues surrounding the introduction of AI into higher education. Among risks facing institutions, there are biased suggestions, violations of personal information, and the use of generative AI to plagiarise. The literature by Alammari et al. (2024) also observed the significance of harmonising the governance practices in line with the national regulations. As an example, the Saudi Personal Data Protection Law will mandate universities to restrict access, anonymise sensitive student data, and obtain express permission to use research data. Ethical issues also include the explainability of the model; students and faculty need to be able to comprehend the reasons behind why the AI systems give specific recommendations (Khan et al., 2025). The world is amending academic integrity policies to accommodate the issue of plagiarism in terms of AI-generated essays. The Saudi context also has a cultural aspect, with AI systems having to honour the social standards and not generate outputs that are opposed to the local values. Effective governance systems, hence, come to be a precondition for responsible adoption. Similar to the other studies by Khan et al. (2025) and Alammari et al. (2024) that concentrate on the particular client group, the researcher of this research paper predominantly focuses on the nursing profession and the overall welfare of patients and the well-being of patients in general.

II.3 Theme 3: The Faculty Preparedness and Digital Capabilities

The study by Khan et al. (2025) believed that faculty acceptance, training, and digital literacy make major predictions about AI adoption. Unless the faculty develops professionally, they are likely to be resistant to or abusive of AI tools (Alammari et al., 2024). It has been demonstrated that faculty members are more inclined toward the use of AI with the help of institutional support, micro- credentials, and specific workshops. Besides lowering uncertainty, the training also allows instructors to make use of AI as a pedagogical ally instead of a substitute. The systematic capacity- building is critical in Saudi universities where the background of the faculty and their level of readiness differ. On the other hand, Alammari et al. (2024) addressed that faculty engagement in the development of AI solutions will improve trust and minimise opposition.

II.4 Theme 4: National and Cultural Setting

The majority of the existing studies are in the Western context, and there is a void in the Arab or Saudi context (Merino-Campos, 2025). There is limited empirical literature on whether Vision 2030, the AI strategy of SDAIA, or the Arabic-language tools can influence the adoption of AI in higher education. The Vision 2030 of Saudi Arabia directly focuses on the digitalisation and modern technologies in education (SDAIA, n.d.; AL Rousan, 2024). The local research by the SDAIA framework (n.d) indicated that there are differences in infrastructure between urban and rural institutions. The national AI framework of SDAIA also envisions Arabic-centric systems, though the system has not yet been examined within the scope of academic literature. Cultural fit is also significant; AI should adapt to the language peculiarities, gender expectations, and principles (Alammari et al., 2024). Thus, these gaps inspire the current research.

II.5 Literature Gap

Although research in artificial intelligence in education is expanding worldwide, many gaps remain in the existing literature of knowledge. Much of the literature focuses on Western settings, general e-learning platforms, data analytics, or AI-driven personalised learning without explicitly analysing how generative AI can be integrated into management information systems (MIS). This limits the applicability of the findings to other regions with diverse cultural, linguistic, and regulatory contexts. There is a lack of research focused on the Arab world, particularly Saudi Arabia. Few studies also consider the impact of national policies such as Saudi Vision 2030 or the SDAIA national AI strategy, which significantly influence the implementation of emerging technologies in higher education. Additionally, the existing knowledge primarily highlights either the technical potential of AI tools or general ethical concerns, without connecting these aspects to institutional governance, faculty preparedness, or policy coherence. There is limited evidence regarding the use of Arabic-centric large language models within academia, which is another limitation. This paper addresses these gaps by contextualising generative AI within Saudi higher education, proposing a conceptual framework that links inputs, processes, and outcomes, and aligning recommendations with the priorities of Vision 2030 and national regulatory needs.

III. THEORETICAL FRAMEWORK

To examine the uses of a GenAI-based MIS, the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Resource-Based View (RBV) can be employed as a theoretical basis. Venkatesh et al. (2003) formulated UTAUT to explain users' intention and use behaviour about new technology. It recommends four main determinants, which are Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. This model is needed to describe the process of students and staff adopting a GenAI-enabled MIS since there are additional factors like digital literacy and support (Arifin et al., 2025).

Building on this user-focused view, the RBV assists in defining a vision for how the system can be developed into a means of sustainable competitive advantage for an organisation (Barney, 1991). RBV contends that the success of an institution is a function of its unique internal capabilities and resources. If the GenAI-supported MIS is to meet the criteria of a strategic asset, then it must be Valuable, Rare, Imperfectly Imitable, and the university must be Non-substitutable to derive its value (VRIN) (Afriyie et al., 2018). Combining these theories, this research has addressed both the micro-level user acceptance level and the macro-level strategic implication, presenting a comprehensive representation of successful implementation.

IV. CONCEPTUAL FRAMEWORK AND KPIS

A clear and visual conceptual framework which correlates the components of Generative AI, MIS functions, institutional inputs and the outcomes of the Vision 2030 should be included in this article (Figure 1). There are three layers of the framework: The inputs include institutional data (SIS, LMS logs, assessment records), faculty feedback as a source of qualitative data, and national policy tools (Vision 2030, SDAIA AI strategy, Personal Data Protection Law), as well as Arabic language corpora to make models culturally aligned.

Processes: the MIS as the unifier (data ingestion, governance, dashboards) with installed GenAI modules: (a) personalised content-generation engines, adapting tone and language to Arabic situations; (b) adaptive assessment adid nd remediation engines; (c) predictive analytics to early warning and intervention; (d) explainability and audit layers to provide fairness and compliance. Results: learner (retention, engagement, higher-order skills development), institutional (curriculum agility, operational efficiency, strategic advantage by VRIN criteria), and national (graduate employability and alignment to national skills priorities of Vision 2030) results. Operational indicators and assessment: To ensure that the framework is empirically testable, add KPIs to every layer. Complete, current, and coverage of Arabic material of track data. Measure processes, monitor model accuracy, explainability measures and response latency. To assess results, retention rate, time to degree, course completion, student satisfaction, and rate of employment. The compliance with the Personal Data Protection Law, the data-sharing agreements, and the presence of AI ethics committees at the university should

be included in governance indicators.

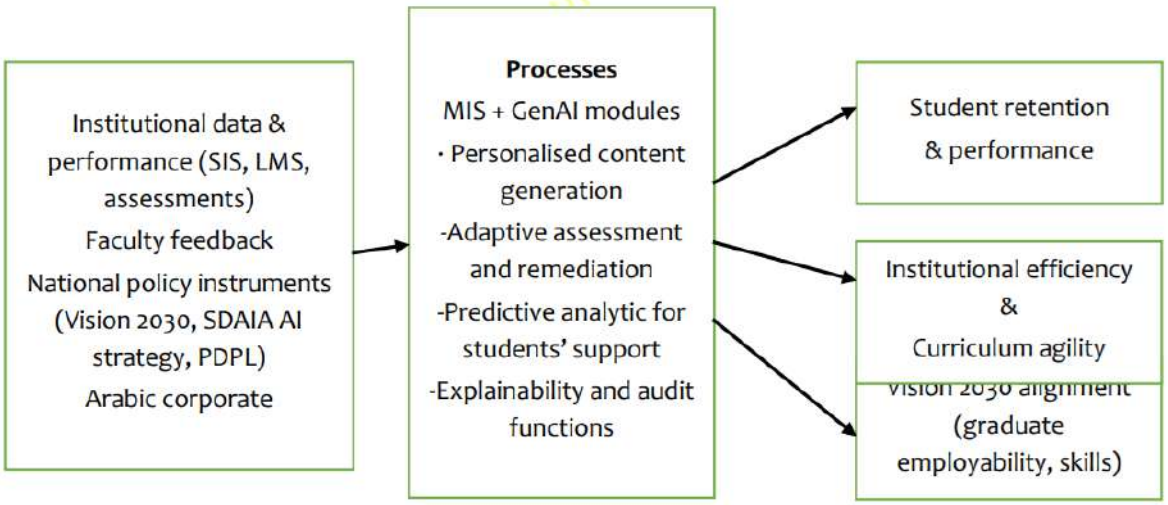


Figure 1: Conceptual Framework Source: Author

V. METHODOLOGY OF THE STUDY

The study has employed the Systematic Literature Review (SLR) method to formulate an explicit and objective summary of the existing research on Generative AI, Management Information Systems, and e-learning in the context of Saudi Arabian higher education. SLR is an open and systematic method of discovering, examining, and integrating the findings of all relevant studies on a single topic, making it a relevant instrument in a multi-disciplinary topic (Carrera-Rivera et al., 2021). The PRISMA guidelines on Preferred Reporting Items of Systematic Reviews and Meta-Analyses were used as the guiding principles of the review to follow the methodical rigour and provide replicability (Page et al., 2021). This will enable a systematic review of the literature, reducing bias and ensuring that the findings and results are based on relevant and reliable evidence (Snyder, 2019).

To select pertinent literature, a comprehensive search strategy was formulated. Search strings were developed based on the research objectives and utilised Boolean operators to combine key concept groups (as illustrated in Table 4.1). Major academic databases, including Scopus, Web of Science, IEEE xplore and Elsevier, were searched. Moreover, government reports and policy documents were sourced from Google Scholar and the official websites of the Saudi Ministry of Education and the Saudi Data & AI Authority (SDAIA). Search terms were adapted on the basis of specific database requirements (Appendix A; Table 4.1). The inclusion criteria specified peer-reviewed articles, conference proceedings, and official reports published between 2020 and 2025 to ensure the timeliness and relevance of the findings in the context of Vision 2030 and the recent advancements in GenAI. Studies focusing exclusively on K-12 education or purely technical papers without an educational application were excluded (Appendix A, Figure 2).

The selection process followed the PRISMA flowchart (as shown in Figure 1), beginning with an initial screening of titles and abstracts, followed by a full-text review for eligibility. The data from the selected studies were identified and transferred into the structured template, including key points such as the objectives of the study, its methodology, theoretical basis, and its primary results. The data extracted was then synthesised through a thematic analysis approach, which revealed common themes and patterns throughout the literature. These themes were divided based on the research questions, and it was possible to create a logical narrative in the form of a synthesis of the results of various sources into one analysis (Naeem et al., 2021).

V.1 Empirical add-on: compact mixed-methods pilot

In order to enhance originality above an SLR, make a pilot addition on a small scale:

(1) Survey: administer brief surveys to 150 students and 30 faculty at 1-2 Saudi universities on AI literacy, perceived usefulness and privacy issues (Likert scales). Examples: I have no doubts about the use of AI tools to aid my teaching (1-5); I believe AI systems are safe enough to store the data of students (1-5).

(2) Pilot implementation: conduct a quasi-experimental implementation of a formative assessment module equipped with GenAI in two course sections. Gather pre-/post-activity and short-term performance data.

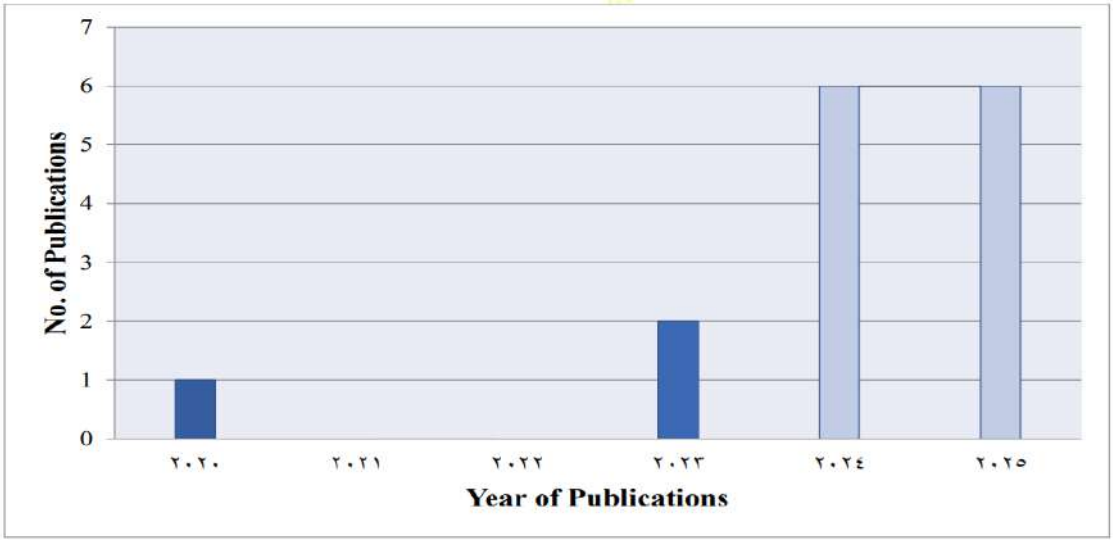
(3) Interviews: semi-structured interviews will be conducted with 8-12 admins/faculty to capture issues of governance and cultural alignment.

- Quantitative analysis: paired t-tests with baseline variations.
- Thematic coding: qualitative analysis.
- The requirements are ethical approvals and the Personal Data Protection Law. This is a realistic next-step presentation that makes the paper more assertive about its practical viability.

VI. RESULTS

VI.1 Notable Contributions

In line with the criteria for inclusion, 15 studies were selected for the current systematic review to demonstrate the potential of Generative AI-Enabled MIS in promoting E-Learning within the KSA. Graph 1 shows years as well as the number of notable publications that met the inclusion criteria for the current research area. It shows that a majority of studies were extracted from the recent two years (2024-2025), which contributed to the selection of a total of six studies each. In addition, two studies from 2023 and one study from 2020 were also eligible. However, no publications were selected from 2021 and 2022 because studies from these years either did not include the context of KSA or integrated MIS-enabled generative AI and focused on automation current research.



Graph 1: Notable Contributions from the Existing Literature

Table 4.1, given below, shows the collective features from these selected studies from 2020 to 2025. Firstly, it summarises the time span and indicates the major regional context of the studies, which was based on KSA. Furthermore, it gives average frequencies of the publication year (2.5), average recruited sample size in the selected studies (approx. 119) and average citations per study (48).

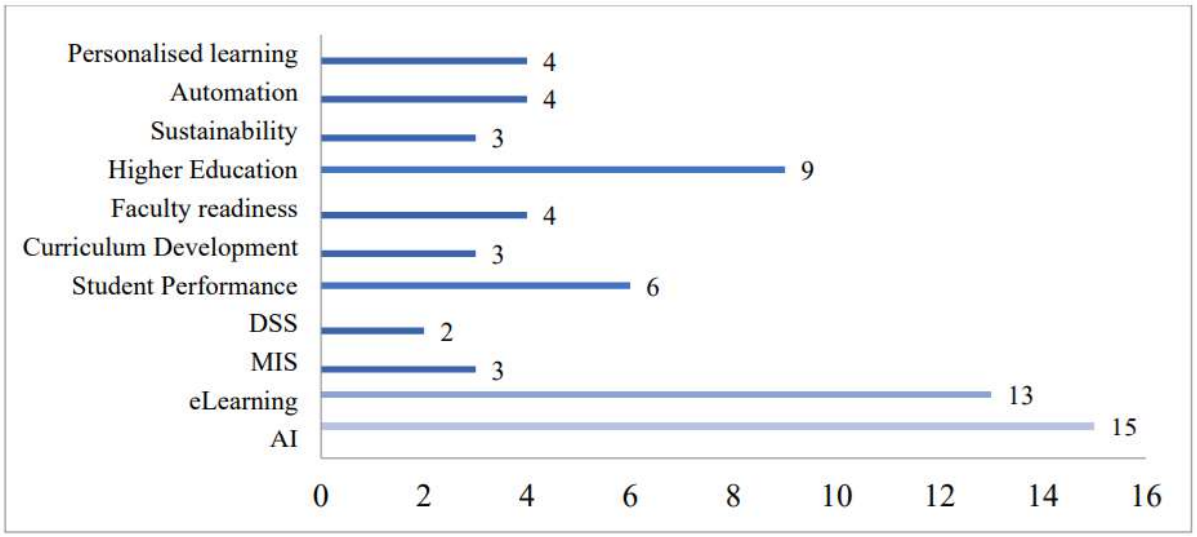
Table 4.1: Information about Key Characteristics from the selected studies

Characteristics	Results
Time span	2020-2025
Average year from Publications	2.5
Explored Regions	KSA
Average number of participants	~119
Average citations per document	~ 48

VI.2 Keyword Analysis

The manual review of the selected studies helped identify a few keywords that were repeatedly cited across multiple research pieces. In line with the current subject of interest, the main keywords included *"Artificial Intelligence (AI)"* AND *"higher education"* OR *"e-learning"* OR *"online learning"* OR *"learning management system"* (that are grouped as e-learning in the graph 2 shown below), *"automation"* AND *"student performance" OR "curriculum development"* OR *"DSS (decision support system)"* AND *"personalised learning"* AND *"faculty readiness"* AND *"sustainability"*. These keywords highlighted the potential benefits of AI-enabled MIS in different aspects, ranging from curriculum development (Objective 1) and tracking student performance

(Objective 2) to improvement in personalised learning and sustainability. Additionally, the keyword analysis also indicated certain challenges that hinder the achievement of the previously mentioned benefits, such as a lack of readiness in AI-enabled MIS adoption by the faculty (Objective 3). Henceforth, the credible evidence was extracted from the selected studies that helped answer each objective of this research. In graph 2, the distribution of these keywords across the selected studies is represented using a bar chart. The frequency shows the number of studies to indicate the frequency of the studies from the selected ones that directly contributed to the analysis of a particular keyword.



Graph 2: Frequency of keywords distribution

VI.3 Thematic Analysis

VI.3.1 MIS-driven Curriculum Support

Out of the 15 selected studies, those shown in Table 4.3.1 directed the research towards a key dependent variable from the first objective, which was curriculum development. The evidence from these sources revealed that the progressive role of AI enabled MIS-led systems to effectively contribute to the development of higher education (Lee & Cho, 2024; Ouyang et al., 2023). Shwedeh (2024) argued that MIS integration helps provide reliable data based on user engagement, which optimises the process of decision-making and enhances support in curriculum development. Moreover, Ouyang et al. (2023) illustrated the potential of MIS in providing tailored support through feedback analysis and risk detection. This evidence reflects its imperative advantages that can be used in developing an efficient curriculum in higher education, which not only helps students learn courses that are integrated globally but also thrive in their academic pathway. Complementing this evidence, the analysis presented by Shwedeh (20,24) illustrated that certain AI-driven institutional factors, including user engagement, data quality and organisational readiness, improved decision-making in higher education institutes. This empirical analysis reinforces that MIS can help in the improvement of curriculum-associated decisions, provided that it is supported by stakeholder commitment and a robust infrastructure. In accordance with these findings, other findings from a previous study also underscored the broader potential of AI-based automation in the form of MIS and stated that it can promote personalised learning (Ejjami, 2024). This scholar is of the view that to optimise the curriculum, AI can be used to tailor it based on the needs of students with diverse backgrounds, including their culture, socioeconomic attributes and education, thereby leveraging innovation to support the higher education needs of diverse students (Appendix B; Table 5.3.1).

VI.3.2 Decision-Support and Prediction

Multiple studies provided evidence regarding the potential of MIS in analysing and predicting the performance of students, thereby addressing the second objective of this study (Alotaibi, 2024; Gabayan & Sable-Gamboa, 2025; Filiz et al., 2025). In light of the study by Gabayan & Sable- Gamboa (2025), it is observed that the MIS plays an important role in terms of recording and managing critical data of students required for active enhancement of their performances. In line with that, integration of AI and MIS significantly captures administrative details, attendance and grades required for providing limited insights linked with the overall progress of the learner. Although the illustration of AI potentials enabled MIS to focus on providing deeper and actionable feedback to tutors. Aslam et al. (2024) supported the previous statement by proposing a human- centred approach in which there is an implication of incorporating behavioural factors and personal traits into certain AI models for accurate prediction of academic outcomes. Contrasting findings of previous studies

reflected that in the modern education system, there is a vital role of MIS tracking in terms of analysing overall student performance linked with holistic and individual assessments. Similarly, Mulaudzi &Hamilton (2025) highlighted that the effective integration of AI within decision support systems in the higher education system reflects how MIS could empower educational institutions to constructively provide real-time insights linked with the development of strategies and administrative policies in the higher education system. Moreover, in the context of the research by Filiz et al. (2025) and Sajja et al. (2023), AI-led assistance can be used by teachers to track the performance needs of their students based on the use of accurate data. However, it is also analysed that although faculty recognise the potential of AI-enabled MIS but they also express concerns about its associated ethics, cultural alignment and skills, which suggest the integral role of human factors in tracking performance (Filiz et al., 2025). Overall, AI-enabled MIS reflects considerable promise for transforming student performance by tracking and predicting their overall performance; the highlighted concerns indicate the prevalence of certain challenges that limit its integration. Therefore, the third theme of this research is to summarise the benefits whilst highlighting the constraints that lower the integration of MIS within the higher education institutes in the KSA (Appendix B; Table 5.3.2).

VI.3.3 Evaluation of AI-enabled MIS in Higher Education

A wide range of benefits as well as challenges are associated with the MIS integration in higher education, which are highlighted in Table 4.3.3. As cited previously, Alotaibi (2024) argued that integration of AI with the learning management system could enhance the performance of digital transformations linked with higher education by providing certain opportunities in terms of improving learner engagement and institutional efficiency. Thus, it is found that AI mainly emphasises personalised learning by highlighting certain benefits, including real-time feedback and individualised pathways. Other studies cited improvement in decision-making, integration of feedback in the learning process and development of curriculum, enhancing research efficiency and streamlining academic functions as the major benefits (Jackman et al., 2025; Khairullah et al., 2025; Khan et al., 2025).

On the other hand, Jackman et al (2025) reflected that educational faculty with limited knowledge of MIS and AI often exhibit restrictions towards the adoption of AI for both innovation and threat to professional autonomy. Simultaneously, Mulaudzi & Hamilton (2025) are of the view that certain cautions rely on AI-driven systems, which often reinforce various biases amongst students, as they lack digital access, given the infrastructural disparities. Thus, AI offers promising developments for higher education, which positively impacts the balance between innovations and human-centred approaches. In line with these findings, Khan et al. (2025) also pointed to the infrastructural disparities that are faced by students, along with a skills deficit in staff, high implementation cost and data privacy risks as the major challenges within the higher education institutions in the KSA, due to which they cannot seek benefits. In summation, despite the advancements of MIS for tracking student performance, critical challenges remain concerning surrounding data privacy, algorithm bias and student autonomy (Appendix B; Table 5.3.3).

VII. DISCUSSION

VII.1 Interpretation of results

In the context of KSA, the interpretation of current study findings reinforces that AI-enabled MIS has potential in optimising e-Learning in higher education. The empirical analysis revealed that AI-enabled MIS is not only significant in terms of adaptive learning but can also shift the curriculum from traditional and static to dynamic models that are capable of ensuring personalised learning, intelligent tutoring and predicting the performance of students. In addition, the subject integration also offers substantial opportunities to the higher education institutes in the KSA to align with its Vision 2030, which seeks to ensure a sustainable digital transformation. Nevertheless, it is essential to eliminate the identified challenges such as implementation cost, data privacy, faculty readiness and access disparities to ensure that AI-enabled MIS drives a sustainable change that favours educational advancement in the region.

VII.2 Comparison with prior studies

The first aspect concerning the adoption of AI-enabled MIS within higher education institutions in the KSA was the improvement in curriculum development. The findings from the current study emphasised that MIS can provide reliable data and feedback about the courses that can help improve the curriculum by tailoring to the diverse needs of students. Similarly, the comparison of this aspect with the broader literature revealed that increased use of AI is a transformative force for higher education, which deals with learning personalisation and potential curriculum development (Merino-Campos, 2025). Another research conducted by Mutambik (2024) supported these findings. It studied the application of artificial intelligence and big data to adaptive e-learning systems in Saudi higher education during the COVID-19 pandemic. In this study, a survey of nearly 2,000 students revealed that AI applications played a major role in enhancing the efficiency of LMS, readiness, and engagement among students, which made AI a channel towards sustainable learning. At the same time, the

results from this study also showed that AI and data tools increased flexibility, learner engagement, and less disengagement in the case of disruption (Mutambik, 2024). This is in line with the demonstration that AI-enabled MIS can play a role in the optimisation of curriculum with adaptive learning pathways, prediction of early performance, and customised support. Nevertheless, although several studies included in the current research, including the study by Khan et al. (2025) and Jackman et al. (2025), focused on benefits to the students, more recent information also pointed to the faculty preparedness, curriculum implementation, equal access and institutional administration as the central issues, meditating these results (Mulaudzi & Hamilton, 2025). It implies that, despite the importance of adaptability and engagement, the application of AI in curricula must be sustainable due to the enabling conditions of the institutional context.

In the context of the stated challenges, the article by Alnasib (2023) from the literature also supports the argument of the current study that cites faculty readiness as a crucial factor in achieving the benefits of AI-enabled MIS. In this research, the researcher included 465 faculty members from King Faisal University to assess their readiness in adopting AI (Alnasib, 2023). The results revealed a strong correlation between AI adoption and perceived usefulness. The participants demonstrated a positive attitude in adopting AI to undertake crucial actions that are also currently studied, including curriculum development and analysing students' performance. However, the study highlighted institutional support in terms of infrastructure and training as an essential constituent of this development (Alnasib, 2023). Henceforth, in the comparison of current findings with the broader academic literature, the researcher did not find any convergence, which helps validate the current proposition that AI-enabled MIS can significantly contribute to higher education by improving curriculum development, enhancing the prediction accuracy of students' performance and ensuring individualised learning flexibility.

VII.3 Theoretical and Practical Implications

VII.3.1 Theoretical Implications

Current research demonstrates multiple theoretical and practical implications for higher education institutions within the KSA. At first, the study validates that AI-enabled MIS has the potential to equip institutions to streamline their curriculum development and pave flexible learning paths that accommodate the needs of different learners. It demands that the curriculum developers take informed actions by utilising the data of diverse students in order to evaluate the diverse educational needs of students who belong to different educational and socio-economic settings. In this context, the predictive potential of AI-enabled MIS can play a crucial role in integrating demographic data of students with their academic performance, thereby identifying the at-risk or low-performing segment of students. It can help devise inclusive programmes that can increase the academic performance and engagement of students while satisfying their higher education needs in the context of a global market environment.

VII.3.2 Practical Implications

As a result, these findings align with the UTAUT because taking measures that eliminate the identified challenges can help fulfil all four determinants of this theory, given by Venkatesh et al. (2003). Simultaneously, it is equally important to fulfil the developmental needs of the higher education faculty in enabling the use of the study innovations in real-world educational settings. To serve this purpose, enhancing institutional support is crucial, as emphasised in the theoretical framework related to RBV. In this regard, enhancing the skill set of faculty through training programs is recommended to extend organisational support in achieving the holistic benefits of AI-enabled MIS in the higher education setting of the KSA. Commission three national pilots in three institutions (urban, rural, women-only campus), finance work streams of Arabic LLM, and require university-level AI governance committees to report yearly on their transparency. These measures can make Saudi higher education a leader in responsible GenAI utilisation in the region and speed up the achievement of the Vision 2030 goals without harming learners and damaging the academic quality.

VII.4 Critical Opportunities vs. Risks

There are potential advantages to having generative AI infused in MIS: personalised learning paths, scalable tutoring, automated administrative workflows and deeper decision support for curriculum design. However, each opportunity is coupled to different risks which must be actively managed.

- Algorithmic bias and cultural misalignment. LLMs that are trained on a dataset from the West can respond in a culturally inappropriate or biased manner. Mitigations: Invest in Arabic datasets, ensure fairness for periodic audits & signoff for human in the loop of high stakes outputs (grading, advising)
- Data privacy & governance. Student records are sensitive: Weak Governance, Breaches Mitigations: Role-based access control, Data minimisation, Encryption at rest/transit, contractual vendor (provenance, audit rights)

- Faculty resistance and deskilling. Threats to Professional Autonomy Can Dim Adoption Mitigations: Frame GenAI as augmentation (assistive drafts, recommendation explainers), use Faculty co-design workshops, tie use to professional development credits.
- Academic integrity and over-reliance. It is easy to generate text that can promote plagiarism and surface-level learning. Mitigations: reframe the assessments to process- based evaluation (portfolios, presentations, viva), AI-literacy included in the learning outcomes, and outputs from AI to formative and not summative.
- Vendor and legal risks. Third-party vendors can design lock-in or spread opaque models. Mitigations: Work centrally, enforce rights-to-audit clauses, and favour models with open- benchmarked performance or documented provenance

Thus, combining each risk with specific mitigations including policy, pedagogy and procurement, the discourse is shifted from alarm to actionable governance, essential to a national-scale adoption consistent with Vision 2030.

VIII. CONCLUSION AND RECOMMENDATIONS

This study has performed a systematic review of the literature to analyse how Management Information Systems empowered by Generative AI can be strategically adopted as a component of the e-learning environment of the Kingdom of Saudi Arabia within the higher education domain. The results validate the assumption that the national ambitions of Vision 2030 present a significant push to technological development, although major challenges associated with infrastructure, digital literacy, and pedagogy have to be addressed. A GenAI-powered MIS as an intelligent ecosystem of tutoring, student success, and curriculum management is a potentially promising way to overcome these issues and speed up the process.

However, its successful implementation is contingent upon a dual focus on ensuring user engagement and building a sustainable institutional capability. To navigate this complex landscape, a multi-layered strategic approach is essential. For national policymakers such as the Ministry of Education and SDAIA, it is essential to strengthen the national infrastructure, establish a national data governance framework and champion Arabic Language Models. For this, they should prioritise investments to ensure equitable, high-speed internet access across all regions to close the digital divide, develop and enforce clear policies for data privacy, security, and ethical AI use in education, in line with the Personal Data Protection Law, and support the development of high-quality, culturally-aligned Arabic LLMs to ensure the relevance and effectiveness of GenAI tools in the KSA context.

VIII.1 Policy alignment: mapping recommendations to Saudi strategy and actions

Mapping each recommendation to responsible actors, specific actions and timeframes to make recommendations implementable:

- Developing national infrastructure and digital equality;

Who: Ministry of communications and information technology + Ministry of education

Action: speed up broadband deployment to unserved areas, subsidise institutional higher bandwidth connectivity upgrades and ensure redundancy at the campus level.

Timeframe: 12–36 months.

For this reason, it is important to include the digital transformation goals from Vision 2030 and the infrastructure priorities of the SDAIA.

- Develop data governance and ethical AI guidelines for education. Who: SDAIA together with the Ministry of Education

Action: Keeping out the specifics, the PDP Act should issue guidelines for its operationalisation across the education sector (consent, anonymisation, exceptions allowed for research) and mandating template data processing agreements for vendors.

Timeframe: 12–18 months.

- Invest in Arabic LLMs & educational adapters. Who: SDAIA + national universities + private partners.

Action: The initial funding to build LLMs for Arabic, Domain Adaptation for Pedagogy and Open Benchmarks and Datasets. The safe testing before scale-up can be achieved through regulatory sandboxes.

Timeframe: 18–36 months.

- Capacity building and governance among universities' faculty Who: University management (Provost/CTO) + Ministry of Education.

Action: Compulsory micro-credentials in AI literacy for teaching staff; establishment of AI governance committees; encouragement of faculty co-design of GenAI modules.

Timeframe Pilot 6-12 months; scale 12-24 months.

- Phase: pilot and evaluation

Who: Pilot universities - those that have been designated by
Action: deploy GenAI-enabled MIS modules at 3-5 faculties; capture pre-defined KPIs (retention, performance, student satisfaction); release iterative reports to inform scaling and funding tranches; Timeframe: 6–18 months.

- Financing and Budgeting for Education

Establish a GenAI in Education innovation fund (public-private matching), administered by SDAIA, which will make tranches dispersed against milestone-based assessments. Make anonymised evaluation KPIs, as accountability and knowledge-sharing tools available to the public by pilot institutions. In conclusion, educational organisations need to develop an educational plan that integrates implementing a GenAI-powered MIS with the mission of the university and the objectives of Vision 2030. Moreover, faculty training that is centred around AI education and digital literacy needs to be implemented continuously in order to make sure that the system is used efficiently. Furthermore, it is also recommended that teachers should shift the priority of the evaluation towards the analysis of more advanced skills, like critical thinking, problem-solving, and analysis of AI-generated content, instead of memorisation. They should also work towards ensuring that AI literacy becomes one of the skills in all subjects to teach students how to properly use such tools and their ethical implications. Furthermore, it must be encouraged that GenAI be used as an intellectual companion that can complement the learning and research process rather than be used as a substitute for intellectual work. Through this holistic and strategic outlook, the Saudi higher education system will be able to utilise the transformative potential of Generative AI to not only meet the ambitious goals of Vision 2030 but also create a more positive and equitable and innovative educational future.

VIII.2 Future Contribution Statement

The contributions of this study are:

(1) a localised synthesis that connects Generative AI/MIS studies to the Saudi context (Vision 2030 and SDAIA), due to the gap in the literature in which international scholarship is not localised.
(2) A stratified conceptual framework incorporating UTAUT, RBV, and system design, such as inputs to processes to outcomes and providing quantifiable KPI to measure; and
(3) A recommendations package (infrastructure, governance, Arabic LLM investment, faculty training), policy-consistent and time-bounded that can be operational and actionable.

IX. LIMITATIONS AND FUTURE RESEARCH

This study, as a systematic literature review, is intrinsically limited by the scope and recentness of the available published research. While it provides a comprehensive synthesis of the current state of knowledge, the field of Generative AI is evolving at an exceptionally rapid pace, which implies that new applications, challenges, and research findings are constantly emerging. The findings in this paper are based on the existing evidence, but they have not been empirically validated within the specific context of Saudi Arabian universities, as most studies report preliminary findings rather than longitudinal outcomes. Besides, there can also be publication bias in favour of positive findings and successful implementations. Also, KSA context consideration, in particular, can constrain generalisability to other systems of higher education, although many findings are more general.

Therefore, this review highlights several critical areas for future empirical research. There is an urgent need for in-depth, longitudinal case studies of Saudi universities that are early adopters of GenAI technologies. Such studies would provide rich, qualitative insights into the practical challenges of implementation, the lived experiences of students and faculty, and the organisational changes required for success. Rigorous quantitative studies are also needed to measure the causal impact of GenAI-enabled interventions on key performance indicators such as student retention, learning outcomes, and graduation rates. Furthermore, dedicated research into the efficacy and cultural alignment of Arabic-centric Large Language Models (LLMs) in educational settings is crucial to ensure that these technologies are both effective and appropriate for the local context. By pursuing these research areas, a more robust, evidence-based understanding can be developed to guide the future of higher education in the KSA.

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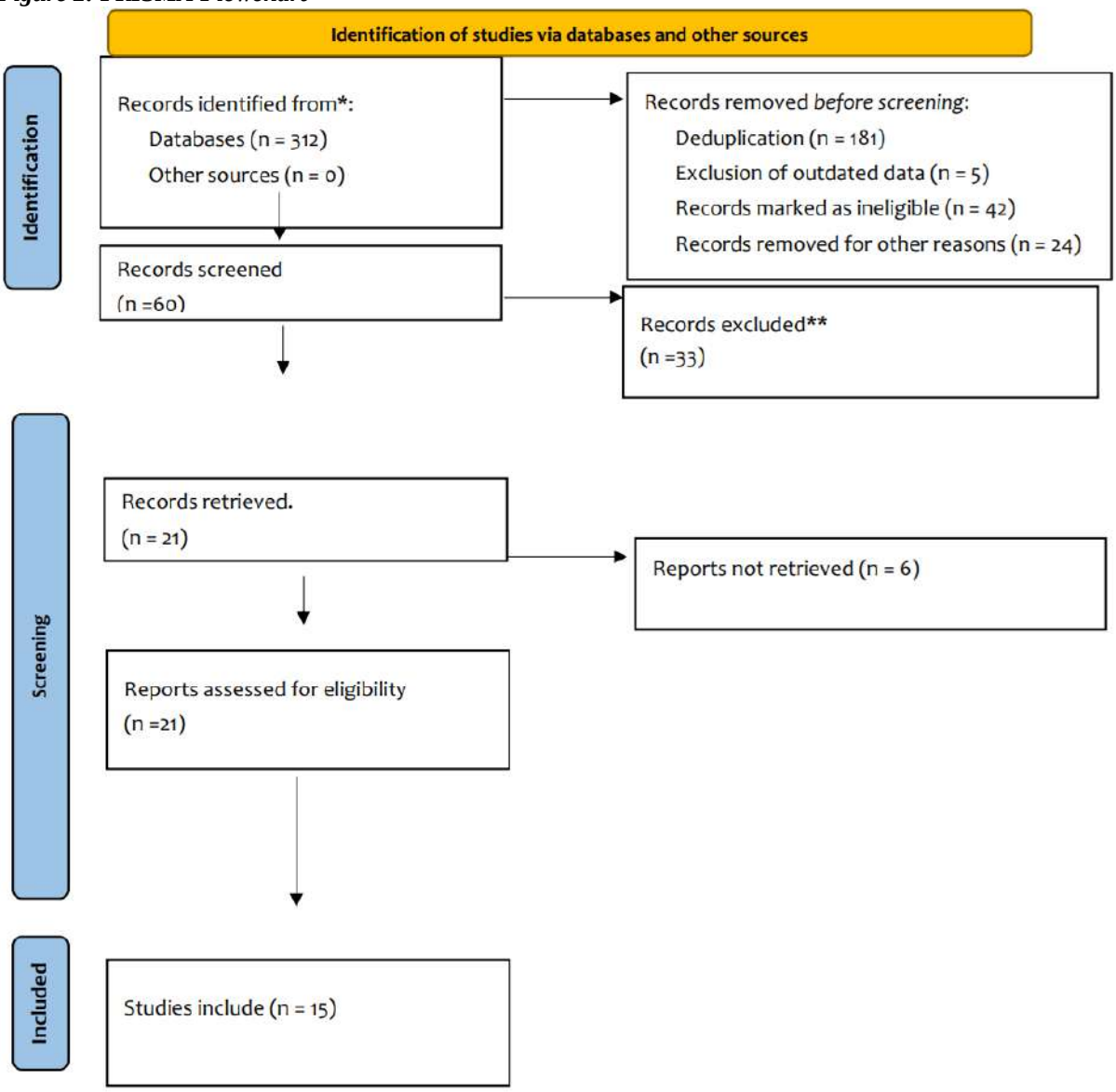
Appendices

Appendix A: Search Terms and PRISMA Flow

Table 4.1 Search Terms and Strings

Search terms	
AI OR "Artificial intelligence" OR "Machine learning" OR "Generative AI"	AND
"Management information systems" OR "	AND
"learning management system" OR "MIS" OR "Student information systems" OR "SIS"	
"E-learning" OR "Online learning" OR "Distance education"	AND
"Higher education" OR "University" OR "College"	AND
"Saudi" OR "KSA" OR "Kingdom of Saudi Arabia"	

Figure 2: PRISMA Flowchart



Appendix B: Study Tables

Table 5.3.1 Studies complementing theme 1

Scholars	Aim of the study	Research Methods	Research Results	Contribution to Curriculum Optimisation	Research Limitations
Shwedeh (2024)	To examine factors influencing AI integration into decision	Cross- sectional survey, purposive and stratified sampling,	Data quality, readiness, engagement and infrastructure significantly	Provides evidence that reliable data, organisational preparedness, and user	Limited to the UAE context andcross-sectional design, results may not

	support systems for improved decision-making in HEIs.	SEM analysis of variables (data quality, readiness, engagement, infrastructure).	enhanced AI- driven decision- making, while system complexity was insignificant.	engagement can optimise curriculum-related decision processes.	generalise across regions or over time.
Lee & Cho (2024)	To analyse global AI curricula and propose a model for AI- specialised university programs.	Comparative curriculum analysis using course data and CS2023 (Computer Science Curricula 2023) framework.	Identified key AI-related courses and proposed a semester-wise structure for specialist training.	Provides a framework to design AI- focused curricula aligned with international standards.	Focused on Korea, limited generalisability to other regional contexts.
Ouyang et al. (2023)	To test AI- enabled prediction with learning analytics to improve student learning in online engineering.	Quasi- experimental design with 62 graduate students in a collaborative online course.	AI+LA model boosted engagement, improved collaboration, and increased learning satisfaction.	Demonstrated MIS potential for real-time feedback, early risk detection, and tailored learning support.	Limited to one course, short duration, and a small sample from a single institution.
Ejjami (2024)	To review AI-enabled education and its role in curriculum and learning innovation.	Integrative literature review of studies on AI in higher education.	Found AI supports personalised curriculum design but faces challenges like bias, privacy, and equity.	Highlights the potential of AI in tailoring curricula to diverse student needs.	Limited to secondary data, lacks empirical testing.

Table 5.3.2 Studies complementing theme 2

Scholars	**Aim of the study**	**Research Methods**	**Research Results**	**Contributio n to Curriculum Optimisatio n**	**Research Limitations**
Gabayan & Sable-Gamboa (2025)	To assess MIS effectiveness in improving preschool administrative efficiency.	Quantitative- correlational design with 15 staff participants.	MIS improved accuracy, speed, timeliness, and user satisfaction.	Demonstrates the MIS role in organising learner records for better monitoring.	Small sample, single preschool setting limits generalisability .
				Suggests MIS can inform early indicators of performance needs.	
Alotaibi (2024)	To investigate the impact of AI–LMS integration on educational quality, student success, and institutional performance.	Systematic literature review following PRISMA 2020, 60 publications from 2014–2023 analysed.	AI–LMS improves personalised learning, engagement, adaptive assessments, and decision-making, and enhances	Data privacy, algorithmic bias, faculty readiness, digital divide, and ethical concerns.	Personalised learning paths, adaptive assessments, intelligent tutoring systems, efficiency in administration, and sustainable

			sustainability and equity.		resource usage.
Filiz et al. (2025)	To examine psychological and pedagogical factors shaping teachers' readiness for AI integration.	An exploratory qualitative study with 66 teachers, using online forums and activity design tasks.	Teachers valued AI for efficiency and personalisation but raised concerns about ethics, curriculum fit, and culture.	Opportunities in adaptive teaching and efficiency, challenges include technical issues, misalignment, ethics, and cultural barriers.	Focused on one private school in Türkiye, limited generalisability and short-term scope.
Aslam et al. (2024)	To assess how personality traits improve AI models for academic performance prediction.	Used SAPEx-D dataset (494 records) with regression/classification models and SHAP analysis.	Incorporating personality factors raised accuracy (R^2 = 0.83, grades up to 0.85).	Shows MIS/AI can integrate non-academic factors for holistic performance tracking.	Limited to one dataset (SAPEx-D), results may not generalise widely.
				Provides explainable, human- centred predictions with higher accuracy.	
Sajja et al. (2023)	To develop a platform-independent AI-based intelligent assistant for higher education using GPT-3.	Designed and evaluated a syllabus- driven VirtualTA framework with NLP, knowledge graphs, and case study testing.	The assistant improved student engagement, reduced logistical workload, and provided 24/7 course support.	Helps track academi,c progress by ensuring access to curriculum and logistics information. Supports personalised learning pathways by predicting and addressing student needs.	Results are based on limited case studies; scalability and long-term effects have not been fully tested.
Mutambik (2024)	To assess AI automation's impact on student learning in KSA.	Survey of 1,991 students, SEM analysis.	AI improved LMS efficiency, readiness, and engagement.	Showed AI can track learning readiness and LMS use. Supports predictive insights into sustainable learning outcomes.	Focused only on Saudi universities, limiting generalisation.

Table 5.3.3 Studies complementing theme 3

Scholars	Aim of the study	Research Methods	Research Results	Contribution to Curriculum Optimisation	Research Limitations
Jackman et al. (2025)	To examine faculty readiness for AI adoption in Caribbean HEIs.	Quantitative survey of 78 faculty using the UTAUT model.	Faculty readiness is linked to perceived benefits and institutional support.	Limited AI expertise, lack of training, and ethical concerns.	Structured training, stronger institutional support, and clear AI policies.
Mulaudzi & Hamilton (2025)	To explore lecturers' views on AI in personalised learning, benefits, and ethics.	Qualitative case study, 16 lecturers, thematic analysis.	Found mixed perceptions: ethical concerns, but also teaching benefits.	Risk of plagiarism, over-reliance, and academic integrity issues.	AI tools enable personalised learning, feedback, and innovative assessment.
Khan et al. (2025)	To examine how AI, ML, and Big Data can enhance sustainability in Saudi universities.	Mixed methods: case studies, interviews, policy review, and data analysis.	Found AI and big data improve decision-making, personalisation, and sustainability, Random Forest best predicted performance (R^2 = 0.85).	High costs, infrastructure gaps, privacy concerns, and a shortage of skilled staff.	AI enables predictive analytics, optimised resources, and personalised learning aligned with Vision 2030.
Khairullah et al. (2025)	Examine AI integration in academic, administrative, and strategic leadership processes in HEIs.	Review of literature on AI applications in higher education, analysis of academic and administrative impacts.	AI improves student learning, engagement, research efficiency, and streamlines admin processes.	AI bias, data privacy/security, ethical issues, faculty job displacement, over-reliance on AI, and governance gaps.	Personalised learning, predictive analytics, intelligent tutoring, automated admin, research enhancement, and strategic decision support.