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Implementing artificial intelligence in academic and administrative processes through responsible strategic leadership in the higher education institutions

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Artificial Intelligence (AI) has enormous potential to make a transformative impact in multiple fields. It has made significant strides in Higher Education by reshaping traditional administrative processes, learning, leadership, and teaching. This review explores the substantial impact of integrating AI in Higher Education Institutions (HEIs), from improving education delivery to enhancing student outcomes and streamlining administrative processes and strategic leadership. By catering to the diverse learning needs of students with the help of tools that directly affect academics, monitor student engagement and performance, and provide data-driven interventions, AI offers what the HEIs have long been waiting for to revolutionize the overall Higher Education landscape. This review also highlights that with AI's ability to streamline administrative tasks by enhancing admissions and enrolment processes, academic records management system, and financial aid and scholarships processes, AI not only facilitates improving the overall processes but also makes staff and faculty members focus less on mundane and monotonous tasks, hence concentrating more on the responsibilities and strategic initiatives that require focused attention. We identified that the key to unlocking the significant potential of AI is responsible strategic leadership. Strategic leadership requires aligning AI integration goals with the strategic mission of HEIs, fostering an environment ready to embrace innovation and ensuring that the required accountability and governance frameworks are in place for AI integration and usage. It is also the role of leadership to consider ethical considerations, collaborations with the relevant stakeholders, concerns about job displacement, and potential biases, ensuring that AI is used to its full potential for the benefit of faculty, staff, students, and society. We conclude the paper with AI-driven future implications, i.e., emerging technologies, continuous enhancement and AI-based enhanced research accomplishments.

KEYWORDS

higher education institutions (HEIs), artificial intelligence (AI), AI-driven administrative processes, strategic leadership, education—active learning

1 Introduction

Artificial intelligence (AI) has become predominant in modern society, affecting several domains and fundamentally altering the nature of work and various aspects of day-to-day activities (Khan and Yasir, 2024). In this regard, AI retains the potential to influence higher education institutions (HEIs) on a broader spectrum. Universities and other educational institutions actively investigate how to incorporate AI into their research capacities, administrative procedures, and pedagogical practices to enhance these imperative areas (Lee et al., 2024). However, introducing AI into HEIs brings a multi-layered potential and complexities that need scientific research for its wider acceptability and implementation (Saaida, 2023; Rashid et al., 2024). Higher education has seen a radical change due to AI technologies (Ozfidan et al., 2024), which have opened up opportunities for data-driven decision-making, individualized learning, and creative pedagogical approaches (Rahiman and Kodikal, 2024). Large volumes of data may be sorted through adaptive learning systems, allowing for the development of customized learning routes that complement each student's unique learning preferences, styles, and aptitudes, thereby improving their educational experience (Gligorea, 2023). AI-powered intelligent tutoring solutions provide students with immediate feedback and assistance, enabling them to understand different subjects and attain better learning objectives (Lin et al., 2023). Moreover, virtual learning assistants (Pogorskiy and Beckmann, 2023) are an AI-driven innovation that has the potential to enhance student engagement by providing prompt support and promoting communication. By reinventing how education is delivered and experienced in the twenty-first century, integrating these AI technologies in HEIs opens up novel pedagogical possibilities.

Previous research demonstrated that integrating AI in universities may result in cost-effective and efficient administrative process optimisation (Crompton and Burke, 2023). AI-powered solutions may automate repetitive processes like financial aid processing, enrolment management, and student admissions to facilitate several key projects. AI-driven predictive analytics helps academic institutions spot patterns and trends that help them make data-driven decisions about resource allocation, budgeting, and focused interventions that boost student achievement. Additionally, AI can improve research capacities by accelerating academic inquiry through data analysis automation, research gap identification, and insights generation from academic publications (Rafik, 2023). A new age of efficient and data-driven decision-making might be ushered in by integrating AI into administrative procedures, with far-reaching impacts on higher education.

The research study (Crompton and Burke, 2023) also focused on the challenges associated with integrating AI into higher education. The biases in AI systems (Varsha, 2023) raise questions about end-to-end accountability, transparency, privacy and security (Cen and Alur, 2024) by running the risk of sustaining current disparities. Robust data governance, informed consent, and cyber security measures are critical for guaranteeing the privacy and security of student data in AI-driven systems (Farayola et al., 2024). Another issue is how AI will affect faculty positions and lead to job displacement, i.e., proactive steps to assist faculty in this transformation are needed (Aithal et al., 2024). Careful strategic planning is necessary when institutions incorporate AI to guarantee its ethical and responsible application (Chan, 2023) in higher education environments.

The research study highlighted that considering the pedagogical consequences of AI integration in higher education is indispensable (Wang and Pange, 2023). Due diligence is required for the ethical use of AI in assessment, balancing human and AI-driven education, and analysis of the effects on student motivation and engagement (George, 2023). Furthermore, concerns about the use of AI in decision-making procedures that have historically relied heavily on human judgment, such as student admissions, may surface (Naseer et al., 2024). Hence, an evaluation of these aspects, where Higher Education Institutions (HEIs) incorporate AI, is crucial to ensure the appropriate and efficient application of AI technologies in HEIs.

This study reviews the advantages and disadvantages of integrating AI into higher education. It draws attention to how AI has the potential to transform education, streamline administrative procedures, and advance research capacities (Singh, 2023). However, it also raises questions regarding ethical issues, biases, the influence of AI on faculty positions, pedagogical consequences, and the overuse of AI in decision-making processes (Wang, 2021). The study highlights the necessity of using AI in higher education responsibly and morally. It also reports the significance of more research and cooperative efforts between academia, industry, and government to analyse and evaluate AI's potential for students, teachers, and society. The authors in Leoste et al. (2021) highlight that the implications of integrating AI into higher education offers both potential and obstacles, which is the pivotal point of this study. Concerns about biases, ethical issues, and the effects on academic duties are all covered by the possible advantages of AI (Alam, 2023a). It will allow AI in higher education to reach its full potential and benefit students, teachers, and society.

1.1 Objectives and motivation

The developments in AI have transformed various domains in the real world, such as education, finance, healthcare, etc. Personalized learning (George and Wooden, 2023), early intervention and student support (Zhao and Otteson, 2024), language processing and translation (Gayam, 2021), early detection and diagnosis of diseases (Saleh et al., 2022), medical imaging (Rajpurkar and Lungren, 2023), fraud detection (Javaid, 2024), customer support and quality assurance (Chen and Xiong, 2023) are just a few examples. However, the misuse of AI-driven technologies (Pöhler et al., 2024), fake news dissemination (Harris et al., 2023) and drastic effects of widespread AI-generated content (Mitrou, 2024) are also perceived. However, it cannot be denied that AI has driven efficiency, innovation, and personalisation, changing how we work, learn, heal, and interact in a world where everything is connected by technology. Thus, this review is aimed to highlight the impact of AI on HEIs and strategic leadership as shown in Figure 1. Table 1 presents the advantages and challenges of AI integration in HEIs. The objectives of this paper are as follows:

- Analyzing the uses of AI in HEIs and highlighting the development and current situation.

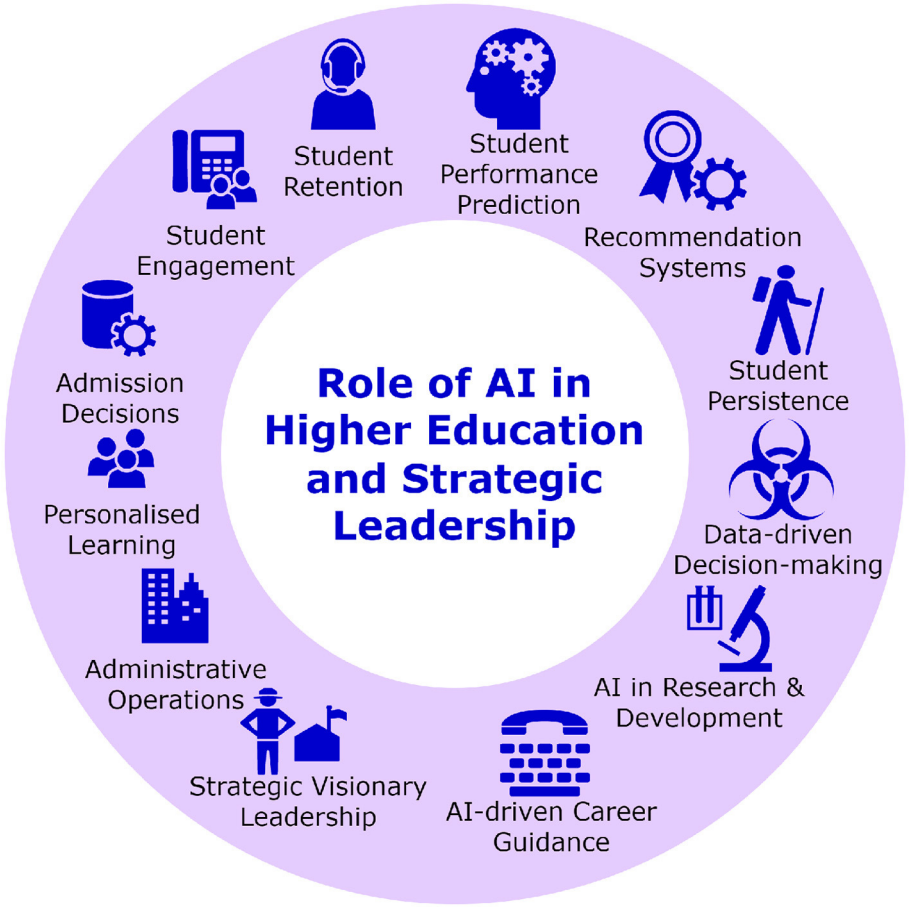

FIGURE 1
Various aspects of AI's role in higher education institutions (HEIs) and strategic leadership.

- Investigating the role of AI in improving the quality of education focused on personalized learning, student engagement, retention and performance prediction.
- Presenting the comprehensive overview of AI-driven career guidance and effects of AI in Research and Development in HEIs.
- Identifying how AI can facilitate data-driven decision-making, administrative operations and strategic visionary leadership.

1.2 Contributions to higher education institutes (HEIs) and leadership in AI era

This review analyses the role of AI in HEIs and its impacts on strategic visionary leadership, focused on progressive perceptions that are disregarded in the existing literature. The contributions of our review to the existing reviews on AI integration in HEIs are shown in Table 2. We also highlight the future research directions in this area. Thus, this review presents:

- Emphasizing the unparalleled benefits of AI to improve student success metrics (engagement, retention, persistence, performance prediction, graduation rates, and career placement) and designing relevant recommendation systems.
- Using AI's potential to address contemporary educational challenges, from making personalized learning possible to streamlining administrative processes, especially admissions-related processes.
- Highlighting how AI's potential can be harnessed to make informed decisions and facilitate research and development, enhancing the overall leadership capabilities.
- Exploring digital leadership in the age of artificial intelligence and the related challenges leaders face.
- Presenting a compelling call to action that challenges the researchers and HEIs' leaders to rethink traditional educational models and collaborative practices, ensuring that higher education not only endures but thrives with relevance, resilience, and responsiveness in the AI-driven era.

1.3 Comparison with the existing literature reviews on AI integration in HEIs

To highlight the contributions and significance of this review, we compared it with the related existing reviews

TABLE 1 Advantages and challenges of AI integration in HEIs.

HEIs aspects	Advantages of AI	Challenges of AI integration
Academics	• Personalized and adaptive learning systems • Personalized content for the students • Automated grading • Enhanced teaching efficiency and learning outcomes • Early warning of possible dropout issues • Preventive assistance • Monitoring attendance and success metrics	• Potential biases in AI algorithms • Privacy and data security issues • Over-reliance on technology
Administration	• Automated scheduling • Reduced administrative constraints • Robust processes • Efficient enrolment systems • Financial aid analysis • AI chatbots for assistance • Records management • Resource management • Security aspects • Career services	• Potential biases in AI-driven systems • Privacy and data security issues • Concerns about fairness • Challenges regarding wide-acceptability • Diminished human intervention
Strategic leadership	• Data-driven decision making • Enhanced strategic planning • Stakeholders' involvement • Diversity at all leadership and decision-making levels • Authenticity and accountability • Interdisciplinary collaboration • Effective management of institutional resources • Long-term plans to address social demands, technical breakthroughs, and worldwide trends • Ensures consistency with institutional values for advanced and equitable results	• Ethical concerns • Balancing innovation with privacy and security

in the field. The review in Zawacki-Richter et al. (2019) demonstrated the importance of AI integration in HEIs focused on Student Success Metrics, i.e., tutoring systems, grading and feedback support, adaptive learning platforms, predictive analytics, reinforcements for support and AI-based systems for admissions and enrolment. The literature review (Chen and Lin, 2020) expanded the existing areas of AI integration in HEIs and also discussed the role of AI-based career services and emerging technologies, such as Virtual Reality (VR) and Augmented Reality (AR). The researchers in Huang et al. (2021) concentrated on AI's role in Student Success Metrics and some AI-driven administrative processes, such as optimal course scheduling, security aspects, i.e., privacy challenges, and overall advantages and challenges of AI-driven automation along with emerging technologies in HEIs. The literature review (Ouyang et al., 2022) also focused on AI-driven student success metrics, resource management, optimal course scheduling and emerging technologies in HEIs. The research study (Crompton and Burke, 2023) highlighted the significance of AI integration in HEIs with its impact on tutoring systems, grading and feedback support, adaptive learning platforms and predictive analytics. The literature review (Chiu et al., 2023) also explained the effectiveness and challenges of AI-based automated mechanisms for tutoring systems, grading and feedback support, adaptive learning platforms, predictive analytics and reinforcements for support. The research study (Alqahtani et al., 2023) highlighted the efficacy of AI-driven mechanisms in HEIs by highlighting their role in current student success metrics and future implications and transformations in HEIs. The review (Bond et al., 2024) discussed the potential advantages and challenges of AI integration in HEIs and comprehended student success metrics, some administrative processes, such as admissions and enrolment, student record management, resource management and optimal course scheduling, career services and overall advantages and challenges. Our review fills the gap in the existing reviews by focusing on AI integration in HEIs concerning its adaptability to student success metrics with improvement in administrative processes and its impact on the role of responsible strategic leadership and AI-driven future implications and transformations in HEIs.

1.4 AI implementation process in HEIs

AI plays a transformative role in HEIs across three key domains, i.e., academic, administrative, and leadership, presented in Figure 2. The comparison with the existing studies indicates the significance of this review in terms of the AI Implementation process in HEIs shown in Figure 3, which is overlooked. In the educational sphere, AI enables adaptive learning systems that personalize content and automate grading, enhancing teaching efficiency and learning outcomes. The administrative sphere benefits from AI by automating critical processes, such as enrolment, record-keeping, and financial aid management, streamlining operations and reducing human error. In the leadership sphere, AI supports data-driven decision-making by providing advanced analytics for policy formulation, strategic planning, and resource optimization, helping institutional leaders make informed decisions that align with institutional goals and improve overall efficiency. This review also determines that integrating AI into HEIs involves several critical stages. It begins with strategic goal alignment, where specific goals for AI integration are defined to align

TABLE 2 Comparison with the existing literature reviews on AI in HEIs.

Ref + Year	AI's Role in Student Success Metrics						AI's Role in Administrative Processes							AI Integration and Role of Responsible Strategic Leadership				AI-driven Future Implications and Transformations in HEIs		
	Direct Effects on Academics			Student Progress & Engagement Monitoring	Data-driven Interventions in HEIs		Admissions & Enrolment	Students Record Management	Scholarships & Financial Assistance	Resource Management & Optimal Course Scheduling	Security Aspects in HEIs	Career Services	Advantages and Challenges	Effective Leadership Frameworks	Strategic Visionary Leadership and Goal Alignment	Importance of Fostering an Innovation-Driven Environment	Accountability and Governance Frameworks	Emerging Technologies	Continuous Enhancement	Enhanced Research Accomplishments
	Tutoring Systems	Grading & Feedback Support	Adaptive Learning Platforms	Monitoring attendance, engagement, and performance	Predictive Analytics	Reinforcements for Support														
[131] 2019	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
[132] 2020	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✓	✗	✗
[134] 2021	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗	✗
[133] 2022	✓	✓	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗
[8] 2023	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
[130] 2023	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
[136] 2023	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓
[135] 2024	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗
Our Review	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

with the institution's strategic policies and defined mission. Next is stakeholder collaboration, which involves engaging faculty, students, and administrative staff to ensure buy-in and collective support for the initiative. This process is followed by AI tool selection, where tools are identified to address academic, administrative, and leadership needs effectively. In the integration phase, AI is gradually implemented in processes, i.e., admissions, teaching, and records management. A robust framework for governance and accountability is developed, including ethical guidelines and governance mechanisms to ensure ethical and responsible use. Finally, evaluation and continuous improvement are undertaken by measuring outcomes, gathering feedback, and refining AI systems to ensure they remain effective and aligned with institutional goals.

2 Methodology

This literature review analyses and evaluates the existing literature on the Role of AI in HEIs and its impacts on strategic visionary leadership. This integrated approach covers comprehensive research studies in this domain. An empirical investigation using primary data is challenging since the widespread application of AI in HEIs and leadership is still novel. However, this study identifies and presents a comprehensive review of the practices and prospective approaches to integrate AI in HEIs effectively. The review paper overflow is presented in Figure 4, and the methodology for this literature review is detailed in Figure 5.

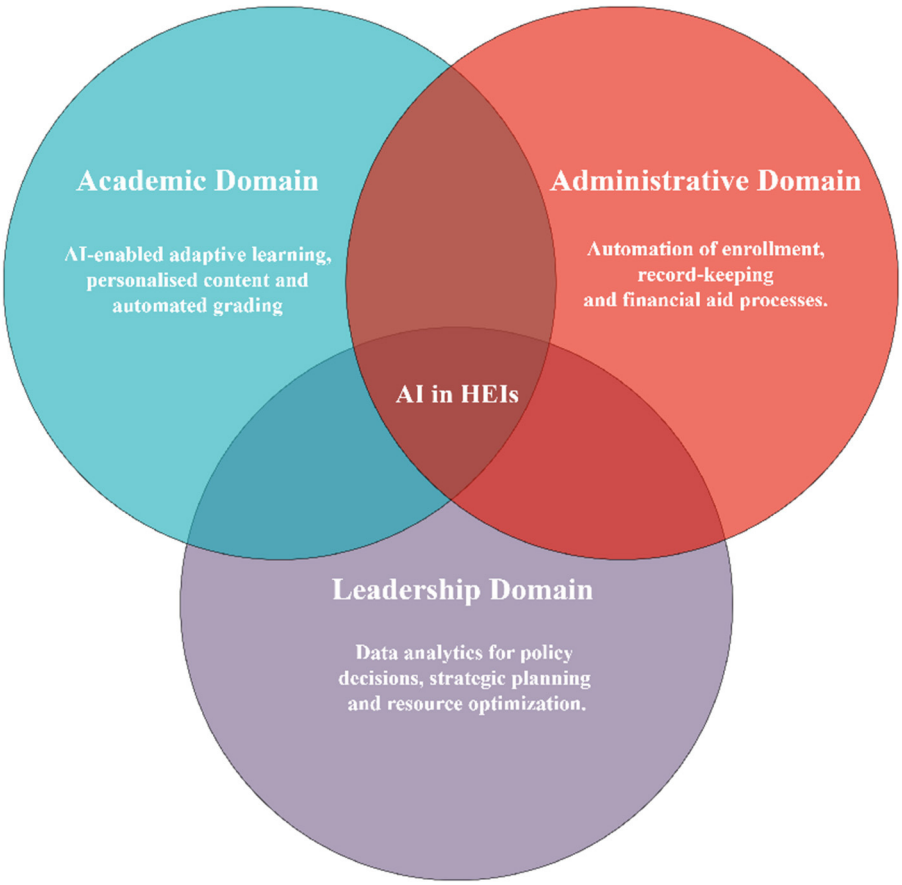

FIGURE 2
AI's role in academic, administrative and strategic leadership processes in HEIs.

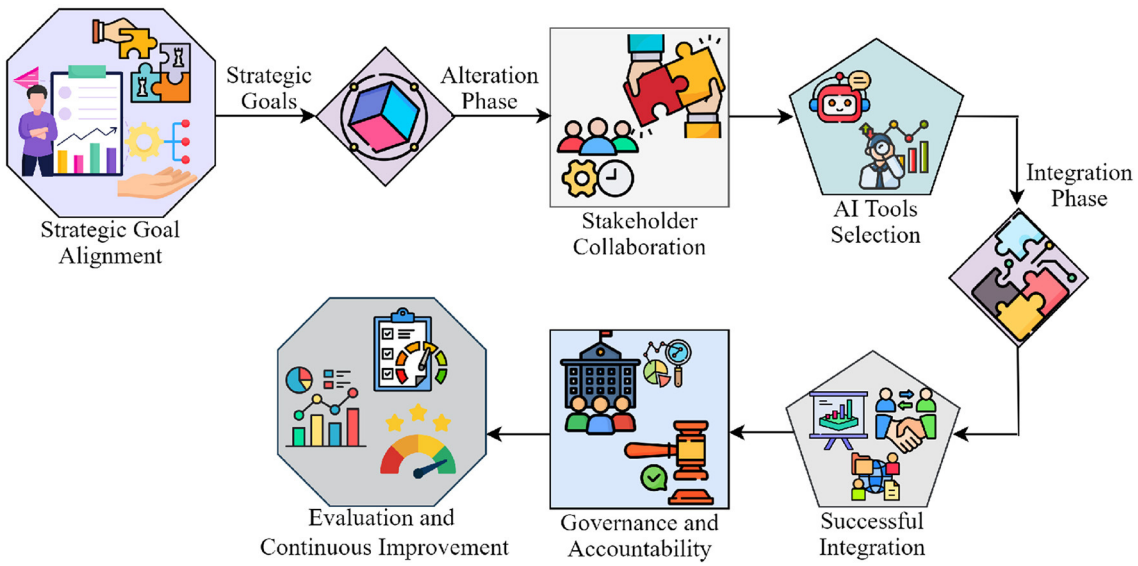

FIGURE 3
AI implementation process in HEIs.

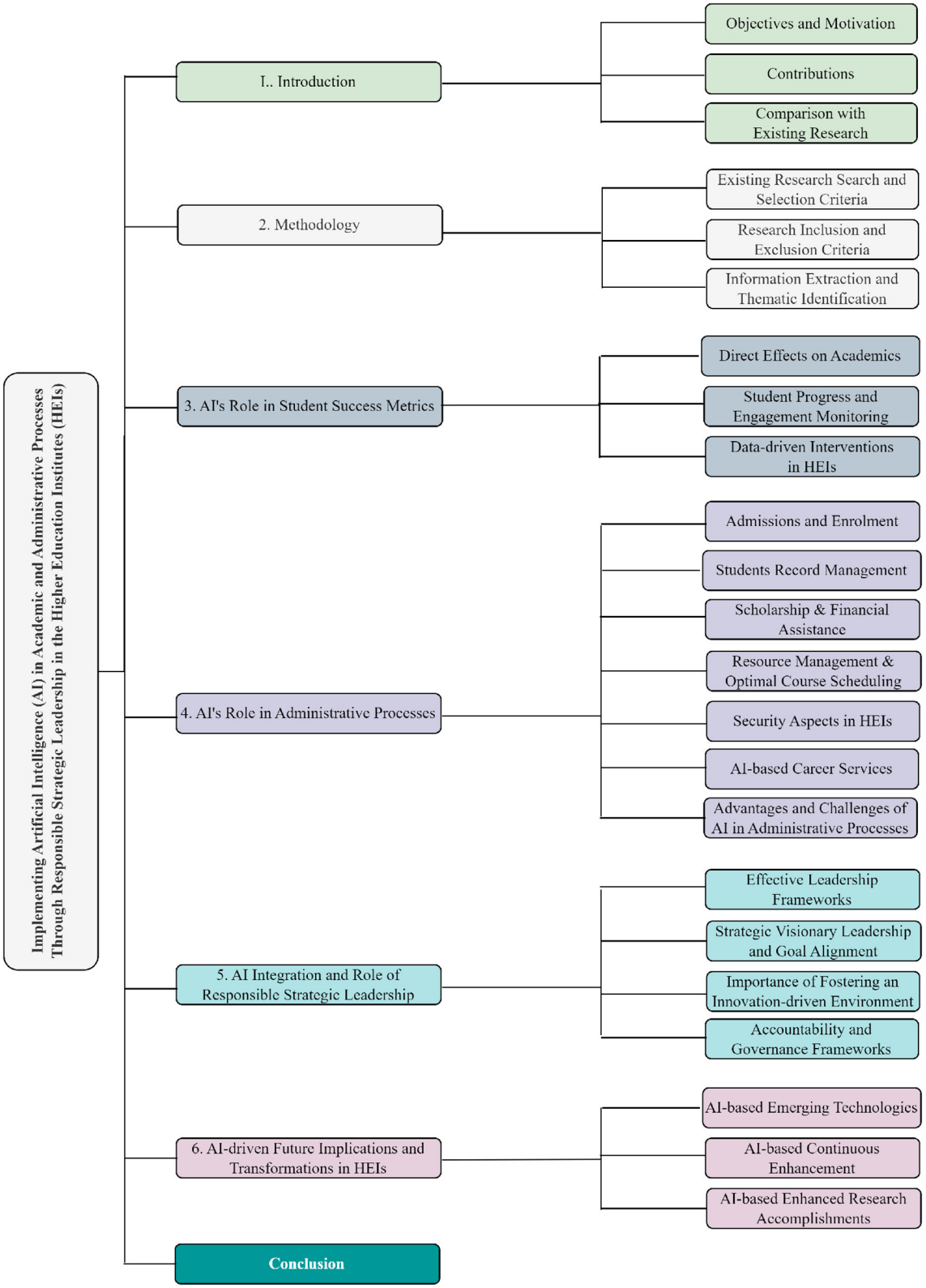

FIGURE 4
Review paper flow.

2.1 Existing research studies' search and selection criteria

The existing research offers valuable insights into the current state of AI in education, from the emergence of online learning platforms to the more complex uses of AI for administrative automation and personalized learning. However, the existing research studies overlook the current wave of AI in HEIs from various perspectives and strategic leadership. The focal point of the existing studies was digital transformation, which failed to highlight the role of AI in HEIs and its automation process in general. Therefore, this review presents the AI revolution in HEIs with its diverse impacts on students, administrative systems and strategic leadership.

We used different academic search engines comprehensively for the pertinent papers, such as Google Scholar, Semantic Scholar, Scopus, etc. Multiple keywords were used to acquire the relevant research studies. The terms "AI in Higher Education," "Higher Education in the AI Era," "Leadership in Higher Education in the AI Era," "AI Transformations in Higher Education," "Facilitating Administrative Processes through AI in Higher Education," "Enhancing Leadership Potential through AI in Higher Education" were considered and used for the literature search.

2.2 Research inclusion and exclusion criteria

The inclusion criteria were based on the most recent research studies. We used existing relevant research studies published in 2019 or later. The research quality criteria were based on being indexed in reputable databases like Google Scholar, SCOPUS or Web of Science. We excluded the research studies that did not address AI or its implications in the context of higher education.

2.3 Information extraction and thematic identification

The relevant identified research studies that met the selection criteria were examined and compiled for this literature review. This process identified recurrent themes, and thus, we arranged the acquired information into various categories. This enabled us to collect and correlate multidimensional research findings on the role of AI in HEIs and its implications in strategic leadership. We used an analytical approach in this literature review to enable a comprehensive understanding of how AI will affect higher education in the future. The results of this review will provide insights for academia, instructors, legislators, and researchers on how AI may revolutionize higher education.

3 AI's role in student success metrics

Education is one of the most important areas where AI is used. Several AI applications and processes in the HEIs have been implemented, i.e., in-person instruction and intelligent online learning, and e-learning, which uses dynamic learning, ontologies, conceptual systems, computational linguistics, and state-of-the-art models to enable direct and personalized learning processes. Therefore, AI has become more significant in forming and improving student success metrics, which aids in better decision-making for HEIs and instructors. Significant components of AI-based student success metrics in HEIs are presented in Figure 6. Some of the highlighted significant areas in Table 3 where AI is helpful in HEIs are discussed as follows.

3.1 Direct effects on academics

3.1.1 AI-based tutoring systems

AI-based tutoring systems are used for personalized learning experiences (Alam, 2023b) for students, which provide them with activities and material pertinent to increasing their level of engagement. In addition to making learning more engaging and relevant, personalized learning may boost motivation by giving students a sense of control and ownership over their education. Personalized learning has been demonstrated to enhance learning results, especially for students who might find it difficult to learn using conventional methods. Moreover, augmented and virtual reality (AR/VR) are used to create immersive learning experiences that allow students to explore and engage with virtual settings and simulations (Familoni and Onyebuchi, 2024). This also enables them to customize according to their unique needs and skills and offer real-time feedback on their progress. Online learning systems provide students more freedom regarding when and where they learn and access the educational resources and courses around the globe. Technology-enabled learning that adapts to the learning style, speed, and progress of the learner is known as adaptive learning. In order to achieve this, algorithms are used to analyse student data, including test scores, and modify the pedagogy or content (Shoaib et al., 2024) as necessary. However, personalized learning analytics presents several challenges and difficulties (Chinta et al., 2024), such as the requirement for trustworthy data sources and the risk that biased algorithms or tailored suggestions could reinforce already-existing disparities. Although learning analytics personalisation has the potential to increase educational effectiveness, it is crucial to carefully weigh the advantages and disadvantages of this approach to ensure that it is just and equal for all students.

3.1.2 AI-based grading and feedback support

AI-based grading and feedback support systems use artificial intelligence to assess student work, provide feedback, and sometimes assign grades (Jonäll, 2024). These robust systems enable the instructors to concentrate more on instructional design (González-Calatayud et al., 2021) and less on mundane duties. Thus, AI allows educators to focus on student engagement, course design, and meeting individual learning requirements by automating grading and feedback. Moreover, these systems provide automated grading efficacy with standards and real-time responses. Multiple-choice tests, short-answer assessments and true or false questions are a few examples of AI-based

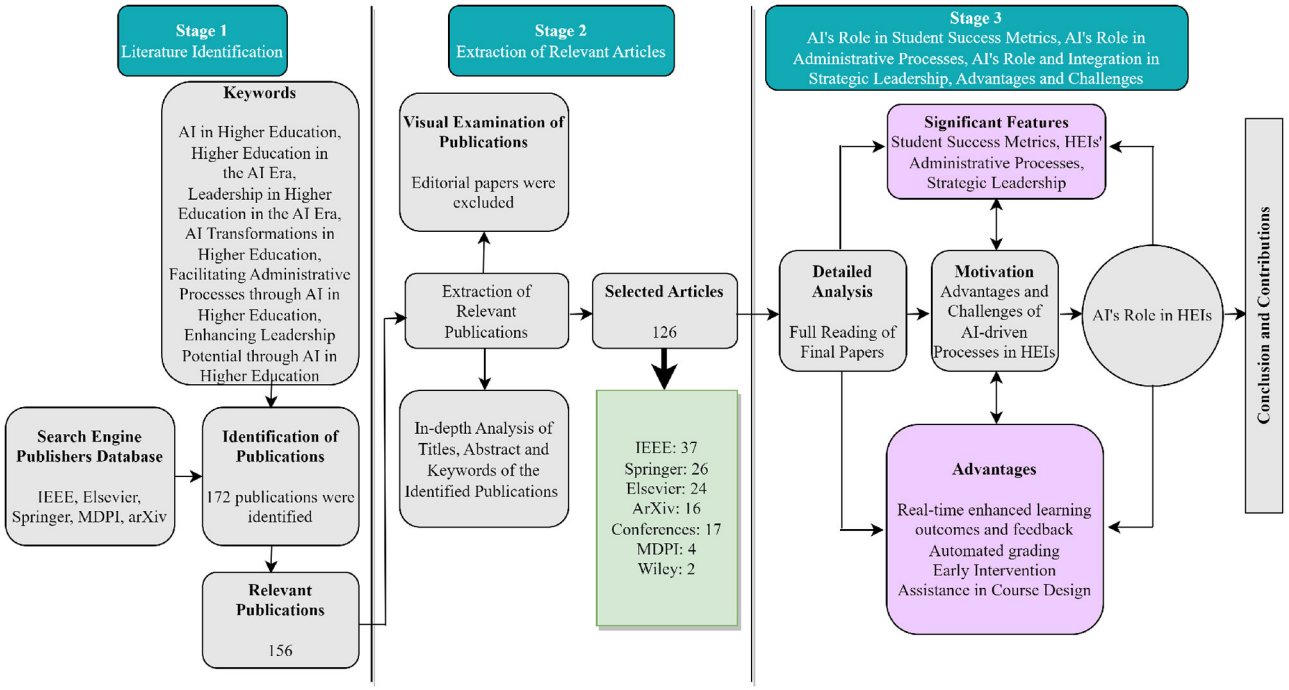

FIGURE 5
Literature review methodology and research studies' search and selection criteria.

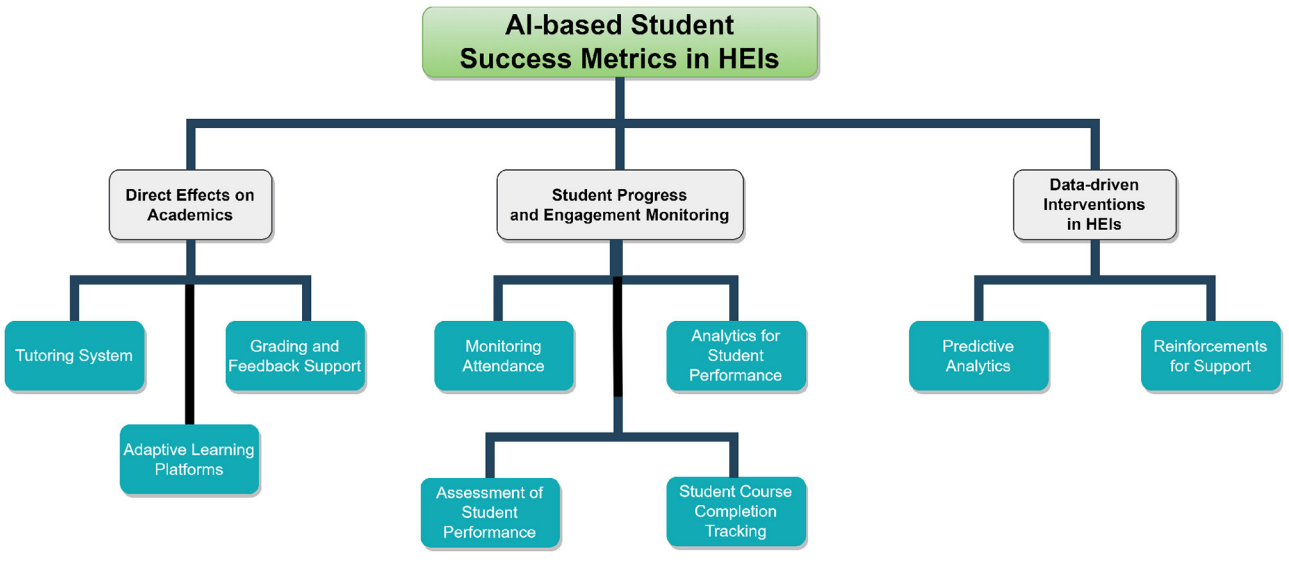

FIGURE 6
Significant components of AI-based student success metrics in HEIs.

grading systems (Owan et al., 2023). Additionally, these systems assess subjective assignments like essays by examining language, coherence, structure, and the logical flow of arguments using Natural Language Processing (NLP) techniques. Thus, AI-based systems offer prompt, tailored feedback and are helpful for big classrooms and online learning portals. As students advance through a course, these systems may also provide formative comments to assist them expound their abilities (Zhu and Lee, 2020). With its uniform methodology, AI-based grading reduces the biases present in human grading and produces more equitable results. These systems are helpful and scalable when dealing with courses where individualized feedback might be difficult. Long-term student achievement tracking by some AI techniques may yield insights for more focused help. However, AI-based grading

has drawbacks, such as its inability to evaluate students' work for creativity or subtleties as well as a human teacher (Fagbohun et al., 2024). Lastly, algorithmic bias, data security, and privacy issues (Shwedeh et al., 2024) are important factors to be considered while deploying these systems in HEIs.

3.1.3 Adaptive learning platforms

AI-based adaptive learning platforms are tailored for student learning experiences (Kabudi et al., 2021) according to each student's unique needs, learning capability levels and their adopted pace. These systems include dynamic material and assessments, real-time feedback, individualized content delivery, scalability for different learning requirements, instructor assistance and insights, predictive analytics for early intervention, and improved student engagement (Ahamed and Hanirex, 2024). In order to provide individualized learning routes, personalized content delivery entails evaluating student preferences, inadequacies, and capabilities. Students may comprehend their success and areas for growth using real-time feedback. Videos, tests, interactive exercises, and simulations are dynamic content formats (Clark and Mayer, 2023) that keep students interested and accommodate various learning preferences. By identifying students who are in danger of falling behind or having difficulty with particular subjects, predictive analytics (Azcona and Smeaton, 2019) enables teachers to step in and offer more resources.

Presenting material in a thought-provoking way and at an appropriate degree of difficulty encourages students and lessens their frustration (Muir et al., 2019), which increases student engagement. These platforms' scalability enables them to accommodate learners ranging from novices to experts within a single system. Teachers may use each student's performance data to identify patterns, monitor development, and make informed decisions (Wise, 2019). Carnegie Learning, Smart Sparrow, Knewton, and DreamBox Learning are examples of AI-based adaptive learning solutions. However, these systems have issues like privacy and data, and uncertainties (Pedro et al., 2019) about relying too much on AI for learning. Notwithstanding these obstacles, AI-powered adaptive learning systems are a breakthrough in education, offering scalable, customized assistance to different learners and assisting students in HEIs.

3.2 AI-based student progress and engagement monitoring

3.2.1 Monitoring attendance

Automated Attendance records and monitors students' attendance using biometric devices or login credentials in virtual and real environments. AI can identify patterns in attendance behavior, such as persistent absences or late arrivals, which may be early signs of disengagement (Graven and MacKinnon, 2023). This data is combined with the student's performance in HEIs to determine the effect of attendance on grades and engagement. Once the data is analyzed, AI allows for proactive outreach by identifying possible attendance problems before they become more significant, followed by automated notifications (Atif et al., 2020) to the students in HEIs. Advisors and students receive alerts on poor attendance, which increases student accountability and permits prompt interventions.

3.2.2 Analytics for student engagement

Student contributions to online discussions (Ding and Orey, 2018) are tracked to distinguish between active and potentially disengaged students. Secondly, learning material-based tracking (Regan and Jesse, 2019) indicates how much time students spend on particular topics and provides information about their level of interest. Thirdly, it also tracks how frequently students interact with the course materials (Zhu et al., 2024), including how often they watch videos, take quizzes, and access resources. Analyzing peer collaboration helps distinguish between disengaged students and those who are well-integrated into peer networks (Darling-Hammond et al., 2020) by looking at trends in group interactions. Lastly, resource utilization evaluation examines how students in HEIs access learning resources (Chaka, 2020) to identify the most popular or effective materials. This offers a more thorough perspective of student involvement than just attendance and aids in detecting and filling in the gaps in students' interaction with the course materials. These results can be used to enhance the course design by emphasizing the most thought-provoking resources. However, it could result in excessive monitoring, compromising students' privacy and independence in HEIs. It can be incomprehensible to interpret engagement data because comprehension does not always correspond with the time spent on content. Diverse degrees of comfort with digital interaction may impact the data.

3.2.3 Student course completion tracking

Student Course Completion Tracking is an AI-driven method to track their progress in real-time, demonstrating that they have finished courses, online questionnaires and tests. AI-based systems in HEIs monitor their accomplishments of significant course benchmarks, enabling teachers to identify instances of students' lacking performance (Shoaib et al., 2024). Comparing current completion rates with previous data also allows for identifying patterns and predicting possible dropout spots (Prenkaj et al., 2020). Identifying common dropout points helps teachers take pre-emptive action by highlighting the phases at which students frequently drop out. It also enables examining success rates for various courses, and levels of success rate analysis offer valuable information (de Oliveira and Moreira, 2021) for developing curriculums. Thus, AI-driven systems present early warning signs of possible dropout issues, enabling preventative assistance (Ahmad et al., 2023) and allowing for a more focused strategy to lower dropout rates. It also assists HEIs in comprehending the components of course design that might influence student's success or failure. However, there are several challenges. Firstly, high dropout rates can be due to extracurricular variables, including personal or financial difficulties. Secondly, it focuses heavily on completion metrics by pressuring students to finish classes and online assessments quickly, which could lower the quality of education as particular courses may inherently have lower completion rates and require a sophisticated approach to data interpretation and response.

TABLE 3 Role of AI in student success metrics in HEIs with examples, real-world advantages and challenges.

AI-based student success metrics	Examples	Advantages	Challenges
Direct effects on academics	AI-based tutoring systems	• Personalized and customised Learning • Increased level of engagement and motivation • Immersive learning experience • Enhanced learning results • Real-time feedback	• Requirement for trustworthy data sources • Biased algorithms or tailored suggestions
	AI-based grading & feedback support	• Provide real-time feedback • Automated grading efficacy with standards • Robust systems • Time efficient • More freedom for the instructors to focus on instructional design, such as student engagement, course design, and meeting individual learning requirements • Formative comments for students • Uniform methodology and equitable results • Scalable, individualized feedback and long-term student achievement tracking	• Inability to evaluate students' work for creativity • Algorithmic bias • Data security • Privacy
	Adaptive learning platforms	• Specifically tailored for student learning experiences according to each student's unique needs, learning capability levels and adopted pace • Interactive and dynamic material and assessments, and individualized content delivery • Scalability for different learning requirements, instructor assistance and insights, predictive analytics for early intervention • Improved and increased student engagement • Real-time feedback • Predictive analytics for teachers to step in and offer more resources • Teachers may use each student's performance data to identify patterns, monitor development, and make informed decisions	• Creating adaptable content • Improving algorithms • Privacy and data security • Relying too much on AI for learning
AI-based student progress and engagement monitoring	Monitoring attendance	• Offers a trustworthy, up-to-date attendance and students' performance data • Early intervention for disengaged students • Automated mechanism to lessen administrative effort	• Privacy issues to monitoring online attendance and physical presence • Student participation may not be completely shown by attendance data alone • Potential biases in the event that absences are misunderstood with the missing context
	Analytics for student engagement	• A thorough perspective of student's involvement • Aids in detecting and filling in the gaps in students' interaction with the course materials • Results in suggestions for an improved course design	• Excessive monitoring, compromising students' privacy and independence in HEIs • Interpretation of engagement data may be challenging, as time spent on content does not always correlate with understanding • Diverse degrees of comfort with digital interaction may impact the data
	Student course completion tracking	• Early warning of possible dropout issues • Enables preventative assistance • Allows for a more focused strategy to lower dropout rates • Assists HEIs in course design	• High dropout rates due to extracurricular variables, including personal or financial difficulties • Focuses heavily on completion metrics • Pressuring students to finish classes and online assessments quickly • Lower quality of education
	Assessment of Student Performance	• Real-time view of each student's course standing with continued monitoring and tracking • Regular progress reports and real-time feedback • Students who may have difficulties can also be identified promptly • Teachers can take immediate action, such as providing resources or assistance • Data-driven interventions enhance student performance	• Excessive monitoring, compromising students' privacy and independence in HEIs • Bias in algorithms may perpetuate the existing biases

(Continued)

TABLE 3 Continued

AI-based student success metrics	Examples	Advantages	Challenges
AI-based data-driven interventions in HEIs	AI-driven predictive analytics	• Pre-emptive Measures • Personalized assistance for students • Customised resource allocation • Increased effectiveness of support services • Continuous improvement • Assessment of the impact of interventions	• Data privacy issues • Risk to Personal Identifiable Information (PII) • Limitations of predictive algorithms • Absence of contextual elements may influence performance results • Maintaining data quality is essential otherwise inaccurate data may result in ineffective measurements
	AI-based reinforcements for support	• Special tailored and targeted suggestions for each student's need • Possibility of positive results • Improved peer support • Support network • The most pertinent resources	• Speculated student's choices • Limited fair access

3.2.4 Assessment of student performance

AI-driven systems track student involvement in class activities, test results, and assignment completion, updating and monitoring performance data in real-time (Shoaib et al., 2024). A real-time view of each student's current course standing is possible by continued monitoring and tracking (Vashishth et al., 2024). Students who may have difficulties can also be identified promptly. Thus, teachers can take immediate action, such as providing resources or assistance (Makinde et al., 2024b) if a student's performance declines. Lastly, data-driven interventions can enhance student performance, which may prevent surprises when the course concludes by giving regular progress reports and providing students with real-time feedback to help them stay on course. However, continuous monitoring can lead to privacy violation concerns. Secondly, if there are biases present in the training data, it may lead AI systems to perpetuate the existing biases, hence resulting in unfair evaluations or feedback.

3.3 AI-based data-driven interventions in HEIs

Data-driven interventions (Makinde et al., 2024b) in HEIs use analytics to provide students with proactive and personalized assistance. These interventions improve student achievement and retention through early identification of students at risk and providing resources specifically tailored to their academic needs. The elements, advantages, and challenges of various AI-powered approaches in HEIs are discussed as follows.

3.3.1 AI-driven predictive analytics

AI employs predictive models to detect critical risk indicators, such as low attendance, subpar grades in required courses, or low levels of interest, that might impede their progress. By examining these variables, teachers may proactively connect with students in HEIs (Herodotou et al., 2019) who struggle with their performance. Using data from engagement metrics, current performance, and comparisons with comparable student profiles, AI determines each student's probability of success. This aids teachers in determining which students might need instant support and guidance (Almusaed et al., 2023). AI-driven mechanism improves support timing and determines when students may benefit from intervention. For instance, if a student is expected to have difficulties prior to midterms, an early intervention with extra help or tutoring might help avoid problems later. The impact of support measures is assessed by AI by monitoring the results of earlier initiatives. For instance, if an approach, such as tutoring, is successful for some students, the AI-driven algorithm will suggest the same measures for other students dealing with similar difficulties. Thus, pre-emptive measures allow prompt and personalized assistance by identifying students in danger of failing or dropping out. Secondly, customized resource allocation increases the effectiveness of support services by focusing resources on the students who require them the most. These measures, in the end, result in continuous improvement, and by assessing the impact of interventions, institutions may improve their tactics for increased efficacy. However, there are risks to data privacy. Therefore, there should be strict privacy regulations to collect and analyse the performance corresponding to the personal data to safeguard their Personal Identifiable Information (PII) (Mordecai, 2022). Secondly, predictive algorithms may incorrectly identify "at-risk" students or overlook contextual elements that influence performance, such as personal struggles. Thirdly, maintaining data quality is essential since inaccurate data may result in ineffective measurements.

3.3.2 AI-based reinforcements for support

AI uses performance and engagement data to suggest resources (Sayed et al., 2023), such as interactive exercises, articles, or videos tailored to a student's learning requirements. For instance, students who have trouble understanding mathematical topics, i.e., may be given extra arithmetic practice materials. AI-based approaches suggest interventions such as one-on-one tutoring (Srinivasa and Saritha, 2022) for students who require more academic help or flexible scheduling alternatives for those who need to balance work and study. AI-driven methods find students with comparable academic objectives or difficulties and recommend study groups to assist peers. Students can learn more collaboratively when grouped according to their complementary skills. AI also pairs students with tutors according to their learning preferences, subject-matter competence, and availability (Makinde et al., 2024a), guaranteeing that every student gets the most pertinent help. AI can recommend support services, such as career coaching, academic advising, or

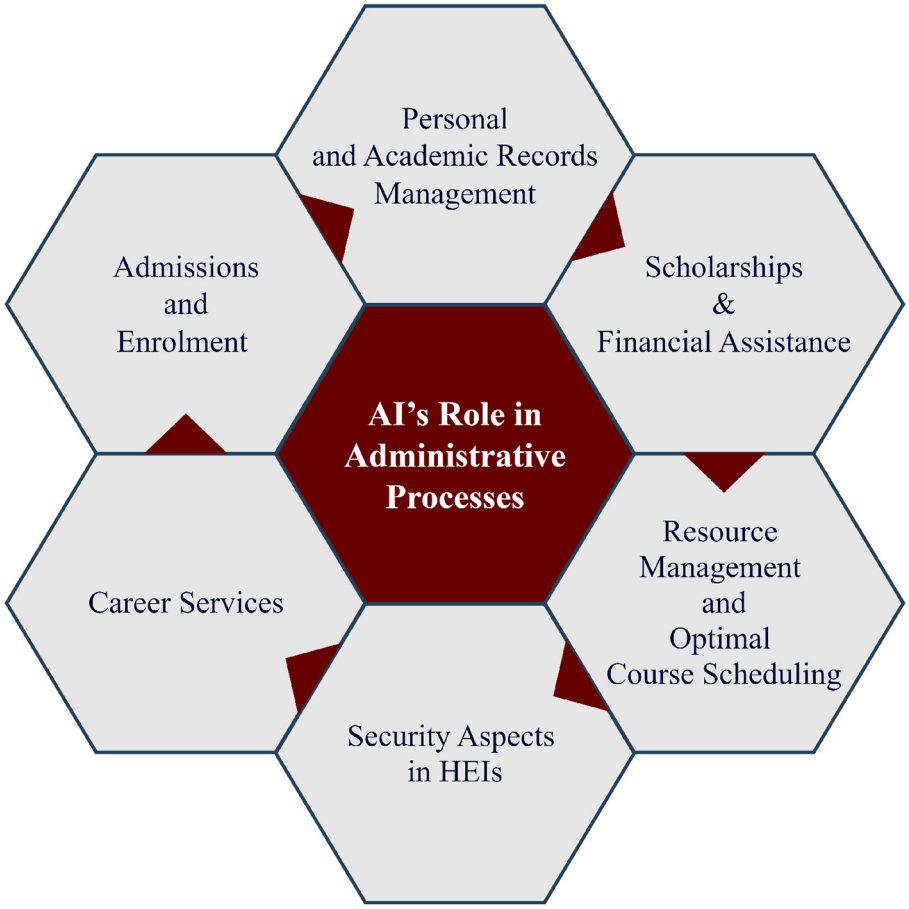

FIGURE 7
Salient aspects of AI's role in administrative process of HEIs.

counseling, to students who have difficulties with personal matters or particular needs to address non-academic complexities.

4 AI's role in administrative processes

AI significantly improves efficiency, decision-making, and resource allocation while simplifying administrative processes in HEIs (George and Wooden, 2023). AI revolutionizes the operations of HEIs (Funda, 2023) by automating monotonous jobs, analyzing large, complicated datasets, and offering insights. Figure 7 demonstrates salient aspects of AI's role in the administrative process of HEIs, and Figure 8 explains the advantages and challenges of employing AI for the administrative processes of HEIs. Lastly, this section elaborates the AI's roles, advantages and challenges in HEIs' administration as follows.

4.1 Admissions and enrolment in HEIs

AI-driven systems handle applications load and process these applications in a short time, retrieving and evaluating applicant data (Oladele, 2023) according to predetermined standards in HEIs. AI systems based on Natural Language Processing (NLP) tools evaluate essays and assessments. AI-based predictive models estimate a student's success through early intervention, explore the possible outcomes (Farhood et al., 2024) and predict suitable measurements for improvement. The admissions process is enhanced using AI-driven chatbots, which interact with potential students (Tritscher and Schlögl, 2023), responding to their multiple queries about classes, degree requirements, costs, student growth (Shoaib et al., 2024) and help with follow-ups. Moreover, by analyzing applicant demographics and histories, AI systems assist institutions in fairly and equitably (Barnes and Hutson, 2024) achieving their diversity and inclusion objectives to maintain diversity in HEIs.

4.2 Student's personal and academic records management in HEIs

In student information systems, AI reduces human error and enables administrative staff to perform various constructive duties by automating data entry, verification, and updates. Document management solutions facilitate swift access to information and compliance with HEI rules and regulations by making it simpler to retrieve, archive, and arrange records. This also protects and limits unauthorized access to students' PII.

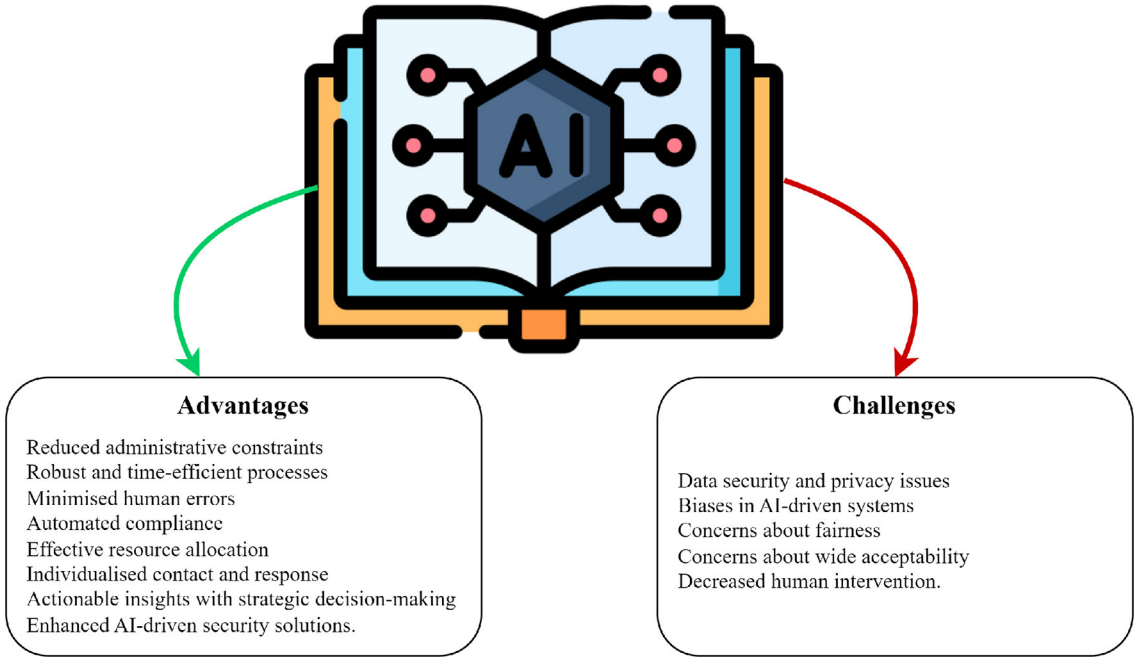

FIGURE 8
Advantages and challenges of AI in administrative processes of HEIs.

4.3 Scholarships and financial assistance

AI streamlines and improves the evaluation of financial assistance applications by evaluating academic standing, income, and other factors (Chisom et al., 2023). AI-based algorithms assist HEIs in identifying irregularities or frauds in financial data to lower the number of fraud cases (Kanagaraj, 2020), which also affect the HEIs' reputation (Utkirov, 2024). These algorithms can also predict internal and external financial aid needs, which aids in better budget planning for educational institutions.

4.4 Resource management and optimal course scheduling

AI-based optimal scheduling tools are automated to assign various facilities, such as rooms, maintain schedules, and avoid clashes (Taye et al., 2023). These schedules are maintained according to student enrolment, course requirements, and availability of different resources (Alam, 2022a). The automated mechanism can also predict the demand for faculty, equipment, and facilities, enabling organizations to manage resources effectively.

4.5 Security aspects in HEIs

AI lowers expenses and enhances sustainability by optimizing energy (Sutjarittham et al., 2019) use, maintenance planning, and space use throughout campus facilities. These systems are based on real-world scenarios and lessen the threats (Dunant et al., 2021) caused by natural and artificial calamities. The surveillance cameras and systems improve campus security by identifying illegal entry, odd activity, or possible threats. AI-driven resource allocation and privileged access management also decline and limit the impact of overall hazards (Dunant et al., 2021) and risks identified in the risk assessment (Tchassem, 2024) of resources from the department to the whole institution level.

4.6 AI-based career services

AI assists career services in providing customized job suggestions by matching students' academic accomplishments, interests, and talents (Sathish et al., 2024) with possible employment prospects [82]. AI-driven technologies monitor the professional development (Westman et al., 2021) of former students and encourage them to interact with the school through tailored messages (Makinde et al., 2024a), boosting their engagement and contributions.

4.7 Advantages and challenges of AI in administrative processes of HEIs

AI reduces administrative constraints on employees and speeds up processes (Parycek and Novak, 2024) by automating time-consuming operations like data input, application processing, and record keeping. It minimizes human error-causing blunders and the risk of bad reputation for HEIs, resulting in more dependable

data processing with regulatory compliance in HEIs (Hina et al., 2019), which raises the accuracy of documents and reports. By giving institutions insights into resource demands, AI enables them to distribute resources efficiently, such as teachers, classrooms, and financial assistance, limiting waste and enhancing service. Students and applicants benefit from more individualized contact and robust response times. AI allows human personnel to manage more complicated and individualized student demands (Alam, 2021) by promptly responding to their multiple enquiries in real time. From budget allocation to enrolment projection, AI evaluates vast amounts of institutional data to produce actionable insights that enhance planning and strategic decision-making (Garcia and Adams, 2023). Lastly, AI-driven security solutions improve safety by enhancing monitoring capabilities and instantly notifying personnel of any threats or data and Information Systems (IS) breaches.

AI depends on large volumes of data that contain private student information, i.e., PII (Mita, 2022). This raises concerns about data security and privacy (Aswathy and Tyagi, 2022) because breaches or exploitation may undermine student trust and result in legal repercussions. Thus, it is imperative to ensure data privacy and cybersecurity aspects. AI models may inadvertently introduce biases if trained on outdated data. This raises concerns about prejudice and fairness and may result in judgments about admissions, financial assistance, or resource distribution that unfairly target particular demographic groups (Chinta et al., 2024). AI systems necessitate hefty infrastructure, training, and technology investments. Many institutions may find the initial expenditures prohibitive, particularly if they lack the requisite funding or technological knowledge and proficiency (Oladele, 2023). The richness and quality of data are essential to AI's efficacy. Outdated or inaccurate data might produce faulty insights, which lowers the accuracy of judgments made by AI. Staff members frequently need to adjust and undergo cultural changes while using AI. Teachers and administrators may be resistant to these changes (Selwyn, 2019) because they are unsure how AI will affect their jobs. If AI is used excessively, it may decrease human contact in administrative procedures (Robert et al., 2020), giving the organization an impersonal appearance. Therefore, to keep the atmosphere friendly and encouraging, it is essential to maintain a balance between automation and human judgment.

5 AI integration and role of responsible strategic leadership

The most crucial responsibility of university leadership is to address the technological, moral, cultural, and resource issues related to AI adoption coherent with educational principles and objectives. To get support from stakeholders around the university, leaders must present the advantages of AI in an open and accountable way (Zheng and Webber, 2023). Ethical and sustainable AI adoption must be facilitated and integrated through developing an astute strategic plan. Leaders must cultivate an institutional culture receptive to testing and assessing novel AI technologies. Initiatives such as AI skill development training programs and rewards for pilot participation may encourage adaptability (Zheng and Webber, 2023). Additionally, leaders must ensure diversity in AI design teams to reduce algorithmic bias. Assessing possible unequal consequences on excluded populations requires formal assessments of AI systems (Hagerty and Rubinov, 2019). Thirdly, leaders must reserve funds, personnel, infrastructure, and governance systems for deploying AI. A specialized AI oversight committee is essential to guarantee consistency with institutional principles (Cihon, 2019). Leaders should form alliances with peer universities to exchange best practices on the ethical use of AI in HEIs. Visionary leadership is essential to steer AI responsibly in a way that promotes education while respecting human values. Therefore, in HEIs, prioritizing education or research, visionary leadership entails foreseeing future developments and coordinating efforts to promote long-lasting change. A visionary approach to AI integration guarantees that technology promotes long-term institutional goals, values, and social advancement focused on current demands. Figure 9 demonstrates the integration of AI and the role of responsible strategic leadership in HEIs.

5.1 Effective leadership frameworks

Developing strong leadership and ethical frameworks is crucial for teaching, research, and administration when AI is integrated into HEIs. HEIs require leadership frameworks (Khalifa et al., 2023) to navigate problems, encourage innovation, and ensure their relevance in a robust global environment. A strong leadership framework (Ruben et al., 2023) combines ethical stewardship, collaborative governance, flexibility, and strategic vision to accomplish institutional objectives (Sharma and Sharma, 2021). Whereas, through ethical frameworks, AI applications are guaranteed to protect human rights (Díaz-Rodríguez et al., 2023), be consistent with institutional values, and advance sustainable and equitable results. Acceptance and integration of AI follow the phases of awareness, assessment, experimentation, and implementation as outlined in Everett Rogers' Diffusion of Innovations Theory. This emphasizes how crucial technology-oriented leadership (Rorink, 2024) is in adopting, integrating, and administrating AI tools. Purpose-oriented leadership creates a vision that supports the HEI's goals of advancing research, education, and social impact with a strategic focus (Doussineau et al., 2021) that defines priorities that correlate with innovation, operational effectiveness, and academic quality. This results in collaborative decision-making by including teachers, staff, students, and other stakeholders' involvement and promotes diversity at all leadership and decision-making levels. It also ensures that choices and procedures are explained in an authentic, understandable and accountable manner.

A leadership framework for HEIs (Ruben et al., 2023) considers various factors to satisfy the particular requirements of academic institutions, such as academic, operational, strategic and community leadership. Academic leadership (Leal Filho et al., 2020) promotes interdisciplinary research, encourages curricular innovation, and maintains academic standards (Dopson et al., 2019). However, operational leadership strives to manage institutional resources effectively and sustainably (Iqbal and Ahmad, 2021). These include managing human

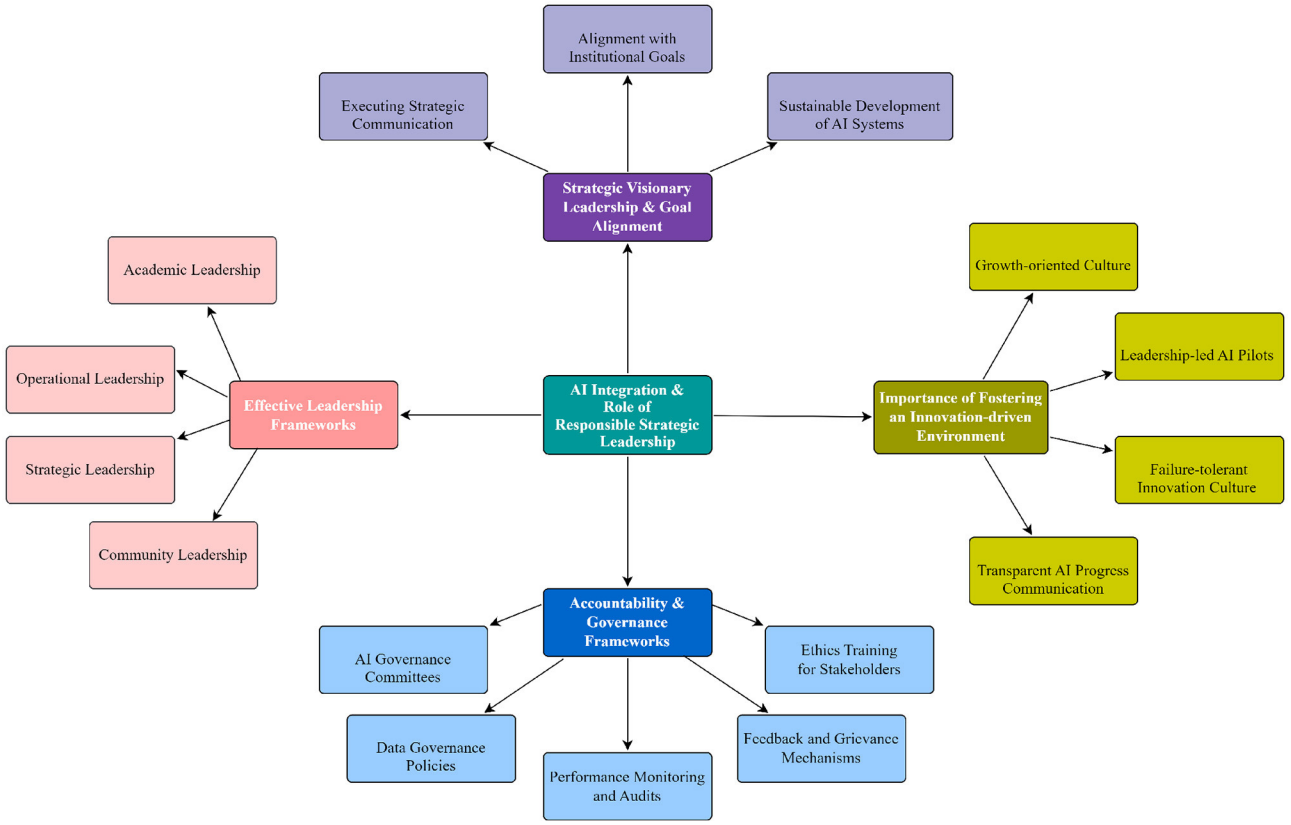

FIGURE 9
AI integration and role of responsible strategic leadership.

resources, technology, infrastructure, and budgets to guarantee efficient operations. Strategic leadership (Samimi et al., 2022) entails creating long-term plans that address social demands, technical breakthroughs, and worldwide trends. Community leadership increases the HEI's credibility by forming alliances with businesses, governments, and local communities (Shyiramunda and van den Bersselaar, 2024). Ethical leadership in HEIs guarantees accountability, transparency, and equity (Gonçalves, 2024). In HEIs, transparency is essential to fostering confidence in AI systems. HEIs ensure stakeholders can understand and access AI decisions and procedures using comprehensible justifications for their results, particularly in high-stakes contexts like financial aid distribution, grading, and admissions. Accountability guarantees that HEIs and stakeholders (Padro et al., 2023) accept accountability for AI effects on HEIs, i.e., information dissemination about the data sources, training procedures, planned uses and defined roles.

5.2 Strategic visionary leadership and goal alignment

The strategic mission of an HEI must correlate with the AI integration. Establishing a clear strategy for attaining HEI success requires objective alignment (Zabalawi and Aftimos, 2024). The leadership must create strategies for AI adoption and integration that are practical, feasible, and in line with the long-term objectives of the university. In HEIs, visionary leadership (Devika, 2024) entails foreseeing future trends, promoting innovation, and coordinating technology developments with institutional ideals. A clear, forward-thinking strategy (Asagba and Oshebor, 2024) is necessary to integrate AI into research, education, and administration while preparing institutions for long-term sustainable practices and implications. This results in multidisciplinary collaboration, AI-powered discovery, rapid insights, virtual classrooms, predictive analytics, and personalized learning experiences. AI in research has the potential to speed up and deepen disciplinary insights, promote interdisciplinary cooperation, and reveal patterns in intricate datasets (Górriz et al., 2020). Furthermore, AI can boost stakeholder participation, decision-making, and operational efficiency in administration. To sum up, to guarantee accountability and transparency, HEIs need to execute strategic communication, connect with institutional principles, and give priority to the sustainable development of AI systems.

5.3 Importance of fostering an innovation-driven environment

HEIs' leadership must establish an atmosphere that supports AI pilots, encourages experimentation, and prepares faculty and

staff to accept AI-driven changes to cultivate an innovation-ready culture successfully. Lack of knowledge, a fear of becoming redundant, or worries about the moral ramifications are common causes of resistance to change (Gkrimpizi and Magnisalis, 2023). Strategic leadership (Samimi et al., 2022) that develops AI capabilities and synchronizes institutional objectives with human-centered innovation is necessary to address these challenges. Thus, it should foster an institutional culture that values inquiry, flexibility, and lifelong learning. Leaders should actively participate in AI pilot projects and provide an example of creative behavior. Faculty and staff may encourage innovation without penalizing failures by establishing a safe environment for experimenting. AI prototypes and pilots may test concepts, get insights, and improve implementation tactics. Resources and funds must be reserved for investigating AI tools pertinent to their roles. Feedback loops must be established to gather information from pilot initiatives and incorporate the knowledge gained into more comprehensive plans. For AI to reach its full potential, cooperation and interdisciplinary initiatives must be encouraged (Dwivedi et al., 2021). AI projects should be co-designed by interdisciplinary teams. Cross-departmental communication and invention sharing can be facilitated by collaborative platforms. To foster trust, AI must be in line with institutional ideals. Academic achievement, diversity, inclusiveness, and equity should be given top priority in an ethical AI charter. It is also critical to regularly communicate the goals, developments, and results of AI initiatives. AI has changed research and learning, among other aspects of education.

Assessments of faculty and staff members with current AI literacy levels, surveys, audits, and role-based requirements analyses are all necessary to develop AI competencies. This can be achieved by offering training courses and workshops, certification courses, learning laboratories and professional growth opportunities. Identifying early adopters or tech-savvy faculty members who may serve as mentors for peers can also be employed to establish peer learning and mentorship networks. HEIs must also ensure that the opinions of academics and staff are considered while developing AI policies and initiatives.

5.4 Accountability and governance frameworks

AI-driven practices in HEIs pose significant challenges in terms of ethical responsibility, transparency, and regulatory compliance. AI systems must be transparent and effectively convey to stakeholders their capabilities, constraints, and decision-making procedures to guarantee ethical practices (Felzmann et al., 2020). AI governance mechanisms, i.e., AI Governance Committees that supervise AI strategy, implementation, and ethical issues, must be formed and implemented. These committees must include students, academics, administrators, technologists, and external specialists. The committees must assign positions for AI supervision, such as Chief AI Officer (CAIO) and AI Ethics Officers, to guarantee adherence to legal requirements and HEI principles.

Data governance policies must be developed to ensure responsible data management used in AI applications. These policies should include data access controls, quality assurance, access restrictions and lifecycle management (Janssen et al., 2020). Performance monitoring and audits should be implemented to evaluate AI performance and outcomes. Feedback and grievance mechanisms should be established, allowing stakeholders to report issues or provide feedback on AI systems. Ethics training for stakeholders, such as training for professors and staff, seminars for students, leadership development, collaborative policy creation, stakeholder engagement, openness in governance procedures, and open access rules, should foster a culture of accountability. AI in HEIs must be flexible (Chan, 2023) and compliant with regulations. To ensure the ethical use of AI in HEIs, compliance with national and international laws, including UNESCO's AI ethics guidelines, the Family Educational Rights and Privacy Act (FERPA), and the General Data Protection Regulation (GDPR), is essential. All institutional stakeholders should also have access to AI through public reporting and open access rules.

6 AI-driven future implications and transformations in HEIs

AI integration in HEIs may revolutionize significant areas, such as research, teaching, learning, and administration, resulting in more developed, inclusive, adaptable, and future-ready institutions. AI can leverage SOTA technologies (Pedro et al., 2019) and accentuate continuous development to make education effective, comprehensive, and productive. In addition to addressing issues such as data privacy, equity, and ethical concerns, HEIs can promote collaboration between educators, technologists, and legislators (Pechenkina, 2023). This calculated approach guarantees that, in an AI-driven future, education will continue to be a vital component of societal progress. A detailed explanation of these implications and transformations is as follows.

6.1 AI-based emerging technologies

Real-world scenarios can be simulated in Virtual Reality (VR) environments driven by AI (Shirazi et al., 2024), allowing and promoting experiential learning. Students can investigate complex systems, historical locations, or virtual labs without physical limitations. For instance, medical students could use risk-free VR simulations to practice surgeries. Augmented Reality (AR) provides experiential learning opportunities by superimposing digital data on actual environments (Akpan, 2024). AI algorithms in AR tools can tailor instruction, changing the degree of difficulty according to a student's development (Hernandez-de Menendez et al., 2020). Thus, engineers, architects, and healthcare professionals may benefit from this technology. AI-driven intelligent systems can examine student's academic history, hobbies, and labor market trends to provide individualized career guidance. AI chatbots or virtual advisors can offer assistance with job applications, skill development, and career planning. When combined with AI, blockchain technology (Alam, 2022b) guarantees safe, unchangeable online records of academic accomplishments. The ease with which employers can confirm qualifications lowers the administrative load and fraud. The system

has the potential to facilitate micro-credentialing for continuous education. Campus-based IoT devices (Samancioglu, 2022) with AI integration can track facility management, energy consumption, and attendance. AI-driven IoT data analytics can increase campus safety and optimize resource allocation. Smart classrooms can automatically adjust settings (such as temperature and lighting) according to student preferences.

6.2 AI-based continuous enhancement

AI can evaluate data from institutional operations to optimize procedures, such as resource management, course scheduling, and admissions. HEIs can predict issues like enrolment patterns (Tariq, 2024) or resource unavailability through AI-driven predictive analytics (Khan and Mahade, 2024). AI algorithms are continuously improved to guarantee increased accuracy in administrative work, learning analytics, and student assessments. The efficacy of AI-driven solutions can be improved through frequent feedback loops involving educators and students (Katiyar and Tiwari, 2024). AI-powered adaptive learning systems can offer individualized feedback, pacing, and content delivery. By providing staff and students with real-time support, virtual assistants can increase accessibility and engagement. HEIs can modify their curricula (Mohamed Hashim and Matthews, 2022) and methodologies to satisfy changing industry and societal demands due to AI's capacity to analyse global trends. For example, AI-powered simulations enable students to be inclined to cutting-edge disciplines like climate science or quantum computing.

6.3 AI-based enhanced research accomplishments

AI-Assisted Research Accomplishments for HEIs are significant accomplishments or standards that HEIs strive to reach by incorporating AI into their research environments. An institution's advancements in improving research quality, teamwork, creativity, and worldwide impact are frequently reflective (De Wit, 2019). AI can ensure that HEIs remain relevant by expediting the implementation of state-of-the-art (SOTA) educational research. Tools for research discovery and plagiarism detection driven by AI can improve academic integrity and creativity. Establishing specialized AI research labs with powerful computers, data storage, and cutting-edge AI tools can promote advancements in computer vision, big data analytics, and NLP (Harris et al., 2024). Developing AI education initiatives for students, faculty, and researchers may increase the ability to conduct interdisciplinary research by fusing AI with conventional domains such as the social sciences, engineering, and medicine. Developing or implementing AI tools to support data analysis, hypothesis development, and experiment design can boost precision and reproducibility (Ahmed et al., 2020) while expediting research workflows. AI may increase grant-writing success rates, discover funding opportunities, promote large-scale initiatives and increase research funding. AI-driven research results in real-world settings to tackle societal issues like healthcare, education, and climate change may exhibit the HEIs' dedication to innovation and societal wellbeing (Ramkissoon, 2024). Based on institutional research, launching spin-offs or start-ups with an AI focus can stimulate entrepreneurship and open up new business prospects. AI-driven research (Madanchian and Taherdoost, 2024) stimulates engagement with International AI research networks by participating in international AI consortiums and cooperative research projects. Lastly, creating innovative AI-based teaching can integrate educational findings with research findings to use AI for individualized learning and teaching support, which may result in improved student outcomes and instruction quality.

6.4 Current real-world examples of AI integration in HEIs

We explored AI-driven future implications for HEIs, supported by real-world examples and empirical evidence. Emerging technologies like intelligent virtual assistants, real-time performance tracking tools, and advanced predictive analytics systems (Rehan, 2023) will continue to shape the educational landscape. Continuous enhancement through AI can be seen in tools like Coursera, which evolves its recommendations based on changing user behavior, and Microsoft Azure, which refines interventions based on updated engagement metrics. These examples substantiate AI's potential to enhance research accomplishments and institutional strategies (Delello et al., 2025). Future advancements could also include integrating AI into strategic planning, enabling HEIs to remain agile in responding to societal and technological changes.

We present some examples of AI tools successfully implemented in HEIs globally to contextualize theoretical claims with real-world applications. For instance, IBM Watson for Education has been used to personalize learning experiences by leveraging its cognitive computing capabilities to analyse student performance, identify learning gaps, and provide tailored recommendations. This tool exemplifies how AI can enhance student outcomes by facilitating data-driven decision-making in educational contexts. Similarly, platforms such as Coursera and Duolingo employ machine learning algorithms to adapt to individual learner needs, optimizing course delivery and language acquisition. These practical applications demonstrate how AI can transform educational processes, validating theoretical frameworks on integrating AI in teaching and learning. Empirical evidence also highlights the use of AI in administrative processes within HEIs. For example, Georgia State University implemented an AI-powered chatbot, Pounce , to improve student engagement and reduce summer melt by answering student queries and sending reminders about deadlines. This initiative reportedly increased enrolment retention rates, showcasing the tangible benefits of AI in addressing institutional challenges. Another example is the University of Murcia in Spain, which adopted AI tools to automate grading and administrative processes, reducing faculty workload and enhancing efficiency with accuracy. These cases validate theoretical claims about the potential of AI in streamlining administrative tasks are supported by practical outcomes in real-world scenarios.

Moreover, documented case studies from HEIs worldwide provide insights into AI integration. For instance, the Open University in the United Kingdom uses predictive analytics to identify students at risk of dropping out and provide timely interventions (Saxena and Parivara, 2025). In Australia, Deakin University has integrated IBM Watson into its student services to offer 24/7 support (Scheepers et al., 2018), addressing queries related to enrolment, course selection, and campus resources. These examples contextualize theoretical discussions, emphasizing the transformative role of AI in improving both academic and administrative processes. Thus, AI's integration with a positive impact on HEIs globally is witnessed, and with wide acceptability, AI will improve the academic, administrative, and leadership of HEIs.

7 Conclusion and discussion

AI offers enormous transformative opportunities in HEIs, but responsible integration and implementation are crucial. The power of AI not only brings automation but also enhances human potential and administrative processes. It empowers educators to inspire and nurture the next generation of thinkers. However, collaborations with the relevant stakeholders and partnerships with AI experts and other educational institutions are significant in addressing the opportunities and challenges that AI brings with it. Additionally, emphasizing and prioritizing ethical considerations, including accountability, fairness, and protecting data privacy, are important aspects of responsible AI integration. As AI continues to evolve and transform, the leadership and higher education stakeholders need to collaborate, stay up-to-date, and be willing to adapt to this robust AI-driven landscape of HEIs. While challenges exist, AI promises a bright future where learning is adaptive, personalized, and truly understood, resulting in a more inclusive learning environment. With this evolving nature of AI, we intend to pursue further research efforts, maybe to explore how AI could facilitate addressing the pressing issues of access, diversity, and inclusion (ADI) in HEIs. Integrating AI in HEIs incorporates undeniable benefits, but a comprehensive understanding requires addressing the significant challenges accompanying this transformation. One of the foremost challenges is resistance to change, as faculty, staff, and administrators may be apprehensive about adopting new technologies. This resistance often stems from a lack of familiarity with AI tools, concerns about job displacement, and the fear of being rendered obsolete by automation. Additionally, ethical considerations pose a critical challenge in ensuring responsible AI implementation. For instance, biases embedded in AI algorithms can perpetuate inequalities, disproportionately affecting underrepresented groups in admissions, grading, or hiring decisions. The lack of transparency in AI decision-making processes, often called the "black box" problem, complicates accountability and trust in AI systems. Furthermore, concerns over data privacy and security are paramount, as the collection and analysis of vast amounts of sensitive student and institutional data make HEIs attractive targets for cyberattacks. Leadership must also navigate the delicate balance between innovation and the potential for over-reliance on technology, which could undermine human-centric aspects of education, such as personalized mentorship and critical thinking development. Addressing these challenges requires proactive strategies, including comprehensive training programs to build confidence in AI tools, establishing robust governance frameworks to ensure ethical use, and fostering a culture of collaboration and inclusivity that embraces AI as a complement rather than a replacement for human efforts. Only by addressing these multifaceted challenges can HEIs harness AI's potential responsibly and sustainably.

Author contributions

SK: Writing – original draft, Writing – review & editing. SH: Conceptualization, Writing – review & editing, Writing – original draft. HH: Writing – review & editing, Writing – original draft. RS: Methodology, Writing – original draft, Writing – review & editing. NA: Supervision, Writing – original draft, Writing – review & editing. MA: Funding acquisition, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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Glossary

Term	Definition
Artificial intelligence (AI)	The simulation of human intelligence by machines, including learning, reasoning, and problem-solving, often applied in HEIs for tasks such as data analysis, personalized learning, and automation.
AI-powered assessment	Automated systems that evaluate student performance using algorithms, often employed for grading essays, quizzes, and assignments efficiently and objectively.
AI-supported peer learning	Platforms that connect students with peers for collaborative learning, utilizing AI to match participants based on skill level or learning goals.
AI-driven insights	Actionable recommendations generated by AI systems from analyzing patterns in student data, helping institutions improve strategies and outcomes.
Academic records management	The use of AI to organize, secure, and analyse student academic histories, facilitating better decision-making for curriculum design and advising.
Automated Feedback Systems	Tools that provide instant feedback on student submissions, such as assignments or code, enabling continuous learning.
Adaptive learning platforms	AI-powered systems that tailor educational content and activities to individual students' learning needs, pacing, and preferences, improving engagement and outcomes.
AI governance	The framework of policies and guidelines ensuring the ethical and responsible use of AI within institutions.
Augmented reality (AR) and virtual reality (VR)	AI-enhanced technologies that provide immersive learning experiences, such as virtual lab simulations or historical reenactments.
AI-enhanced research tools	AI systems that aid researchers in literature review, data analysis, and hypothesis generation, improving efficiency and innovation.
Collaborative AI platforms	Systems that facilitate group projects and discussions by using AI to suggest relevant resources or optimize team composition.
Chatbots	AI-driven virtual assistants designed to handle queries and provide information in real time, commonly used in admissions and student support systems.
Data-driven decision-making	A process where institutional strategies and policies are informed by insights derived from analyzing large datasets using AI tools.
Ethical AI	Principles and practices ensuring AI systems operate transparently, without bias, and align with human values, especially critical in decision-making processes like admissions and grading.
Engagement metrics	Data points such as login frequency, time spent on tasks, and participation rates, tracked and analyzed by AI to measure student involvement.
Early warning systems	AI systems that alert administrators and faculty to students who are at risk of academic failure or disengagement.
Gamification in education	The integration of AI-driven game elements into educational platforms to enhance motivation and engagement.
Interactive learning environments	AI-powered systems that provide immersive learning experiences, such as virtual labs or simulations, to enhance understanding.
Intelligent tutoring systems (ITS)	AI-based tools that simulate a one-on-one tutor, providing personalized feedback, instruction, and learning pathways.
Learning analytics	The measurement and analysis of student data, such as engagement and performance, to enhance learning experiences and outcomes.
Natural language processing (NLP)	A subfield of AI enabling machines to understand, interpret, and generate human language, used in HEIs for grading, content summarisation, and language tutoring.
Plagiarism detection tools	AI systems like Turnitin that analyse written submissions to identify copied content and ensure academic integrity.
Predictive analytics	The use of historical data and AI algorithms to predict future outcomes, such as identifying students at risk of dropping out or underperforming.
Personalized learning	An AI-enabled educational approach where content delivery and pacing are tailored to each student's needs, preferences, and progress.
Recommendation systems	AI algorithms that suggest relevant content or resources to users, such as courses, research materials, or extracurricular activities.
Lifecycle management	AI systems that support students throughout their educational journey, from enrolment to graduation and beyond.
Engagement monitoring	AI systems that track student activity, participation, and interactions to identify trends and areas requiring attention.
AI-powered simulations	AI-powered tools that create realistic scenarios for skills training, such as medical procedures or engineering tasks.
Virtual assistants	AI tools, like Siri or Google Assistant, that automate routine tasks such as reminders, scheduling, and answering FAQs in HEIs.
Virtual labs	AI-enabled platforms that simulate lab experiments, allowing students to practice and learn without physical equipment.