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A systematic review of the utilization of artificial intelligence applications within the educational Oman systems

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ABSTRACT

In the wake of rapid digital transformation and the increasing role of artificial intelligence (AI) in enhancing educational outcomes, this study investigates the integration of AI applications within the Omani educational portal under Oman's Vision 2040. A systematic review was conducted using the Education Resources Information Center (ERIC) database, focusing on peer-reviewed articles published between 2020 and 2024. The six studies were selected for analysis following a rigorous screening process with defined inclusion and exclusion criteria. The findings indicate that AI is currently enhancing personalized learning, enabling data-driven decision-making, and supporting hybrid education platforms in Oman. These developments reflect the educational system's readiness to adopt further AI technologies while directly contributing to the strategic priorities of Oman's Vision 2040. This study provides important insights for decision-makers and educators looking to enhance the incorporation of advanced AI applications, thus revolutionizing educational practices and fostering sustainable national growth.

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1. INTRODUCTION

Technology has become deeply woven into the fabric of human existence, fundamentally transforming how individuals engage socially and economically in modern societies. From facilitating instant communication across the globe to enabling seamless online transactions and remote work, technology has reshaped everyday interactions and economic activities. This pervasive influence underscores the critical need for awareness and mindfulness regarding the technological landscape, recognizing both its benefits, such as increased connectivity and efficiency, and its drawbacks, including privacy concerns and digital dependency. As technology continues to evolve, maintaining a balanced perspective is essential to harness its potential while mitigating its risks [1]. Moreover, technology has influenced every aspect of life, including education, which has experienced significant transformations recently. The conventional classroom, characterized by the blackboard method involving teachers and students, has evolved dramatically. Technology has integrated itself into this process, bringing substantial improvements. Whereas traditional classrooms relied solely on teachers, students, and physical books, modern classrooms now incorporate teachers, students, robots, e-books, laptops, and traditional books. This technological integration has allowed education to transcend physical boundaries through e-lectures and online tutorials [2].

As technological advancements progressed forward, new applications and systems emerged, one of which is artificial intelligence (AI) as the pinnacle of such advancements [3]. Accordingly, AI seeks to create systems with cognitive functions similar to those of humans. Since its inception in the mid-1950s, AI has made significant strides across various fields, from gaming to autonomous robotic surgery, and it continues to advance swiftly. AI-powered machines are now ubiquitous, serving numerous functions across all sectors. In developing countries, AI is extensively utilized in a wide array of daily activities [4]. The integration of AI applications into the Omani educational system through the educational portal has been considered an immense leap forward towards transforming teachers into facilitators of learning and allowing students to place their theoretical knowledge into practice. Additionally, such applications are integrated into the Omani educational system through specified initiatives that are directed towards both teachers and students; given the fact that they can always be directly accessed through the portal in what is known as the "AI monitor" [5]. However, the enhancement of the Sultanate's educational information system, in accordance with this new level of AI integration, remains considerably novel and requires further evaluation to discern and extract its long-term effectiveness and success indicators that affect teachers and students within the education system [6]. Therefore, the lack of sufficient data that evaluates this very novel approach urged me, as a researcher, to conduct the current study.

Accordingly, the literature indeed provides a general basis regarding AI's role in educational improvement all over the world; however, the review does not cover critical dimensions relating to the Omani educational portal. To be precise, it lacks depth on whether or not the Omani educational portal's information system is advanced. While AI applications are discussed broadly, the literature lacks a focused examination of their current utilization within the Omani educational context, particularly in aligning with the goals of hybrid education, library services, and computerized systems such as "Atad" and "Zawity". Furthermore, there is a lack of assessment regarding how these developments in the information system contribute to the realization of the priorities of Oman Vision 2040, including the development of innovation, improvement of digital infrastructure, and a knowledge-based society. These shortcomings indicate the need for an in-depth investigation that is tailored to the specific goals and challenges of the Omani educational landscape. Therefore, this study attempt to specify the scope of the current research by asking a central question: what is the practical effectiveness of AI within the educational system? This question can be answered through the following secondary research questions:

i) What is the extent to which the information system in the Omani educational portal is considered advanced?
ii) What is the extent to which AI applications are utilized in educational portals?
iii) How does the advancement of the information system in the Omani educational portal through the utilization of AI applications achieve the priorities and goals of Oman's 2040 Vision?

2. LITERATURE REVIEW

AI is an artificial system that mimics human intelligence which encompasses a range of methods that enhance the precision, speed, and scale of machine performance, particularly in handling complex and large datasets. These methods enable machines to substitute human performance in various tasks, including decision-making, pattern recognition, and prediction [7]. Similarly, AI is an advanced field of research focused on developing machines that can mimic human behavior, decision-making, and actions [8]. However, it is worth mentioning that although AI is rapidly evolving and holds the potential to significantly enhance and reshape many areas of society, and while it brings excitement, anticipation, and hope, its rapid development and widespread use also raise ethical concerns, fears, risks, and potential dangers [9]. Nevertheless, AI can still be implemented in various domains; including psychology [10], e-commerce [11], and education [12].

Accordingly, AI, a branch of computer science, enables computers to think and make decisions like humans by mimicking human brain functions. This capability significantly influences education by shaping curriculum design, instructional methods, and more. The integration of AI with information and communication technology (ICT) tools is revolutionizing the education sector [13]. Regarding the functions that AI implements as a prominent and novel domain of computer science, the most essential ones can be outlined as [14]: i) learning, methods for recognizing patterns in data, primarily through unsupervised learning, i.e., directly from raw data, and supervised learning, i.e., with human-labeled data; ii) deep learning, this function is considered a subset of supervised learning and relies on artificial neural networks; iii) understanding, techniques for representing knowledge necessary for specific fields like medicine, accounting, and law; iv) reasoning, various forms, including deductive, inductive, temporal, probabilistic, and quantitative reasoning; and v) interacting, collaborating with humans or other machines to perform tasks or engage with the environment.

In this case, AI, as a technology, can be inclusive of specific levels; as it can be categorized into different levels including: i) narrow/weak AI, which operates below human-level intelligence and excels in

specific tasks but lacks versatility; ii) general AI, which matches human-level intelligence across various domains; and iii) artificial super-intelligence, which surpasses human intelligence [15]. Such levels can also be outlined in further detail. Firstly, weak AI refers to machines that lack autonomous consciousness and true intelligence. Current intelligent systems, like facial recognition and voice assistants, are examples of weak AI, as they exhibit human-like intelligence in only specific areas or tasks but not across a broad range of functions [16]. Secondly, general AI refers to systems that possess abilities equivalent to human thinking and judgment, with the flexibility to learn and perform any intellectual task that humans can accomplish [17]. Thirdly, super AI refers to the stage where general AI and strong AI merge, resulting in intelligence and abilities that exceed those of the human brain [18]. Moreover, super AI also includes systems that surpass human intelligence, with the ability to be self-aware and continuously improve themselves. This concept, though futuristic, raises significant ethical and moral concerns [19]. This is because AI-enhanced technologies and tools are increasingly present in education. It is crucial to prepare K-12 students for their future careers and to equip them with the understanding and skills necessary to utilize AI-enhanced technologies effectively [20]. Furthermore, a key feature of AI-enabled tools is personalization, acting as intelligent assistants for students. These systems answer queries, assist with learning, manage assignments, and provide reinforcement materials tailored to each course. Consequently, teachers have a minimal intervention role, primarily serving as facilitators in this AI-enhanced educational process [13].

Consequently, AI has become a valuable tool in today's rapidly changing educational landscape, assisting students in enhancing their writing skills [21]. Thus, it can be indicated that as students increasingly use AI-powered apps in their daily lives, they become more familiar and comfortable with educational tools that incorporate AI [22]. For instance, generative AI can equip students to navigate the swiftly evolving job market, which is increasingly influenced by AI technologies [23]. Furthermore, generative AI can monitor a student's progress and adjust the complexity of problems to provide a sufficient variety of practice, helping the student master the concept effectively [24]. This means that the advancements in AI, machine learning (ML), and natural language processing (NLP) may facilitate the development of a chatbot or voice-bot that can in turn help enhance consultation-provision services for students [25]. This also means that AI has the potential to offer personalized services to various stakeholders. Therefore, countries should strive to advance this trend by integrating these capabilities into higher education [26].

Along with AI applications, the academic achievement of students is also a constant concern for educational institutions. Today, the swift advancement of digital transformation has led to the generation of vast amounts of data through learning management systems (LMS) [27]. This is because a LMS is considered the most effective method for delivering educational content in higher education, providing students around the world with access to high-quality educational materials [28]. Indeed, education is undergoing a significant transformation. Online, virtual, and hybrid learning models have emerged as key components of education and research, prioritizing the integration of technology to enhance learning. By adopting new student-centered educational approaches, it is possible to improve learning outcomes and address issues such as high dropout rates and low academic effectiveness, which is reflected in the ratio of graduates to admissions [29]. AI-powered chatbots and LMS can offer students the resources they require on any topic and help solve their problems. The features of this product include a dynamic front-end, interactive query search, personalized student-centered assessments, and a super user interface [30]. However, it should be noted that effectively integrating AI into a LMS necessitates careful planning and assessment to ensure alignment with educational goals and objectives. By following the outlined steps and thoroughly evaluating various pertinent factors, it is possible to successfully incorporate AI into an LMS, leveraging its potential to enhance both the effectiveness and accessibility of education [31]. Therefore, in the midst of the current advances in the education domain, AI applications can always be used to enhance educational services and learning accretive by integrating them into LMS [32].

In this case, AI applications in the education context are inclusive of the following innovations that can be implemented to help enhance both teachers' and students' instructional and learning skills [33], [34]:

- Intelligent tutoring systems: provide personalized instruction and feedback to students, adapting to their individual learning needs and pacing. Moreover, these systems are a promising integrated educational resource that customizes formal education by providing intelligent instruction and feedback [35].
- Teaching robots: assist in classroom teaching, engaging students with interactive lessons, and providing additional support. Moreover, robotics in education is increasingly attracting the interest of teachers and researchers. Its incorporation in the classroom enables educators to blend four key disciplines: science, technology, engineering, and mathematics (STEM) [36].
- Learning analytics dashboards: offer educators insights into student performance and behavior, helping to identify areas where students may need extra help. Moreover, such dashboards offer educators and students a comprehensive overview of the learning domain [37].

- Adaptive learning systems: customize educational content based on a student's learning progress and preferences, ensuring a tailored educational experience. Moreover, adaptive learning systems tailor instruction to meet the unique learning needs and abilities of each student. These systems have demonstrated positive effects on learning outcomes [38].
- Human-computer interactions: enhance student engagement and learning outcomes through interactive educational software and virtual assistants. Moreover, they can also be improved by enabling machines to recognize a user's emotional state and respond appropriately. This requires text-to-speech systems capable of generating natural, emotionally expressive speech [39].

In the case of the Sultanate of Oman, digital transformation can be seen as the adoption of various technologies to enhance processes and skills. Generally, the primary aim of digital transformation is to increase efficiency and value through innovative practices. In Oman, digital transformation is particularly noteworthy, as it seeks to embrace digital technology and optimize its application in government processes, including the educational system [40]. Moreover, Oman has performed well in the digital competency framework, particularly in investing in technology and preparing for future readiness [41]. Such approach is still being improved by researchers and governmental personnel in the Sultanate. For instance, Al-Bemani *et al.* [42] indicated that AI-driven Gen-Alpha education guidance indicator is a transformative force set to redefine education in Oman, enhancing students' lives and contributing to the country's prosperity. Moreover, study by Syahrin and Akmal [43] examined the perceptions of instructors, students, and administrative staff regarding the role of ChatGPT in Oman's educational setting. The findings concluded that ChatGPT played an instrumental role in refining content, particularly for students, administrative staff, and instructors who were non-native English speakers, as another study by Al-Raimi *et al.* [44] concluded that Omani EFL students most commonly used AI applications like ChatGPT for translating words, phrases, and sentences.

Accordingly, the Omani educational portal utilizes ICT applications and models to improve its information system. For instance, the portal offers an array of data that is openly available for users online, which offers statistical information, facts, and figures about Omani students, teachers, schools, school maps, and other data that is also available upon request, along with other online services that allow users to participate by adding their comments, views, and opinions about the ministry's and portal's efficiency [5]. Moreover, the portal also demonstrates the ministry's educational information system which is inclusive of the following sub-domains and components [5]. Correspondingly, the portal's information system is also inclusive of an AI-based sub-system that is also inclusive of the following services, models, and educational services [5]. Accordingly, the Sultanate of Oman's vision is considered a forward-looking strategy that builds upon the country's past achievements and outlines a comprehensive set of socio-economic policies aimed at transforming Oman by 2040. The Vision also acknowledges the country's progress over the past decades, driven by a strong Omani identity that embraces other cultures, and highlights the need for reliable infrastructure, a modern legislative framework, and well-defined economic relationships. The vision emphasizes leveraging the maturity and sophistication Oman has attained to confidently address future challenges, societal needs, and ambitions. By reflecting on the strategic use of oil revenues to lay the foundation for human development and economic growth, the vision underscores the importance of diversifying the economy away from non-renewable resources towards innovation and knowledge, driven by local, regional, and global dynamics [6].

3. METHOD

The current study used qualitative research as the main methodology through the utilization of systematic review as the main research instrument. Moreover, the studies that were analyzed in this case will all revolved around the use of AI applications on online educational portals in general and the Omani educational portal in particular, and in accordance with specified inclusion and exclusion criteria. Thus, in order to reach decisive answers to the previously outlined research questions, studies in the literature that addressed the utilization of AI within the Omani educational system were analyzed to gain insightful understanding of the current state of AI utilization and the readiness for further improvement on instructional and learning-based levels. As a result, the current study utilized interpretivism as the main research philosophy; in order to provide a path that does not only provide a description of the phenomenon of using AI applications in the Omani educational system but also interpreted the meaning of these phenomenon in terms of the status quo of AI technologies in the Omani education system and the aspects that need to be improved in the future. Furthermore, an inductive approach was used to cohere with such philosophy reinforced with the grounded theory as it aimed to provide an understanding of these aspects using a qualitative approach through systematic review.

Accordingly, a systematic review was a rigorous research method used to synthesize and summarize the results of primary research studies, ensuring that the findings were based on comprehensive and balanced evidence. This approach involved systematically collecting, critically evaluating, and integrating research findings from multiple studies on a specific topic. Moreover, utilizing a structured and transparent

methodology allowed for the minimization of bias and provided a reliable and objective summary of the existing evidence, which informed decision-making and guided future research. This method is particularly valuable in fields such as healthcare and education, where it was essential to base conclusions on a thorough and unbiased examination of the available data [45]. The study instrument, therefore, was represented by the review-research plan which started with determining the inclusion/exclusion criteria, study-filtration flowchart diagram, and the extraction of findings that cohered with the previously formulated research questions.

Accordingly, we utilized the Education Resources Information Center (ERIC) as the main database from which relevant studies were collected, analyzed, and processed in order to extract the findings that answered the research questions of the current study. This was because other databases included studies that cannot be accessed unless a specific sum of monetary subscription fee was paid which proved to be an inconvenient option for me as a researcher. Moreover, the inclusion and exclusion criteria were applied in multiple stages, identification, screening, eligibility, and inclusion.

In Figure 1, the researcher presented the criteria on study inclusion and exclusion about AI applications in educational information systems and platforms. First, the studies needed to have a publication date from the year 2020 onwards and up to 2024. The full papers in PDF format are also desirable for accessibility and comprehensiveness in English. Inclusion and exclusion criteria concerned a significant study of the usage of AI applications in an educational system, having appropriate aims, methods, and results. Peer-reviewed journal articles were considered solely; hence, books, proceedings, and reports were excluded.

A total of 494 articles were initially identified and subsequently narrowed down to 323 according to the publication timeframe. After a thorough screening process utilizing specific inclusion and exclusion criteria, removing studies not pertinent and those that were not peer-reviewed, 6 articles were finally chosen for analysis. The selected studies involved elementary students or middle/secondary school students as only post-secondary or adult educations focusing on Omani Educational Portal under the Ministry of Education was considered.

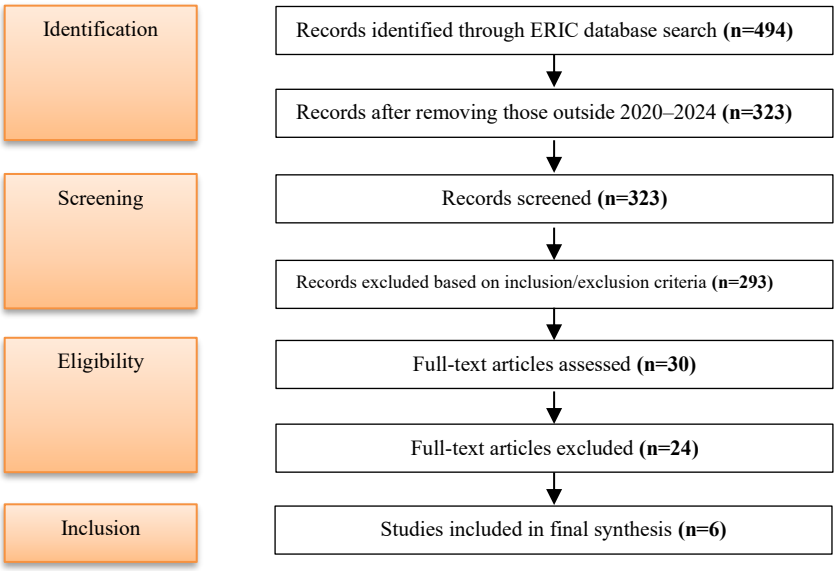

Figure 1. Inclusion and exclusion criteria

4. BIBLIOMETRIC ANALYSIS

Table 1 is the result of a bibliometric analysis, which systematically examines studies on the integration of AI in K-12 education. It organizes key information from selected studies, such as the authors' aims, methodologies, populations, findings, and recommendations. Moreover, the analysis identifies the trends and patterns within the research for improving learning outcomes with AI, embedding computational thinking (CT) into STEM subjects, and applying AI-powered tools such as chatbots and concept maps. The findings underline the potential of AI to improve student engagement and learning outcomes, while recommendations range from curriculum development to gender concerns in AI learning approaches. Therefore, the bibliometric-based analysis of the selected studies can be conducted as in Table 1.

Table 1. Bibliometric analysis

Ref.	Aims	Methodology	Population/sample	Findings	Recommendations
[45]	To provide an overview about how the CT skills of decomposition, pattern recognition, algorithmic thinking, and abstraction can help high school students learn how to solve problems and improve their AI and ML skills.	Qualitative research using document analysis and review of the literature	Studies from the literature	The incorporation of CT within STEM fields, which may enhance the cultivation of ML and AI skills in students, indicates that K-12 curricula and their designers must clearly articulate their objectives while intentionally structuring the integrated STEM experience to meet these aims.	Curriculum designers must clearly express their justification for how a specific CT-integrated STEM experience will yield defined outcomes in AI and ML learning for K-12 students, as well as the methods for assessing these experiences.
[46]	To formulate a curriculum for AI applications in secondary education. The curriculum's learning objective was to enable students to comprehend the application of conversational AI.	Experimental research using pre and post-tests	The 21 secondary school students comprised the control group, while 25 secondary school students constituted the experimental group.	This empirical study suggests that when teachers instruct secondary school students in a conversational AI curriculum, low-achieving males and high-achieving females should engage in project-based learning.	Information processing theory posits that females concentrate on disseminating information and establishing connections among the knowledge they possess.
[47]	Experimental instruction was implemented via the artificial intelligence of things (AIOT) practical course, utilizing the 4D (discover, define, develop, deliver) double diamond framework to structure the curriculum and organize the instructional material, with the aim of assessing students' self-efficacy and learning anxiety.	Mixed method using questionnaires and interviews	A total of 36 first-year students from a senior high school	The findings indicate that self-efficacy significantly enhances both the perceived usefulness and perceived ease of use for users. Learning anxiety does not significantly predict the perceived ease of use or perceived usefulness of flipped learning through online e-learning. The perceived ease of use and perceived usefulness positively influence the prediction of behavioral intention in flipped teaching utilizing online digital teaching materials.	Future researchers are advised to investigate the interconnections among self-efficacy, perceived usefulness, and perceived ease of use within online e-learning contexts.
[48]	To examine the correlation between the utilization of dynamic and interactive mathematical expressions (DIME) maps and student learning outcomes, encompassing self-efficacy and the capacity to comprehend and retain connections among physics concepts.	Experimental research using pre and post-tests	A total of 31 high school students participated in a summer camp focused on STEM.	The DIME map system, an AI-generated concept map, significantly improves student learning outcomes akin to traditional concept maps, yet eliminates the necessity for teacher involvement.	The DIME map system has additional implications for future research, particularly regarding the emergence of connections between the text designed to teach mathematics and symbolic representations for students.
[49]	To create a chatbot that minimizes the volume of emails and phone calls, while alleviating the repetitive human task of responding to identical or similar inquiries.	Quantitative research using questionnaires	A total of secondary school students	79.5% of students concurred that the chatbot was user friendly; 89.6% affirmed that the chatbot's interface was intuitive. The 89.7% of respondents believed the chatbot functioned effectively and provided substantial assistance in addressing their camp or cyber related inquiries. The 75.9% of participants expressed satisfaction with the chatbot.	It is necessary to enhance the chatbot for general inquiries in the cybersecurity domain to enable it to deliver standardized responses to a broader range of knowledge-based questions regarding cybersecurity.
[50]	Examines K-12 educators' perceptions of cross-reality (XR) tools for data visualization and the integration of sensor data from the built environment into classroom curricula.	Quantitative research using surveys and questionnaires	A total of 33 primary and secondary educators participated in a 2-day university hosted professional development workshop for teachers.	Among the three disciplines (physics, engineering, and design), elementary and middle school educators perceive the greatest value in employing sensors within the built environment and XR interfaces for data across all three areas, whereas high school educators seem predominantly focused on the utility of these technologies for imparting fundamental principles of physics.	To comprehend how educators and learners can utilize XR data from intelligent buildings to cultivate specific competencies related to big data and STEM, as well as to identify the structural limitations and opportunities for implementing such XR experiences.

5. RESULTS

5.1. What is the extent to which the information system in the Omani educational portal is considered advanced?

Upon analyzing the Omani educational portal, it was concluded that AI applications and features are already used to enrich the educational information system. Firstly, AI technologies within the Omani educational portal enable adaptive learning experiences tailored to individual student needs and learning styles. Through personalized recommendations and feedback, AI algorithms can identify areas of weakness and provide targeted support, fostering a more effective and engaging learning environment for students of diverse abilities. Secondly, AI-powered analytics tools within the educational portal facilitate data-driven decision-making processes for educators and administrators. By analyzing large volumes of student performance data, AI can identify trends, predict outcomes, and inform instructional strategies and resource allocation, ultimately leading to more informed and effective educational policies and practices. Next, the Omani educational portal utilizes ICT applications and models to enhance its information system, offering a variety of openly available data online, including statistical information about Omani students, teachers, schools, and maps, along with interactive features for users to contribute comments and opinions. In addition, the portal's AI-based sub-system includes features like AI monitor for continuous performance evaluation of students and teachers, performance-enhancement tools to improve analytical and linguistic skills through AI-based tutoring, and support services for educational materials and workshops on AI applications for learning purposes. Moreover, the portal provides hybrid education through platforms like "Mandhara" for grades 1-4 and Google Classrooms for grades 5-12, enabling virtual classes, activities, tests, communication, and assignment tracking, tailored to specific school cycles. Lastly, the portal offers library services with books, journals, reports, images, diagrams, and figures to aid students, teachers, and researchers, along with computerized systems like "Atad" and "Zawity" that allow students to manage their learning, take tests, and gain access to educational material.

5.2. What is the extent to which AI applications are utilized in educational information systems?

According to the previously reviewed studies, it can be concluded that AI applications can enhance educational information systems by offering advantageous features. Firstly, AI-powered analytics tools enable data-driven decision-making processes for educators and administrators. By analyzing large volumes of student performance data, AI can identify trends, predict outcomes, and inform instructional strategies, leading to more efficient resource allocation and improved educational policies and practices. Secondly, AI applications in educational information systems, such as AI-generated concept maps like the DIME map system, have been shown to enhance student learning outcomes by presenting complex concepts in a visually accessible format, reducing cognitive load, and facilitating personalized learning experiences. Next, AI technologies enable personalized and adaptive learning experiences tailored to individual student needs and learning styles. For instance, in conversational AI curriculum, AI can recommend different learning approaches based on students' achievement levels and gender, such as project-based learning for low-achievement males and high-achievement females, and experiential learning for high-achievement males and low-achievement females. In addition, AI applications in educational information systems can also be utilized to teach students about cybersecurity. For example, chatbots can be programmed to provide information on cybersecurity best practices, answer questions about online safety, and simulate real-world cybersecurity scenarios for students to learn from. Lastly, integration of AI applications in the educational information system supports STEM education by enhancing the teaching and learning of CT within STEM disciplines. AI technologies facilitate the development of ML and AI competencies in students, preparing them for future careers in STEM fields.

5.3. How does the advancement of the information system in the Omani educational portal through the utilization of AI applications achieve the priorities and goals of Oman's 2040 Vision?

Based on the reviewed literature and studies, we conclude that the utilization of AI applications achieves the priorities and goals of Oman's 2040 Vision in the following manner. Firstly, education, the integration of AI applications in the educational portal aligns to promote lifelong learning and inclusive education. This can occur through the provision of personalized and adaptive learning experiences; AI helps cater to the diverse needs and learning styles of students, fostering continuous learning opportunities. Additionally, AI-powered tools enhance scientific research by facilitating data analysis and information retrieval, contributing to the advancement of a knowledge-based society and nurturing competitive national talents. Secondly, economic diversification, AI applications in education contribute to economic diversification by equipping students with skills relevant to innovation, knowledge, and technology. Moreover, this can be achieved by incorporating AI into the curriculum; students gain exposure to emerging technologies and develop critical thinking, problem-solving, and digital literacy skills essential for the

knowledge-based economy. This emphasis on innovation and technology prepares students to contribute to a diversified and sustainable economy, enhancing competitiveness and achieving fiscal sustainability. Next, labor market and employment, the adoption of AI applications in education prepares students for the dynamic labor market by providing them with the skills and competencies needed to adapt to knowledge, technological, and economic changes. Through personalized learning experiences and exposure to AI-powered tools, students acquire in-demand skills that align with industry needs, making them more attractive to employers. Furthermore, by fostering a culture of innovation and lifelong learning, AI in education promotes continuous skill development, enabling individuals to thrive in a rapidly evolving job market. In addition: private sector empowerment, the integration of AI applications in education empowers the private sector by fostering a skilled workforce capable of driving economic growth and innovation. Accordingly, equipping students with advanced technical skills and digital literacy using AI in education enhances the talent pool available to private sector organizations, enabling them to leverage emerging technologies and remain competitive in the global economy. Consequently, AI-powered research and development initiatives in educational institutions can lead to the creation of new products, services, and industries, further stimulating private sector growth and entrepreneurship.

6. DISCUSSION

Based on the aforementioned analysis, it can be concluded that the studies that have been reviewed all direct their scope of research towards the utilization of AI applications and ICT towards the enhancement of educational information systems. However, certain similarities and differences arise among them including the current study as well. For instance, previous research [45], [46] and the current study all emphasize the importance of integrating CT practices and AI into the educational curriculum to enhance students' AI and ML competencies. These studies suggest that explicitly designed STEM experiences are crucial for achieving specific educational outcomes. Other research [46]–[49] also seem to utilize experimental research methods, including pre and post-tests and questionnaires, to evaluate the effectiveness of AI tools and curricula in education. These studies use empirical data to measure changes in student performance and perceptions. Both research by [47], [48] highlight the role of AI in facilitating personalized learning experiences. However, Tsai *et al.* [47] focus on the relationship between self-efficacy and perceived usefulness in online learning, while Rugh *et al.* [48] discusses how AI-generated concept maps help tailor learning to individual student needs. Similarly, research by [46], [48] examine gender differences in learning outcomes. Rugh *et al.* [48] found that females performed better in CT concepts when learning AI, while Rugh *et al.* [48] noted gender differences in the effectiveness of AI-generated concept maps, with females outperforming males. Research by [47], [49] report high levels of student satisfaction and perceived usefulness of AI tools. He and Xin [49] found that students found an AI chatbot user-friendly and helpful, while Tsai *et al.* [47] reported that self-efficacy positively impacts the perceived ease of use and usefulness of AI tools in learning.

On the other hand, as the previously mentioned studies shared some similarities, they also differed in certain facets. Accordingly, Asunda *et al.* [45] and the current study both use qualitative research methods, including document analysis and systematic reviews, to explore their topics. In contrast, several researches [46]–[49] use quantitative and mixed methods approaches. Asunda *et al.* [45] focus on integrating CT practices into STEM education broadly, while Hsu *et al.* [46] design a specific AI curriculum for secondary schools. Furthermore, Tsai *et al.* [47] investigate self-efficacy and learning anxiety in an AIOT practical course, while Rugh *et al.* [48] examine the effectiveness of AI-generated concept maps. He and Xin [49] focus on the practical application of a chatbot for cybersecurity education, and Rowe *et al.* [50] explore teachers' perceptions of XR tools and sensor data in STEM education. The studies vary in their sample populations. Research by [46]–[48] involve secondary school students, while He and Xin [49] focus on middle and high school students. Rowe *et al.* [50] engage K-12 teachers in their study and Asunda *et al.* [45] analyzes literature rather than specific participant groups. He and Xin [49] evaluate a chatbot for cybersecurity education, Rugh *et al.* [48] analyze AI-generated concept maps, and Rowe *et al.* [50] discuss XR tools and sensor data. Tsai *et al.* [47] focus on AIOT practical courses, while other research [45], [46] look at broader AI and CT integration in curricula.

Consequently, each study offers unique recommendations. Asunda *et al.* [45] suggest curriculum designers should articulate the rationale for CT integration. Hsu *et al.* [46] call for further exploration of gender differences in AI learning. Tsai *et al.* [47] recommend investigating other factors influencing perceived ease of use and usefulness. He and Xin [49] suggest expanding chatbots for general cybersecurity education. Rugh *et al.* [48] propose further research on AI concept maps' support for deep cognitive processing. Rowe *et al.* [50] recommend understanding structural constraints for XR tool implementation. As can be seen from past studies [45], [46] and this present study, the development of AI and ML competencies necessitates embedding CT practices within school curricula-a finding shared by many educational agendas. Further, research by [47], [48] highlight how AI can serve the goal of personalized education, while

other research [47], [49] give examples of students expressing high satisfaction with their experience with AI tools and point out their value in enabling efficient learning and increasing student engagement. However, the studies show methodological and focus-based differences that further qualify the discussion. Though research by Asunda *et al.* [45] uses qualitative research to investigate the wider role of AI, other research [46]–[48] use experimental approaches, showing the impact of AI through empirical evidence.

Moreover, from a critical standpoint, it can be concluded that the findings indicate that the Omani educational portal is at an advanced stage of integrating AI technologies to support personalized and adaptive learning experiences, facilitate data-driven decision-making, and enhance user engagement with ICT tools [31]. These aspects are closely related to the broader objectives discussed in other studies [46], [47], which focus on the potential of AI in fostering personalized learning and enhancing educational outcomes. Furthermore, our findings regarding data-driven decision-making support the conclusions of previous studies [31], [48], and highlighting the ability of AI analytics to guide curriculum planning and resource allocation. The influence of AI on enhancing CT and STEM skills builds upon the research of Asunda *et al.* [45], while the real-world use of AI-driven chatbots for student assistance reflects the conclusions by He and Xin [49]. Furthermore, our investigation underscores the importance of learning analytics dashboards as outlined by Ramaswami *et al.* [37] and bolsters the adaptive advantages noted by Wang *et al.* [38]. The hybrid education platforms of the Omani portal, apart from the AI-powered analytics, reflect the experimental approaches mentioned in the studies [46], [49], which show how the adoption of AI-based tools/curricula leads to the improvement of student performances. However, while the Omani portal focuses mainly on infrastructure development and resource availability, Rugh *et al.* [48] delve deeper into how certain AI applications, such as concept maps, address gender-based learning preferences, which may be worthy of further investigation in the Omani context.

This study offers a novel contribution by being the first to systematically examine the integration of AI within the Omani educational portal in direct relation to Oman Vision 2040. Existing literature typically generalizes the role of AI in education across global contexts. This research focuses specifically on the Omani experience. It investigates how AI-driven tools such as adaptive learning systems, AI-powered analytics, and hybrid learning platforms are currently utilized within the national educational infrastructure. Additionally, the study links these technology uses to the specific goals outlined in Vision 2040, which include enhancing digital infrastructure, promoting innovation, and building a knowledge-based society. By employing a rigorous systematic review methodology tailored to the local context, this research fills a critical gap in academic literature and provides a replicable framework for future studies on AI adoption in similar developing education systems.

6.1. Practical contribution

This study presents empirical findings on integrating AI within Oman's educational framework. Also, delivering valuable insights for policymakers, educators, and technologists. The results endorse using AI-based approaches for tailored education, evaluating students, and assisting educators, shaping the direction of upcoming AI applications in the area.

6.2. Theoretical contribution

This study presents a structured framework. It connects AI applications directly to national strategic goals, distinguishing it from earlier works that generally address AI in education. This study adds to the expanding body of work on AI in education by illustrating the alignment of AI adoption with digital transformation goals in developing economies.

6.3. Methodological contribution

This study employs a systematic review methodology. Also, ensuring a thorough and impartial synthesis of AI integration within Oman's education system. This study provides a replicable framework for subsequent investigations into AI adoption across various national educational contexts by establishing precise inclusion and exclusion criteria and a thorough analysis of peer-reviewed sources.

7. CONCLUSION

The systematic review conducted on the utilization of AI within the Omani Educational Portal demonstrates that AI applications have a profound impact on enhancing the educational experience in Oman. The findings reveal that AI technologies within the portal facilitate adaptive and personalized learning, provide data-driven decision-making tools for educators, and continuously monitor and assess the performance of students and teachers. These advancements align closely with the goals of Oman Vision 2040, particularly in fostering lifelong learning, enhancing scientific research, and developing a knowledge-based economy.

Moreover, the findings show that the Omani educational portal has been doing well in integrating AI technologies, enhancing personalized learning, facilitating data-driven decision-making, and improving user engagement through ICT tools. Effective AI applications, such as adaptive learning features and performance-enhancing tools, are being used to cater to diverse learning needs and improve educational outcomes.

Future research should focus on experimental studies to assess the practical usage of AI applications within the Omani educational system, with an emphasis on evaluating their effectiveness in enhancing students' cognitive skills and digital literacy. Additionally, there is a need to develop specific performance-evaluation scales tailored to Omani students. Such research will provide valuable insights into the success of the Ministry of Education's digital initiatives and ensure that the educational goals outlined in Oman Vision 2040 are fully realized.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
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P : **P**roject administration
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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY

This research did not utilize confidential or proprietary data. All data were collected from the ERIC database.

REFERENCES

[1] J. Yang, K. Thompson, I. Cuevas, and W. Sears, "Cyber Security: Modern Environment," *International Journal of Innovative Research and Knowledge*, vol. 5, no. 7, pp. 21–26, 2020. [Online]. Available: https://ijirk.com/issue-details/534

[2] P. Agarwal, S. M. Idrees, and A. J. Obaid, "Blockchain and IoT Technology in Transformation of Education Sector," *International Journal of Online and Biomedical Engineering (iJOE)*, vol. 17, no. 12, pp. 4–18, Nov. 2021, doi: 10.3991/ijoe.v17i12.25015.

[3] Y. N. S. Al Husaini and N. S. A. Shukor, "Factors Affecting Students' Academic Performance: A review," *Social Science Journal*, vol. 12, no. 6, pp. 284–294, 2022.

[4] L. Douali, S. Selmaoui, and W. Bouab, "Artificial Intelligence in Education: Fears and Faiths," *International Journal of Information and Education Technology*, vol. 12, no. 7, pp. 650–657, 2022, doi: 10.18178/ijiet.2022.12.7.1666.

[5] Oman Ministry of Education, "Educational Portal," 2024. Accessed Apr. 30, 2024. [Online]. Available: https://home.moe.gov.om/?GetLang=en

[6] Oman Vision 2040, "Oman Vision 2040," 2019. Accessed May 06, 2024. [Online]. Available: https://www.oman2040.om/?lang=en

[7] G. I. Zekos, *Political, Economic and Legal Effects of Artificial Intelligence: Governance, Digital Economy and Society*, 1st ed. Cham: Springer International Publishing, 2022, doi: 10.1007/978-3-030-94736-1.

[8] G. Naqvi, M. A. Sarfaraz, M. U. Ali, and A. Ali, "Usage and Implications of Artificial Intelligence for Research Purposes at University Level," *Journal of Nanoscope (JN)*, vol. 4, no. 2, pp. 23–43, Dec. 2023, doi: 10.52700/jn.v4i2.92.

[9] P. Smith and L. Smith, "This season's artificial intelligence (AI): is today's AI really that different from the AI of the past? Some reflections and thoughts," *AI and Ethics*, vol. 4, no. 3, pp. 665–668, Aug. 2024, doi: 10.1007/s43681-023-00388-0.

[10] M. Kanazawa, "AI-based Analysis on Relationship between Genes and Personality," *Transactions on Machine Learning and Artificial Intelligence*, vol. 9, no. 6, pp. 26–37, Dec. 2021, doi: 10.14738/tmlai.96.11290.

[11] S. Kumari, T. Pandey, M. Goel, and S. N. Jha, "Artificial Intelligence in E-Commerce: A Comprehensive Analysis Combining Bibliometric Evaluation and TCCM Framework," *Korea Review of International Studies*, vol. 17, no. 3, pp. 177–211, 2024.

[12] B. Powell and S. Burrows, "The Unstoppable Rise of AI: An Interview with Dr. John Sanford, Spencer Burrows, and Anna Birchler," *International Journal of Emerging and Disruptive Innovation in Education: VISIONARIUM*, vol. 1, no. 1, pp. 1–5, Jul. 2023, doi: 10.62608/2831-3550.1009.

[13] N. Malik and A. Solanki, "Simulation of Human Brain: Artificial Intelligence-Based Learning," in *Impact of AI Technologies on Teaching, Learning, and Research in Higher Education*, S. Verma and P. Tomar, Eds., Hershey, PA, 2021, pp. 150–160, doi: 10.4018/978-1-7998-4763-2.ch009.

[14] D. Gil, S. Hobson, A. Mojsilović, R. Puri, and J. R. Smith, "AI for Management: An Overview," in *The Future of Management in an AI World: Redefining Purpose and Strategy in the Fourth Industrial Revolution*, J. Canals and F. Heukamp, Eds., Cham: Springer International Publishing, 2020, pp. 3–19, doi: 10.1007/978-3-030-20680-2_1.

[15] A. Fritz, W. Brandt, H. Gimpel, and S. Bayer, "Moral agency without responsibility? Analysis of three ethical models of human-computer interaction in times of artificial intelligence (AI)," *De Ethica*, vol. 6, no. 1, pp. 3–22, Jun. 2020, doi: 10.3384/de-ethica.2001-8819.20613.

[16] Y. Shen, "The Ethical Dilemma of Artificial Intelligence and Its Construction of Moral Responsibility," *The Frontiers of Society, Science and Technology*, vol. 5, no. 14, pp. 60–66, 2023, doi: 10.25236/FSST.2023.051411.

[17] M. Aitken, D. Leslie, F. Ostmann, J. Pratt, H. Margetts, and C. Dorobantu, "Common regulatory capacity for AI: The Alan Turing Institute," 2022. [Online]. Available: https://www.turing.ac.uk/sites/default/files/2022-07/common_regulatory_capacity_for_ai_the_alan_turing_institute.pdf

[18] O. Vermesan, F. Pétrot, M. Coppola, M. Schneider, and A. Höß, *Industrial AI Technologies for Next-Generation Autonomous Operations with Sustainable Performance*. Gistrup: River Publishers, 2022.

[19] Y. Xia and H. Wei, "Applications of Data Visualization Technology in Artificial Intelligence," *Frontiers in Business, Economics and Management*, vol. 15, no. 2, pp. 385–388, May 2024, doi: 10.54097/k30h7c91.

[20] A. Eguchi, H. Okada, and Y. Muto, "Contextualizing AI education for K-12 students to enhance their learning of AI literacy through culturally responsive approaches," *KI - Künstliche Intelligenz*, vol. 35, no. 2, pp. 153–161, Jun. 2021, doi: 10.1007/s13218-021-00737-3.

[21] E. F. Syarifah and A. Fakhruddin, "Exploring Students' Experience in Using AI to Assist Their Writing," *Journal of English Language Learning*, vol. 8, no. 1, pp. 558–564, Jun. 2024, doi: 10.31949/jell.v8i1.10028.

[22] C. S. Pereira, J. M. Mascarenhas, S. Bhatt, S. S. Rodrigues, and R. S. S. Almeida, "College Students' Perceptions on Artificial Intelligence (AI) in Mangaluru Educational Settings," *SJCC Management Research Review*, vol. 13, no. 2, pp. 68–79, Dec. 2023, doi: 10.35737/sjccmrr/V13/i2/2023/195.

[23] N. Shalamova and T. Rice-Bailey, "Leveraging Design Thinking and Generative AI to Transform TPC Pedagogy," *Programmatic Perspectives*, vol. 15, no. 1, pp. 161–181, 2024.

[24] S. Sundram and R. Chatterjee, "Generative AI for Personalized Problem Setting to Aid Learning," 2023. [Online]. Available: https://www.tdcommons.org/dpubs_series/6394/

[25] S. Digole, H. Date, V. Patil, S. Bhaldand, and A. L. Golande, "Virtual Interface for College Enquiry Using AIML and Query Extraction Techniques and Algorithms," *Mathematical Statistician and Engineering Applications*, vol. 71, no. 4, pp. 79–88, 2022. [Online]. Available: http://philstat.org.ph

[26] L. A. González, A. Neyem, I. Contreras-McKay, and D. Molina, "Improving learning experiences in software engineering capstone courses using artificial intelligence virtual assistants," *Computer Applications in Engineering Education*, vol. 30, no. 5, pp. 1370–1389, Sep. 2022, doi: 10.1002/cae.22526.

[27] C. Li, M. Li, C.-L. Huang, Y.-T. Tseng, S.-H. Kim, and S. Yeom, "Educational data mining in prediction of students' learning performance: a scoping review," in *IFIP World Conference on Computers in Education*, 2023, pp. 361–372, doi: 10.1007/978-3-031-43393-1_33.

[28] N. S. Aldahwan and N. I. Alsaeed, "Use of Artificial Intelligent in Learning Management System (LMS): A Systematic Literature Review," *International Journal of Computer Applications*, vol. 175, no. 13, pp. 16–26, Aug. 2020, doi: 10.5120/ijca2020920611.

[29] M. Jha, D. Richards, M. Porte, and A. Atif, "Work-in-Progress—Virtual Agents in Teaching: A Study of Human Aspects," in *2020 6th International Conference of the Immersive Learning Research Network (iLRN)*, Jun. 2020, pp. 259–262, doi: 10.23919/iLRN47897.2020.9155122.

[30] G. Lakshmi, S. Brindha, M. R. Devi, J. Divya, and N. Shobhanali, "AI-powered digital classroom," in *2022 International Conference on Communication, Computing and Internet of Things (IC3IoT)*, Mar. 2022, pp. 1–6, doi: 10.1109/IC3IOT53935.2022.9767944.

[31] M. Fırat, "Integrating AI applications into learning management systems to enhance e-learning," *Öğretim Teknolojisi ve Hayat Boyu Öğrenme Dergisi - Instructional Technology and Lifelong Learning*, vol. 4, no. 1, pp. 1–14, Jun. 2023, doi: 10.52911/itall.1244453.

[32] R. Manhiça, A. Santos, and J. Cravino, "The journey and the impact of Artificial Intelligence on LMS in a Mozambican Higher Education Context (in Portuguese)," *RE@D-Revista de Educação a Distância e Elearnin*, vol. 6, no. 2, p. e202310, 2023, doi: 10.34627/redvol6iss2e202310.

[33] X. Chen, H. Xie, D. Zou, and G.-J. Hwang, "Application and theory gaps during the rise of Artificial Intelligence in Education," *Computers and Education: Artificial Intelligence*, vol. 1, p. 100002, 2020, doi: 10.1016/j.caeai.2020.100002.

[34] J. Rosak-Szyrocka, "The role of artificial intelligence in digital education," *Scientific Papers of Silesian University of Technology Organization and Management Series*, vol. 2024, no. 195, pp. 477–499, 2024, doi: 10.29119/1641-3466.2024.195.29.

[35] L. Guo, D. Wang, F. Gu, Y. Li, Y. Wang, and R. Zhou, "Evolution and trends in intelligent tutoring systems research: a multidisciplinary and scientometric view," *Asia Pacific Education Review*, vol. 22, no. 3, pp. 441–461, Sep. 2021, doi: 10.1007/s12564-021-09697-7.

[36] Z. Abidin, R. Arifudin, W. Hardyanto, I. Akhlis, R. Umer, and N. Kurniawan, "Low-cost educational robotics for promoting STEM education," *Journal of Physics: Conference Series*, vol. 1918, no. 4, Jun. 2021, doi: 10.1088/1742-6596/1918/4/042018.

[37] G. Ramaswami, T. Susnjak, A. Mathrani, and R. Umer, "Use of predictive analytics within learning analytics dashboards: a review of case studies," *Technology, Knowledge and Learning*, vol. 28, no. 3, pp. 959–980, Sep. 2023, doi: 10.1007/s10758-022-09613-x.

[38] S. Wang *et al.*, "When adaptive learning is effective learning: comparison of an adaptive learning system to teacher-led instruction," *Interactive Learning Environments*, vol. 31, no. 2, pp. 793–803, Feb. 2023, doi: 10.1080/10494820.2020.1808794.

[39] A. R. Gladston, S. Sreenidhi, P. Vijayalakshmi, and T. Nagarajan, "Incorporation of Happiness in Neutral Speech by Modifying Time-Domain Parameters of Emotive-Keywords," *Circuits, Systems, and Signal Processing*, vol. 41, no. 4, pp. 2061–2087, Apr. 2022, doi: 10.1007/s00034-021-01875-7.
[40] M. T. Matriano, "Balancing of Skills in the Digital Transformation of Education and Employability," in *SHS Web of Conferences*, Jan. 2023, vol. 156, p. 08004, doi: 10.1051/shsconf/202315608004.
[41] V. Bhandari and V. Mohite, "Role of higher education institutions in developing digital competence in Sultanate of Oman: a step towards achieving Vision 2040," *Library Hi Tech*, Jul. 2024, doi: 10.1108/LHT-12-2023-0639.
[42] A. S. Al-Bemani, A. A. Nizamudin, G. Balaji, and A. A. Amal, "Optimizing academic journey for high schoolers in Oman: a machine learning-enabled AI model," *Procedia Computer Science*, vol. 235, pp. 2716–2729, 2024, doi: 10.1016/j.procs.2024.04.256.
[43] S. Syahrin and N. Akmal, "Navigating the Artificial Intelligence Frontier: Perceptions of Instructors, Students, and Administrative Staff on the Role of Artificial Intelligence in Education in the Sultanate of Oman," *Arab World English Journal*, vol. 1, no. 1, pp. 73–89, Apr. 2024, doi: 10.24093/awej/ChatGPT.4.
[44] M. Al-Raimi, B. A. Mudhsh, Y. Al-Yafaei, and S. Al-Maashani, "Utilizing artificial intelligence tools for improving writing skills: Exploring Omani EFL learners' perspectives," *Forum for Linguistic Studies*, vol. 6, no. 2, p. 1177, May 2024, doi: 10.59400/fls.v6i2.1177.
[45] P. Asunda, M. Faezipour, J. Tolemy, and M. Engel, "Embracing Computational Thinking as an Impetus for Artificial Intelligence in Integrated STEM Disciplines through Engineering and Technology Education," *Journal of Technology Education*, vol. 34, no. 2, pp. 43–63, Jun. 2023, doi: 10.21061/jte.v34i2.a.3.
[46] T.-C. Hsu, H. Abelson, and J. van Brummelen, "The Effects on Secondary School Students of Applying Experiential Learning to the Conversational AI Learning Curriculum," *The International Review of Research in Open and Distributed Learning*, vol. 23, no. 1, pp. 82–103, Feb. 2022, doi: 10.19173/irrodl.v22i4.5474.
[47] C.-C. Tsai, Y.-M. Cheng, Y.-S. Tsai, and S.-J. Lou, "Impacts of AIOT Implementation Course on the Learning Outcomes of Senior High School Students," *Education Sciences*, vol. 11, no. 2, p. 82, Feb. 2021, doi: 10.3390/educsci11020082.
[48] M. S. Rugh, M. M. Capraro, and R. M. Capraro, "Improving Self-Efficacy with Automatically Generated Interactive Concept Maps: DIME Maps," *Electronic Journal of e-Learning*, vol. 21, no. 3, pp. 141–157, Jul. 2023, doi: 10.34190/ejel.21.3.2765.
[49] J. He and C. Xin, "Developing an AI-powered chatbot to support the administration of middle and high school cybersecurity camps," *Journal of Cybersecurity Education, Research and Practice*, vol. 2021, no. 1, pp. 1–8, Jul. 2021, doi: 10.62915/2472-2707.1077.
[50] S. Rowe, M. Riggio, R. De Amicis, and S. R. Rowe, "Teacher Perceptions of Training and Pedagogical Value of Cross-Reality and Sensor Data from Smart Buildings," *Education Sciences*, vol. 10, no. 9, p. 234, Sep. 2020, doi: 10.3390/educsci10090234.

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