A Systematic Literature Review of the Artificial Intelligence Role in Transformative Academic Advising: A Study of AI Applications in Higher Education

Khawla Albinali[1, 2], Noorminshah A. Iahad[3], Ahmad Fadhil Yusof[1], and Anwaar Abdulla[2]

[1]Faculty of Computing, Universiti Teknologi Malaysia, Johor, Malaysia, [2]Technical Programs, College of Applied Studies, University of Bahrain, Bahrain, [3]Faculty of Management, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia
Corresponding Author Email: khawla.albinali@gmail.com

Abstract

This systematic literature review examines the role of Artificial Intelligence (AI) in transformative academic advising within higher education. The integration of AI in academic advising has the potential to revolutionize the traditional manual processes and enhance student outcomes. The review explores the key applications of AI in academic advising, focusing on chatbots, recommender systems, and predictive analytics. Chatbots provide personalized self-service platforms for students, addressing their queries and assisting with course selection. Recommender systems utilize text-mining techniques to generate module recommendations based on students' interests and learning goals. Predictive analytics employ machine learning algorithms to forecast student grades and identify at-risk students. The benefits of incorporating AI systems in academic advising include personalized recommendations aligned with students' strengths and objectives, as well as improved efficiency and accuracy in providing guidance. However, challenges such as language barriers and ethical considerations need to be addressed. The findings contribute to a comprehensive understanding of the current state of AI in transformative academic advising.
Keywords: Artificial Intelligence, AI, Academic Advising, Higher Education, Chatbots, Recommender Systems, Predictive Analytics

Introduction

Artificial Intelligence or AI has become a game-changing technology that could transform sectors, including higher education according to Lahoud et al. (2023). AI involves creating machines to carry out tasks that typically require human intellect, such as learning, problem-

solving, and decision-making. In the realm of higher education, the use of AI has garnered interest for its potential to improve academic advising processes and boost student outcomes.

Academic advising is vital in helping students navigate their paths by offering guidance on course choices career directions and overall academic achievements as highlighted by Bilquise, Ibrahim, and Salhieh (2023). Traditionally reliant on methods and in-person interactions between students and advisors academic advising has seen changes with the advancements in AI technology.

The incorporation of AI, into advising brings about advantages. By analyzing data sets encompassing students' academic performance, interests, and career aspirations AI-driven systems can offer tailored recommendations and support according to Lahoud et al. (2023).

These systems can improve the efficiency and effectiveness of 1430ounselling by automating tasks allowing advisors to dedicate more time to addressing students' complex needs. Various approaches have been developed for utilizing AI in advising in education. Although the potential of integrating AI in advising is significant it is crucial to conduct a literature review to grasp the current state of research in this field. This literature review aims to offer an overview of how AI influences transformative advising in higher education settings. Through an analysis of existing studies, this review will delve into the applications of AI in advising highlighting their advantages, limitations, and challenges encountered. This analysis Is guided by the following research questions:
1. What are the AI key applications for academic advising in higher education?
2. What benefits and challenges exist in incorporating AI systems to support transformative Academic Advising in Higher Education?

Methodology
The systematic literature review in this study was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Moher et al., 2009). The PRISMA methodology provides a structured approach to ensure transparency and rigor in the review process. To identify relevant studies, electronic databases (Scopus and Google Scholar) were searched, resulting in a total of 635 records. Duplicate records were then removed, reducing the number to 415. The titles of the publications were screened, considering only those with titles containing the predefined search keywords (AI and Higher Education), leading to 238 relevant records. Language screening was performed, restricting the review to English studies, 8 non-English publications were excluded, leaving 230 records. Further screening involved considering studies published no earlier than 2020. Twenty-eight records were excluded, resulting in a dataset of 202 records. The investigation focused on peer-reviewed journal articles and conference papers, excluding 45 records that did not fall into these categories. Full text availability was assessed, and 100 records were excluded due to unavailability. A total of 57 records with full texts were included for further evaluation. These selected records were then assessed for their relevance to the study's scope of academic advising, resulting in 23 records that directly addressed the research objectives. The selection and rejection criteria based on the PRISMA presented in Figure 1.
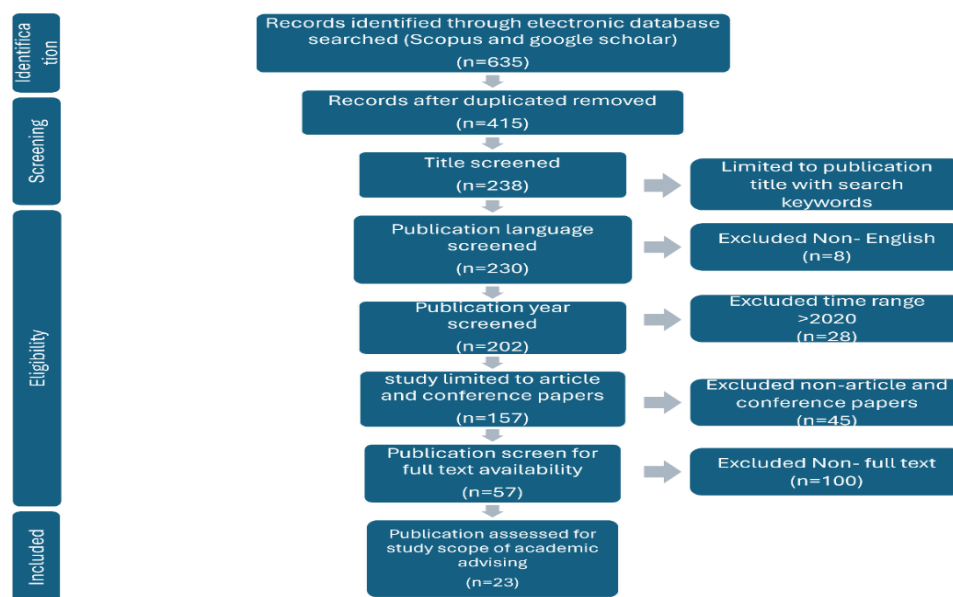
Figure 1. PRISMA Flowchart

Results

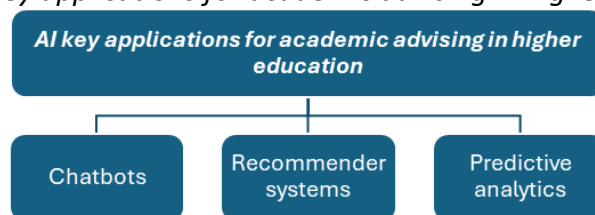*RQ1. What are the AI key applications for academic advising in higher education?*

Figure 2. AI Key Applications

As illustrated in Figure 2, the systematic literature review revealed that Chatbots, recommender systems, and predictive analytics are AI technologies that support transformative advising outcomes in higher education.

Chatbots: Several studies have highlighted the increasing role of chatbots in advising within education as a significant application of AI. By incorporating AI technology these advising chatbots can provide personalized adaptable self-service platforms for students. They assist with tasks like choosing courses sharing information on policies and addressing student queries (Bilquise, Ibrahim, & Shaalan, 2022; Kuhail et al., 2023). These chatbots utilize intelligence and natural language processing to mimic conversation and enhance institutional interactions while enhancing service quality and supporting student success, in higher education settings (Kuhail, Al Katheeri, Negreiros, Seffah, & Alfandi 2023; Akiba & Fraboni 2023). Some of the real-world practices of chatbots that have been designed and examined was explored by Akiba and Fraboni (2023), they compiled a list of frequently asked questions by students and used ChatGPT to generate responses. Their evaluation found that ChatGPT provided high-quality answers in an authoritative yet supportive tone, particularly excelling in general and open-ended career-related questions. Similarly, Bilquise, Ibrahim, and Shaalan (2022) developed a bilingual chatbot using AI and natural language processing (NLP) to support students in both English and Arabic. Their chatbot answered queries related to college and academic matters, significantly improving student satisfaction by providing

accessible and immediate support in multiple languages. Additionally, Kuhail et al. (2023) designed and implemented MyAdvisor, a chatbot-based advising system, and evaluated its usability through semi-structured interviews and field observations. MyAdvisor showed significant usability and usefulness, efficiently providing personalized academic advice based on real user needs.

Recommender systems: Atalla et al. (2023) introduced an intelligent recommendation system that integrates graph theory, performance modelling, and machine learning to automate academic advising. This system includes a course grade modelling and prediction workflow to forecast student performance to create study plans for students. The study demonstrated that this system effectively improves the advising process by predicting students' performance and optimizing curriculum design. Similarly, Hagemann, O'Mahony, and Smyth (2023) conducted a live-user evaluation involving undergraduate students using a visual module recommender system. Through pre-study and post-study surveys, the study assessed the system's impact on students' understanding of module options and decision-making. The visual module recommender system provided an interactive and explanatory interface, significantly aiding students in making informed decisions about their module choices. The study illustrated the employment of data mining techniques to generate modules to individuals based on their interests and learning goals to help undergraduate students make decisions about their academic journey generate module representations. Lahoud et al. (2023) explored approaches of recommender systems for guiding university majors and career paths, underscoring the value of these systems in aiding students in selecting paths and career domains. Similarly, Al Twijri, Luna, Herrera, and Ventura (2022) introduce a search algorithm for mining course recommendations based on sequences, tackling the challenge of long-term course planning and enhancing student retention rates with tailored study plans. Loucif, Gassoumi, and Negreiros (2020) discussed the utilization of machine learning methods for automated course recommendations by considering students past academic performance, the system provided more personalized and beneficial course recommendations. Tawafak et al. (2020) reviewed various student advisory systems and highlighted best practices in using expert systems to provide efficient advising based on pre-requisite courses, majors, and time emphasizing the potential of expert systems in advising for delivering tailored suggestions and support based on student profiles and objectives.

Predictive analytics: Korchi (2023) delved into the use of machine learning algorithms and deep neural networks to forecast student grades for intervention. The study examined models and methods to predict student performance effectively, showcasing the potential of these models in estimating future academic success and identifying students at risk at an early stage (Korchi, 2023). Sandouka (2023) explored the creation of an AI-based academic advising system that employs association rules to guide course placement decisions based on students' skill proficiency scores. This system aims to enhance or substitute test results by analysing data and suggesting appropriate course placements.

RQ2. What benefits and challenges exist in incorporating AI systems to support transformative Academic Advising in Higher Education?
As shown in Figure 3, Studies investigating the application of AI in academic advising have shown promising results, indicating its potential to revolutionize the way students receive guidance and support in their academic journey. For instance, Lahoud et al. (2023) explored

recommender systems tailored to university major and career domain guidance, the hybrid KB RS approach combined with user-based collaborative filtering, ontology, and case-based reasoning (CBR) provided personalized recommendations effectively. Akiba & Fraboni (2023) demonstrated the utility of ChatGPT in providing
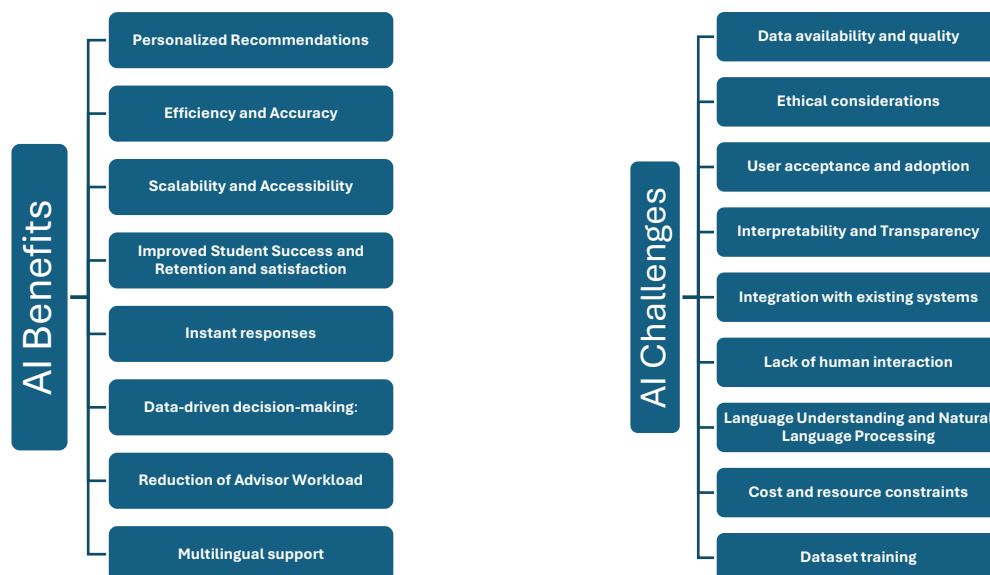

Figure 3. AI Benefits and Challenges

high-quality, supportive responses to frequently asked questions by students. Additionally, research by Al-Twijri et al. (2022) proposed evolutionary algorithm (ES)2P effectively identified emerging sequential patterns in student course enrolment data. This method provided accurate course index and study plan recommendations. Moreover, Korchi et al. (2023) highlighted the use of machine learning and deep learning algorithms to predict student grades accurately. Furthermore, (Kuhail et al., 2023) designed and implemented MyAdvisor, a chatbot-based advising system, that was carefully evaluated for usability. The system was based on real advising scenarios and showed promising results in terms of user engagement and satisfaction. Moreover, Habte (2022) designed and implemented an AI-based advising system called HESAS using natural language processing (NLP) and dialogue management techniques. The system effectively advised students on curricula and extra-curricular issues and achieved promising results in evaluation measures like precision, recall, and F1 score. These studies collectively underscore the transformative potential of AI in academic advising. The following list of benefits is derived from synthesizing findings from various studies to provide a comprehensive understanding of AI's impact as an advising tool in higher education.

Personalized Recommendations: According to several studies the integration of AI in Academic Advising enhances the quality of guidance provided to students, aligning it with their unique strengths and objectives (Lahoud et al., 2022; Akiba & Fraboni, 2023; Al-Twijri et al., 2022; Abdelhamid & Alotaibi, 2021; Bilquise et al., 2023; Assiri, AL-Ghamdi, & Brdesee, 2020; Maghsudi et al., 2021; Assiri et al., 2021; Korchi et al., 2023; Sandouka, 2023; Kuhail et al., 2023; Atalla et al., 2023; Loucif et al., 2020; Hagemann, O'Mahony, & Smyth, 2023; Tawafak et al., 2020; Habte, 2022; Alotaibi & Alshehri, 2023; Briggs, 2021). These AI systems

use student profiles, interests, career aspirations, academic records, and other relevant data to provide tailored guidance and support, enabling students to make more informed decisions about university majors and career paths. AI systems can deliver personalized recommendations for course selection, study plans, and academic opportunities, enabling to provide more personalized guidance and assist in designing well-structured and tailored long-term academic plans for students, ensuring a coherent and efficient educational journey (Maghsudi et al., 2021).

Efficiency and Accuracy: AI in Academic Advising streamlines processes, automates routine tasks, and enhances the accuracy of recommendations. AI systems are capable of processing and analysing large amounts of information rapidly, enabling them to provide prompt and accurate responses to students' queries. Academic advising chatbots, in particular, contribute to streamlined services by automating repetitive tasks and minimizing the time and effort required for manual advising processes. Moreover, AI systems automate tasks like tracking students' performance and suggesting appropriate courses. AI systems minimize errors that humans are prone to, thus increasing the reliability of academic advising (Akiba & Fraboni, 2023; Abdelhamid & Alotaibi, 2021; Bilquise et al., 2023; Loucif, Gassoumi, & Negreiros, 2020; Hagemann et al., 2023; Tawafak et al., 2020; Briggs, 2021; Lahoud et al., 2022).

Scalability and Accessibility: AI systems have the potential to scale personalized advising services by effectively handling large volumes of student data and providing recommendations to a significant number of students simultaneously without facing long wait times. Additionally, chatbots and AI-enabled systems offer 24/7 accessibility (Akiba & Fraboni, 2023; Al-Twijri et al., 2022; Bilquise et al., 2022; Maghsudi et al., 2021; Kuhail et al., 2023; Hagemann et al., 2023; Habte, 2022; Abdelhamid & Alotaibi, 2021; Assiri et al., 2020; Loucif et al., 2020; Tawafak et al., 2020; Briggs, 2021).

Improved Student Success, Retention and satisfaction: AI systems enhance students' academic pathways, engagement, skill development, and knowledge acquisition, ultimately leading to increased success and retention rates. AI systems consider students past academic performance and abilities to identify potential challenges or areas where additional support may be needed, they also, provide timely support and guidance throughout students' academic journeys. AI-powered predictive models enable educational institutions to identify at-risk students early and provide timely support (Bilquise et al., 2023; Assiri et al., 2021; Atalla et al., 2023; Loucif et al., 2020; Habte, 2022; Bilquise et al., 2022; Al-Twijri et al., 2022; Bilquise & Shaalan, 2022; Korchi et al., 2023; Sandouka, 2023). Chatbots emulate conversations, making the advising experience more interactive and engaging for students (Kuhail et al., 2023). Furthermore, AI systems analyse longitudinal data to identify patterns in student performance and learning gains, which informs academic advisors about the sequence of general education courses that support essential skills, enhancing learning outcomes for students (Sandouka, 2023).

Instant responses: Incorporating AI systems in Academic Advising facilitates instant responses, improving the accessibility and efficiency of the support provided to students (Bilquise et al., 2022; Chiu et al., 2022; Stojanov, 2023; Kuhail et al., 2023).

Data-driven decision-making: AI systems process vast quantities of data and provide data-driven insights, enabling academic advisors to make informed decisions regarding students' academic paths, course selection, and career planning. AI systems provide institutions with valuable insights into student needs, trends, and challenges. AI systems also serve as effective decision support tools for advisors and facilitate timely interventions by monitoring students' progress and identifying potential issues or challenges early on. (Assiri et al., 2020; Korchi et al., 2023; Tawafak et al., 2020; Alotaibi & Alshehri, 2023; Briggs, 2021; Bilquise et al., 2022; Bilquise & Shaalan, 2022; Atalla et al., 2023; Stojanov, 2023; Lahoud et al., 2022; Habte, 2022; Abdelhamid & Alotaibi, 2021). The incorporation of AI systems with a human-in-the-loop approach allows for the dynamic collection of user feedback, enabling updates to the knowledge base and improving the accuracy of recommendations (Atalla et al., 2023).

Reduction of Advisor Workload: AI chatbots, by handling common and repetitive queries, alleviate the workload of academic advisors. These AI chatbots automate routine tasks and provide efficient support to students, thereby reducing the workload of advisors. Additionally, AI-based tools automate tasks such as identifying at-risk students, recommending courses, and answering student queries (Bilquise et al., 2022; Assiri et al., 2021; Bilquise & Shaalan, 2022; Habte, 2022). AI systems can capture, store, and share the knowledge of advisors, facilitating knowledge dissemination within the institution and easing the advising process for new advisors (Bilquise & Shaalan, 2022).

Multilingual support: Bilingual AI-driven chatbots have the capability to cater to students' needs in multiple languages accommodating diverse student populations and ensuring effective communication and support for students who may have different language preferences or backgrounds (Bilquise et al., 2022).

Despite the above-mentioned promising potential of AI in enhancing academic advising in higher education, several significant challenges must be addressed to optimize its effectiveness. For example, Akiba & Fraboni (2023) noted that while ChatGPT can provide high-quality general advice, it lacks the ability to offer individualized guidance due to its inability to access specific student information. Assiri et al. (2020) highlighted gaps in the implementation and evaluation of intelligent academic advising systems, emphasizing the lack of qualitative analysis and empirical evaluation in many proposed models, which creates a disconnect between theoretical advancements and practical, reliable solutions. Additionally, Kuhail et al. (2023) identified challenges in ensuring the scalability and sustained effectiveness of chatbot-based advising systems, noting that evaluations were conducted with small sample sizes and did not measure long-term usage effects. Furthermore, Habte (2022) indicated that although AI-based advising systems demonstrated promising results, they did not address issues such as adaptability to different educational contexts and scalability, reflecting a common challenge in ensuring that AI systems can be widely applicable and scalable across diverse educational settings. Below are the challenges and limitations identified through this systematic literature review:

Data availability and quality: The effectiveness of AI systems in academic advising relies heavily on the availability and quality of data. Obtaining comprehensive and reliable data on students' academic performance, demographics, and other relevant factors can be challenging. Incomplete or inaccurate data is another challenge encountered. Furthermore,

ensuring the quality, integrity, and privacy of the data used by these systems is a complex task that necessitates careful management to maintain student trust and comply with data protection regulations. (Korchi et al., 2023; Atalla et al., 2023; Hagemann et al., 2023; Lahoud et al., 2022; Al-Twijri et al., 2022; Abdelhamid & Alotaibi, 2021; Bilquise & Shaalan, 2022). ChatGPT and other AI-powered chatbots, may provide somewhat superficial answers that lack depth or comprehensive understanding of complex academic advising issues (Stojanov, 2023). Furthermore, the text generated by AI systems may not always be consistent or logical, and there is a possibility of contradictory responses, which can be confusing for students seeking reliable guidance (Stojanov, 2023).

Ethical considerations: The adoption of AI systems in academic advising raises ethical concerns related to privacy, data security, algorithmic bias, and the potential replacement of human advisors (Abdelhamid & Alotaibi, 2021; Bilquise et al., 2022; Bilquise & Shaalan, 2022; Assiri et al., 2020; Chiu et al., 2022; Korchi et al., 2023; Sandouka, 2023; Atalla et al., 2023; Loucif et al., 2020; Tawafak et al., 2020; Habte, 2022; Briggs, 2021; Akiba & Fraboni, 2023; Alotaibi & Alshehri, 2023). AI algorithms may inadvertently introduce biases in the recommendation process, potentially reinforcing existing inequalities (Lahoud et al., 2022).

User acceptance and adoption: Reservations, concerns, and resistance to relying solely on AI systems for academic guidance among students and academic advisors may raise (Lahoud et al., 2022; Abdelhamid & Alotaibi, 2021; Bilquise et al., 2022; Bilquise & Shaalan, 2022; Sandouka, 2023; Kuhail et al., 2023; Hagemann et al., 2023; Tawafak et al., 2020; Habte, 2022; Alotaibi & Alshehri, 2023; Briggs, 2021; Bilquise et al., 2023).

Interpretability and Transparency: AI systems often operate as black boxes, making it challenging to understand the underlying decision-making process (Al-Twijri et al., 2022).

Integration with existing systems: Educational institutions may need to invest in infrastructure, resources, and ongoing maintenance to incorporate AI systems into existing advising processes. Moreover, there is a need for institutions to provide technical expertise, resources, and training to educators (Abdelhamid & Alotaibi, 2021; Bilquise et al., 2023; Bilquise & Shaalan, 2022; Chiu et al., 2022; Assiri et al., 2021; Korchi et al., 2023; Habte, 2022; Briggs, 2021). Integrating AI applications with existing educational systems, processes, and workflows can be challenging due to technological, organizational, and cultural barriers (Assiri et al., 2020; Bilquise et al., 2021).

Lack of human interaction: The absence of face-to-face interactions and the personal connection that human advisors provide can be a drawback of chatbot-based advising systems (Kuhail et al., 2023). Some students may value the empathy, emotional support, and personal consideration of their individual needs that human advisors offer (Tawafak et al., 2020).

Language Understanding and Natural Language Processing: Developing chatbots that can understand and process natural language in different contexts, including colloquial and specialized language used in academia, remains a challenge (Bilquise et al., 2022).

Cost and resource constraints: The development and maintenance of AI systems can be expensive, necessitating financial resources, technical expertise, and infrastructure support. This cost factor can be a barrier, particularly for resource-constrained institutions and regions (Assiri et al., 2020; Chiu et al., 2022).

Dataset training: One of the challenges in utilizing chatbots for transformative academic advising is the need for adequate and sufficient training datasets to ensure accurate and meaningful interactions (Kuhail et al., 2022).

Discussion
AI Key Applications for Academic Advising in Higher Education
The systematic literature review revealed that chatbots, recommender systems, and predictive analytics are significant applications of artificial intelligence (AI) in academic advising within higher education (Bilquise, Ibrahim, & Salhieh, 2023; Hagemann, O'Mahony, & Smyth, 2023; Korchi, 2023). Chatbots, powered by AI and natural language processing, offer personalized, autonomous, and flexible self-service platforms for students, assisting with tasks such as course selection and providing information on academic policies (Bilquise et al., 2023; Kuhail et al., 2023). They simulate human conversation, improve service quality, and contribute to student success (Kuhail et al., 2023; Akiba & Fraboni, 2023). Additionally, recommender systems utilize AI techniques to provide guidance to students for module selection, major exploration, and career planning (Hagemann et al., 2023; Lahoud et al., 2023). These systems leverage text mining and association rules to assist students in making well-informed decisions about their academic paths (Lahoud et al., 2023). They enhance the academic advising experience, support distance learners, and enable customized study plans (Al-Twijri et al., 2022; Maghsudi et al., 2021). Moreover, predictive analytics, using AI algorithms, facilitate early interventions and personalized support for students (Korchi, 2023; Sandouka, 2023). They predict student grades and offer insights for effective course placement decisions (Korchi, 2023; Sandouka, 2023). By providing timely assistance and personalized interventions, predictive analytics contribute to improved student outcomes. Integrating AI applications such as chatbots, recommender systems, and predictive analytics has the potential to transform academic advising in higher education, enhancing student-centred support services, improving service quality, and promoting educational equity (Akiba & Fraboni, 2023; Lahoud et al., 2023).

To effectively integrate AI applications with existing academic advising systems, institutions can adopt a range of strategies tailored to their specific needs. One approach involves developing AI-powered chatbots that cater to a diverse student population, including multilingual support, as demonstrated by Akiba and Fraboni (2023), who found that ChatGPT effectively generated high-quality responses to advising queries. Also, above mentioned chatbots can be deployed for routine queries, as implemented by Bilquise, Ibrahim, and Shaalan (2022), was able to improve student satisfaction by offering instant support in multiple languages, English and Arabic in their case. Institutes can adopt User-centric design principles, as developed and implemented by Kuhail et al. (2023) in their advising system called MyAdvisor, providing instant support and personalized advice based on real advising scenarios to their students.

Another approach is by Implementing intelligent recommendation systems, like the system introduced by Atalla et al. (2023), which integrated graph theory, performance modelling and machine learning to various data sources, including student performance data, curriculum information, and career paths, providing comprehensive recommendations, while using explainable AI techniques to ensure that the recommendations are transparent and understandable to students. Institutes can implement algorithms to analyse student course enrolment data, such as those proposed by Al-Twijri et al. (2022), to help optimizing course recommendations. Personalized education can be achieved through AI/ML systems, as reviewed by Maghsudi et al. (2021), which tailor content to individual student needs. Furthermore, utilizing machine learning algorithms can predict student performance, as shown by Korchi et al. (2023), enabling early intervention for at-risk students. Also, integrating AI with knowledge management systems, as suggested by Assiri et al. (2021), would enhance the quality and relevance of academic advising. Ensuring organizational readiness and employing change management strategies, as explored by Briggs (2021), are crucial for successful AI integration. These strategies, combined with regular updates and stakeholder engagement, can significantly enhance the effectiveness of AI-driven academic advising systems.

Advantages and Benefits of Current AI Applications
Incorporating AI systems in Academic Advising offers benefits such as personalized recommendations, efficiency, scalability, and ultimately improving student success, retention, and satisfaction. These advantages align with the evolving needs of higher education to provide enhanced support throughout students' academic journeys.

One significant benefit is the provision of personalized recommendations. AI systems utilize student data, such as profiles, interests, and academic records, to provide tailored guidance. By analysing individual needs and goals, AI systems can offer personalized recommendations for course selection, study plans, and academic opportunities. This empowers students to make informed decisions aligned with their strengths and objectives. AI systems also assist academic advisors by providing data-driven insights, enabling more personalized guidance (Lahoud et al., 2022; Akiba & Fraboni, 2023; Al-Twijri et al., 2022; Abdelhamid & Alotaibi, 2021; Bilquise et al., 2023).

Efficiency and accuracy are another benefit of AI in Academic Advising (Akiba & Fraboni, 2023; Abdelhamid & Alotaibi, 2021; Bilquise et al., 2023; Loucif et al., 2020; Hagemann et al., 2023; Tawafak et al., 2020; Briggs, 2021). Cited studies highlighted to the ability of AI systems to process and analyse large amounts of information quickly, delivering prompt and accurate responses. By automating tasks like data analysis, scheduling, and personalized recommendations. Additionally, AI allows advisors to focus on more complex and personalized advising tasks by automating repetitive tasks. AI systems also track students' performance and suggest appropriate courses, saving time for both students and advisors (Loucif, Gassoumi, & Negreiros, 2020).

Scalability and accessibility are crucial benefits of AI in Academic. AI-powered tools, such as chatbots, offer readily available advising support, overcoming barriers of traditional services. AI systems can handle large volumes of student data and provide recommendations to numerous students simultaneously, enhancing scalability. This scalability enhances

institutions' ability to provide effective advising support to a growing student population. Chatbots and AI-enabled systems provide 24/7 accessibility, reducing the barriers of time, location, and traditional office hours, ensuring prompt support without long wait times, thus enhancing the responsiveness of academic advising services (Akiba & Fraboni, 2023; Al-Twijri et al., 2022; Bilquise et al., 2022; Maghsudi et al., 2021; Kuhail et al., 2023; Hagemann et al., 2023; Habte, 2022; Abdelhamid & Alotaibi, 2021; Assiri et al., 2020; Loucif et al., 2020; Tawafak et al., 2020; Briggs, 2021). Furthermore, AI enhances engagement, leading to increased satisfaction and retention rates. AI systems possess the capability to analyse large amounts of data, enabling the identification of patterns and trends that form evidence-based decision-making in academic advising. By continuously training and refining predictive models based on historical data, proactive advising interventions and enhanced educational outcomes can be gained (Korchi et al., 2023). Likewise, by offering accurate and timely recommendations, AI systems help students make informed decisions about their course selections, leading to increased engagement, motivation, and reduced dropout rates ultimately improving academic performance and graduation rates (Abdelhamid & Alotaibi, 2021; Bilquise et al., 2023; Maghsudi et al., 2021). Another benefit of AI system is, bilingualism, chatbots offers multilingual support contribute to more inclusive and accessible academic advising experiences, promoting equity and engagement among students from various linguistic backgrounds (Bilquise et al., 2022).

Challenges and Limitations of Current AI Applications
These challenges and limitation revolve around the availability and quality of data ethical considerations, acceptance by users, clarity and openness integration with systems and the absence of interaction (Korchi et al., 2023; Atalla et al., 2023; Hagemann et al., 2023; Lahoud et al., 2022; Al Twijri et al., 2022; Abdelhamid & Alotaibi 2021; Bilquise & Shaalan 2022).

A significant challenge highlighted in this analysis is the concern regarding the accessibility and reliability of data. AI systems heavily depend on trustworthy data to offer recommendations and support to students (Korchi et al., 2023; Atalla et al., 2023; Hagemann et al., 2023; Lahoud et al., 2022; Al Twijri et al., 2022; Abdelhamid & Alotaibi 2021; Bilquise & Shaalan 2022). However, obtaining information can be complex in environments due to privacy issues, fragmented data sources and inconsistent data collection methods (Chiu et al., 2023; Kuhail et al., 2023). Incomplete or inaccurate data might result in unreliable forecasts compromising the efficacy of AI systems, in guidance. To make AI systems work effectively organizations need to deal with issues concerning the accuracy of data as privacy and security concerns.

Ethical considerations also emerged as a significant challenge in incorporating AI systems in academic advising. The adoption of AI systems raises concerns regarding bias and fairness. Studies have highlighted these concerns, Lahoud et al. (2023) underscored potential biases in dataset collection, limiting the generalizability of recommender systems for university major and career guidance. Similarly, Assiri et al. (2020) emphasized the need for fairness in AI-based advising systems to prevent disproportionate benefits or harms to any group. Alotaibi and Alshehri (2023) also stressed the necessity of addressing biases to ensure fair learning outcomes in higher education. To mitigate these issues, fairness-aware and unbiased algorithms should be implemented while conducting regular audits. Also, using datasets that

include all students' demographics for training AI models. Not to forget the need to engage all stakeholders coming from different background in the system design and evaluation.

Another significant ethical concern in integrating AI into higher education is transparency and accountability. AI systems often operate as black boxes, making it challenging to understand the underlying decision-making process (Al-Twijri et al., 2022). Bilquise et al. (2023) emphasized the need for transparency in AI tools to ensure that students understand how decisions are made, fostering trust in these systems. Similarly, Chiu et al. (2023) and Kuhail et al. (2023) highlighted the importance of transparency in AI systems to build trust and ensure accountability. To address these issues explainable AI techniques should be adopted, ensuring users are well-informed about the AI-generated recommendations while a continuous monitoring and evaluation of system performance is taking place.

Another critical concern with the use of AI in education is the privacy and data security. Assiri et al. (2021) and Habte (2022) emphasized the need for strong data protection measures in intelligent academic advising models to safeguard student information. Several recommendations can be adopted to address this sensitive matter. Institutions should implement robust data protection measures, including encryption and access controls, to secure student information. Compliance with relevant governmental data protection regulations is also essential to ensure legal and ethical standards are met. Additionally, providing students with control over their data, including the ability to opt out of data collection if desired, is crucial for maintaining trust and transparency. Regularly updating security protocols to protect against emerging threats further enhances data security.

Lastly, the use of AI systems raises ethical concerns of potential of replacing human advisors entirely. It is important to understand the necessary of incorporating human oversight to ensure quality and integrity in academic advising. Abdelhamid and Alotaibi (2021) and Loucif et al. (2020) underscore the importance of integrating human expertise with AI systems to maintain high standards of advising. Similarly, Briggs (2021) emphasizes that human oversight is critical for ethical advising practices, especially in dynamic educational environments. To address these concerns, it is essential to implement AI systems that ensures final decisions are always involve human judgment. Advisors should receive comprehensive training on effectively using AI tools while adhering clear guidelines for the ethical use of AI in academic advising. Additionally, fostering continuous collaboration between AI developers and academic advisors will help ensure that AI systems meet the real-world needs of students. By adopting these measures, institutions can leverage AI to enhance academic advising while upholding ethical standards and maintaining the critical role of human oversight.

User acceptance and adoption pose substantial challenges in implementing AI systems in academic advising. Building user acceptance, trust, and familiarity with AI-based advising systems is crucial for their successful implementation. Factors such as resistance to change, concerns about job security, and a lack of trust in the reliability and accuracy of AI recommendations need to be addressed. Institutions should provide training and support to stakeholders and involve them in the design process to enhance acceptance and adoption (Lahoud et al., 2022; Abdelhamid & Alotaibi, 2021; Bilquise et al., 2022; Bilquise & Shaalan, 2022; Sandouka, 2023; Kuhail et al., 2023; Hagemann et al., 2023; Tawafak et al., 2020; Habte, 2022; Alotaibi & Alshehri, 2023; Briggs, 2021; Bilquise et al., 2023). Resistance factors from

stakeholders, including students, faculty, and advisors, who may be skeptical about relying on technology for critical advising tasks need to be addressed (Assiri et al., 2020). Some users may doubt the capabilities of AI systems and hesitant to rely on them for important support, information, and guidance (Bilquise et al., 2023).

A successful adoption of AI technologies in academic advising requires seamless integration with the current infrastructure and information systems of institutions. This integration process may necessitate substantial technical and organizational changes, such as data integration, system compatibility, integration with educational platforms, and training for staff (Sandouka, 2023).

Another challenge highlighted by (Bilquise et al., 2023) was the limited accuracy in understanding natural language, difficulty handling complex student scenarios and the need for Chatbots to be culturally sensitive to address the diverse needs and expectations of students from different cultural backgrounds (Bilquise et al., 2022).

Lastly, implementing and maintaining AI systems can be complex and resource intensive. Institutions need to invest in infrastructure, technical expertise, and ongoing system maintenance to ensure the effectiveness and reliability of AI-based advising systems (Sandouka, 2023). AI systems require regular updates, maintenance, and monitoring to ensure their reliability, performance, and adaptability to evolving student needs and changing academic requirements (Bilquise et al., 2022).

Conclusion

In conclusion, this systematic literature review examined the role of artificial intelligence (AI) in transformative academic advising within higher education. The analysis revealed that AI applications, such as chatbots, recommender systems, and predictive analytics, play significant roles in enhancing student-centred support services, improving service quality, and promoting educational equity.

Chatbots, powered by AI and natural language processing, offer personalized and autonomous self-service platforms for students, assisting with tasks such as course selection and providing information on academic policies. Recommender systems utilize AI techniques to guide students in module selection, major exploration, and career planning. These systems leverage text mining and association rules to provide well-informed recommendations and enhance the advising experience. Predictive analytics, using AI algorithms, facilitate early interventions and personalized support for students, contributing to improved student outcomes.

The incorporation of AI systems in academic advising brings several advantages and benefits. Personalized recommendations based on student data empower students to make informed decisions aligned with their strengths and objectives. Efficiency and accuracy are improved through automated data analysis and prompt responses, saving time for both students and advisors. Scalability and accessibility are enhanced, overcoming barriers of time, location, and traditional office hours. AI systems foster engagement, leading to increased satisfaction, retention, and academic performance.

However, challenges and limitations exist in the implementation of AI applications. Data availability and quality, ethical considerations, user acceptance, interpretability, integration with existing systems, and the lack of human interaction pose significant hurdles. Addressing these challenges, including ensuring data privacy and security, mitigating algorithmic bias, and maintaining a balance between AI and human advisors, is crucial for the successful integration of AI in academic advising.

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