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RESEARCH ARTICLE

Role of AI-Powered Online Learning in Improving University Students' Knowledge-Based Economic Skills

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ARTICLE INFO	ABSTRACT
	This qualitative study sought to investigate the potential role that AI-powered online learning could play in improving university students' knowledge-based economic skills. Semi-structured interviews were conducted with seven specialized experts. In addition, social media posts, studies, and other literature related to this topic were reviewed and analyzed. The trustworthiness, credibility, and dependability of the data were verified using techniques suggested for qualitative studies. Thematic analysis of the data revealed several themes: access to knowledge and data analysis; knowledge production and dissemination skills; lifelong learning, training, and development skills; effective communication skills; interaction, collaboration, and teamwork skills; critical and creative thinking skills; technological and digital skills; and discipline and integrity skills. The suggestions presented by the outcomes center around the following: redesigning and reconstructing course plans and content; training; qualifying and motivating faculty members; developing university infrastructure; constructing effective AI models for personalized and adaptive learning; activating online learning assessment methods and immediate feedback; applying recent educational transformations; establishing a clear, well-thought-out vision, plans, and usage policies; raising awareness; and promoting a culture of lifelong learning and training. Based on the findings, recommendations are offered.
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INTRODUCTION

In a world increasingly propelled by innovation and fueled by knowledge, developing a capable workforce equipped with the necessary skills for a knowledge-based economy (KBE) is paramount. One definition of KBE is "production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. (Powell & Snellman, 2004, p. 199).

The burgeoning knowledge-based economy (KBE) requires a skilled workforce equipped with adaptability, critical thinking, and digital literacy skills, such as communication skills, problem-solving skills, the ability to work in teams, and information and communication technology (ICT) skills. Even more than other workers, these knowledgeable workers rely on workplace competencies (OECD, 2001).

KBE demands metacognitive skills, such as problem-solving and the ability to learn and continuously upgrade and broaden skills through formal education, lifelong learning, and learning in the workplace (Kefela, 2010). According to White et al. (2012), there are five structural components of KBE: a foundation of information and communications technology, open innovation, education, knowledge management, and creativity.

Anaekwe (2020) indicated that a successful KBE links science and technology, innovation for economic growth and competitiveness, education, and lifelong learning, along with greater investment in research and development, software, and education generally. Anaekwe (2020) suggested that there are three main driving forces for KBE: (i) knowledge, (ii) changes, and (iii) globalization. Tseng et al. (2020, p. 560) suggested that "the rapid development of technology and knowledge-based economies has drawn attention to the linkage between academic institutions and private industries. Universities are a major source of knowledge creation."

In light of the above, educational institutions, especially higher education, should play a major role in preparing students and qualifying them to acquire KBE skills. To make higher education more relevant to the labor market, KBE, and KBS, instructors must revamp their courses using innovative teaching strategies and relevant technology (Plumb & Zamfir, 2011). In this regard, Anaekwe (2020), Bano and Taylor (2015), and Tseng et al. (2020) noted the significance of higher education in carrying out this task.

However, higher education institutions face the crucial challenge of reskilling and upskilling students with these essential KBE competencies. Traditional pedagogical methods, constrained by resource limitations and rigid structures, struggle to keep pace with the dynamic demands of the evolving workplace. Currently, they are facing unprecedented challenges that demand innovative solutions to bridge the gap between current learning models and the skills required to thrive in the KBE.

Abu Elella (2013) recommended that universities create non-traditional educational methods, such as e-learning, distance learning, and open learning, thereby reinforcing creative thinking and innovation skills and encouraging continuous learning, modern digital technologies, and self-learning, which represents one of the most prominent characteristics of the knowledge economy. Bin Saghir and Bin Riala (2020) drew attention to the necessity of investing in intellectual capital in higher education, in light of the digital environment and knowledge economy, through the application of online learning integration into the educational process and digital technology. Ramaila and Molwele (2022) revealed that technology integration was perceived to promote the acquisition of 21st-century skills and competencies, such as communication, critical thinking, collaboration, problem solving, and computational thinking, as well as academic achievement and motivation.

Abdul Hakim and Mahjoub (2018) argued that the role of e-learning in building the knowledge economy is crucial. In any case, this becomes evident if a simple comparison is made between knowledge economy requirements and the characteristics of e-learning, which include the effective use of various technologies and the general application of e-learning, making learning available to all age groups. In addition, e-learning fosters students' ability to learn, acquire, employ, produce, and exchange knowledge.

An empirical study by Abdal Majeed and Al-Omari (2020) showed that collective and individual e-project strategies developed students' knowledge economy skills related to cooperative and group work, innovation and creativity, problem solving and decision making, critical thinking, and the application of technology. Hasan et al. (2023) indicated that project-based learning (PJBL) in learning economics can improve 21st-century skills through online learning, which has a direct and significant effect on the formation of these skills.

Zurita et al. (2015) found that a blended learning environment could enhance students' meaningful learning by practicing 21st-century skills regarding communication, information literacy, and ICT literacy. Likewise, Sinha and Bagarukayo (2019) considered that the future of education in emerging knowledge economies lies in the blended learning approach.

Artificial intelligence is also important for students' skills in the 21st century (Cantú-Ortiz et al., 2020; Channa et al., 2021; Ng et al., 2021). AI has the potential to play a significant role in equipping students with the crucial skills needed to thrive in today's KBE. Hibbi et al. (2020) suggested that including AI applications, such as intelligent tutoring systems, in the learning process yields significant advantages in enhancing KBE skills.

By augmenting the learning process, AI could boost students' attainment of core competencies, such as digital literacy, problem-solving, critical thinking, collaboration, and adaptability. "AI tools have equipped students with transferable, ready-to-use knowledge and skills for today's job market" (Wanyan & Liu, 2019, p. 1653). AI-based GPTs are making research skills more important in higher education than learning skills, which makes problem identification and solution development more efficient (Aithal & Aithal, 2023).

AI holds significant promise for improving teaching and learning in higher education. It can help teachers and students with personalized learning, intelligent tutoring, collaboration, and automatic grading (Crompton & Song, 2021). Taherdoost and Madanchian (2023) highlighted that numerous studies have concluded that AI improves the quality and effectiveness of knowledge management regarding knowledge acquisition, problem-solving strategies, knowledgeable tutors, optimal solution systems, organization, modeling, etc.

After analyzing 17 eligible studies conducted in different countries from 1995 to 2021, Su and Yang (2022) determined that the majority of the studies demonstrated that AI has greatly enhanced students' understanding of AI itself, robotics, machine learning (ML), computer science, and related topics, as well as abilities that include creativity, emotional regulation, cooperative learning, literacy, and computational thinking. By customizing and personalizing learning to the needs and capabilities of students, AI improved their learning and skills (Biswas, 2023; Chen et al., 2020; Firat, 2023; Kaddoura et al., 2022).

When AI is used effectively, it enables choosing the best learning approach based on each student's unique skills and needs, as well as the demands of the job market (Dilmurod & Fazliddin, 2021). After discussing the role of AI in supporting human development throughout lifelong learning, Poquet and De Laat (2021) concluded that

> AI-based technologies, when viewed optimistically, can put the data related to the mastery of the capabilities into the hands of the learners, minimising the risk to abuse the data for control purposes and engaging learners into the conversation about how their learning can be supported (p. 10).

AI developments are opening new avenues for technology-enhanced and online learning (OL). AI in OL can address the challenges of traditional methods by offering personalized learning, adaptive assessment, and intelligent tutoring systems (Tanjga, 2023). Gligorea et al. (2023) suggested that the incorporation of AI/ML into e-learning has been shown to improve academic performance, customize learning experiences, optimize learning paths, boost engagement, and result in higher exam scores. AI-based personalized e-learning systems provide specific learning content and assessments tailored to each student's level of comprehension and favored styles of learning (Murtaza et al., 2022). Dhananjaya et al. (2024) summarized some of the positive impacts of AI on students' learning, including intelligent tutoring systems, automated grading and assessment, chatbots and virtual assistants, curriculum planning, content recommendations, language learning, learning analytics, and predictive analytics.

Lin et al. (2018) indicated that AI-powered robotic players have the potential to enhance online learning by involving students, closing the gap between virtual and in-person instruction, and even improving student learning outcomes. Kavitha and Lohani (2019) pointed out that e-learning supported by AI has the potential to improve the online learning environment for students, workers, and young learners with different learning preferences. Bagunaid et al. (2022) showed that through recommendations made in response to student performance, an artificial intelligence-based student assessment (AISAR) system improved student learning and increased accuracy, recall, and precision.

Based on the above, online learning empowered by artificial intelligence (AI) applications could be a potent combination that represents a paradigm shift in educational delivery, offering flexibility, scalability, and personalization. This targeted approach could also be effective in enhancing technological skills, deeper understanding, problem-solving abilities, lifelong learning, communication, critical thinking, collaboration, computational thinking, and data analysis skills, which represent the central tenets of KBE skills.

Study problem

A review of the literature reveals that OL is crucial for cultivating 21st-century KBE abilities, such as critical thinking, creativity, problem solving, communication, technical proficiency, and lifelong learning (Abdal Majeed & Al-Omari, 2020; Abdul Hakim & Mahjoub, 2018; Abu Elella, 2013; Bin Saghir & Bin Riala, 2020; Hasan et al., 2023; Ramaila & Molwele, 2022; Zurita et al., 2015).

Recent studies have also concluded that AI applications enable simulations, virtual labs, and interactive tools that expose students to real-world scenarios while fostering hands-on learning of 21st-century abilities, continuous learning, and career development, which are key aspects of the KBE (Biswas, 2023; Cantú-Ortiz et al., 2020; Channa et al., 2021; Chen et al., 2020; Dilmurod & Fazliddin, 2021; Kaddoura et al., 2022; Ng et al., 2021; Poquet & De Laat, 2021; Su & Yang, 2022; Taherdoost & Madanchian, 2023; Wanyan & Liu, 2019).

Strengthening online learning with AI applications may foster a fertile educational and scientific environment that nurtures KBE skills. However, this argument needs further evidence and research support. As far as the present researcher is aware, few studies have been conducted in this area; therefore, in order to fill the gap, the present study dives deep into the potential of OL empowered by AI to equip university students with the critical KBE skillset. It investigates how OL platforms, infused with AI algorithms, can deliver personalized learning experiences, modify diverse learning styles, and adapt to individual needs in real time. This paper employs a mixed methods design to answer the following key question:

How could OL powered by AI play a critical role in improving knowledge-based economic skills of university students?

Two sub-questions emerged from the main study question above:

1. How effectively does AI-powered online learning improve students' KBE skills.
2. What are some suggestions for applying AI-powered online learning effectively to promote KBE skills?

STUDY METHODOLOGY AND INSTRUMENTS

The study applied qualitative methods to gain a deep and comprehensive understanding of the study subject (Creswell & Clark, 2017; Creswell & Creswell, 2017). To collect the qualitative data, semi-structured interviews were used. Additionally, studies, other literature, and social media posts regarding online learning, AI, and KBE were reviewed and analyzed. The trustworthiness, credibility, and dependability of this qualitative study were confirmed using a variety of techniques, including

peer review, member-checking, and external auditing; the study process was subjected to examination by an external expert. Triangulation was carried out using a variety of sources, including interviews, reviews of research, and posts from multiple social media platforms. Additionally, reflexive reviews were written to ensure confirmability and minimize bias. The transferability of the study was enhanced by tying the findings to earlier research and recommendations that can be used in comparable situations.

Study samples

The purposive sampling strategy is a highly valuable method, as it enables the qualitative researcher to concentrate on certain attributes of the population under investigation (Patton, 2002). Semi-structured interviews were used to conduct interviews with experts specialized in instructional technology and interested in AI, online courses, and KBE. These experts were selected via purposive sampling that is appropriate to the purpose of the study. After interviewing seven experts, data saturation was reached, meaning that interviews were no longer useful for obtaining new data, as the new data became duplicative and did not represent any addition to the study, as indicated by Merriam and Tisdell (2015).

A consent form was sent to the participants to ensure their agreement to participate in the study. The consent paper included an explanation of the research objective, interview procedures, audio recording, expected duration, and the participants' rights and confidentiality of their information. By using pseudonyms, the researcher minimized links between the data and the participants identifiers. The researcher conducted one-on-one interviews to protect the participants' privacy, and each interview was recorded. The resulting recordings were transcribed to analyze the data.
Additionally, over 150 social media publications (on Twitter, YouTube, and Instagram) and over 50 research works related to employing AI in education and distance learning were also reviewed.

Data analysis

The thematic analysis (TA) methodology is the most popular technique used to analyze qualitative data (Boyatzis, 1998; Braun & Clarke, 2006). As suggested by Braun and Clarke (2006), TA includes six phases: (1) becoming familiar with the data and background literature; (2) coding; (3) theme identification; (4) revising themes; (5) naming themes; and (6) writing up. The researcher followed these steps: first transcribing the interviews and publications, followed by recording notes, reviewing them carefully, then identifying the codes and linking them to extract themes, revising them, and finally naming them.

RESULTS

Sub-question 1: **How Effectively Does AI-Powered Online Learning Improve Students' KBE Skills?**

Thematic analysis of the qualitative data revealed the following main themes regarding the first study question.

Theme 1: Access to knowledge and data analysis

> **Subtheme 1: Planning and organization skills**. According to the participants, given the potential of AI, OL would be more effective than traditional learning in accessing a variety of data, analyzing them, extracting information, and gaining knowledge to develop skills such as

organization, planning, and creativity, as well as dealing with real data and making logical decisions. In the KBE era, these competencies are essential.

Interviewee MS implied that everything on the internet results in huge amounts of data analyzed by OL platforms and that AI tools turn this data into information and knowledge that can provide creative solutions and offer recommendations to improve, organize, and plan effective courses. Shaltout (2017) said,

For example, I analyzed four courses in learning analytics [on online learning platforms]. How many people watched the video, and how many interacted with it? How many commented? What was its impact? . . . This produced very large amounts of data, helping me evaluate whether the course I had submitted was good or not, how many people dropped out, and so on. It showed me so many ways to gain knowledge based on employing online learning.

Interviewee DH indicated that "online learning environments supported by AI could analyze available data and provide suggestions to help with planning, creativity, and innovation through programs specialized for that." Interviewee FA said that "by employing the various apps and tools provided by OL and AI, some professional and life skills required by the KBE, such as continuous learning, participatory and interactive interaction, planning, and organization, could be developed."

Interviewee DS asserted that "students can work with real economic data and apply statistical and analytical methods to it to understand economic trends." Additionally, DS suggested that OL environments supported by AI could develop skills for "constructing and making rational decisions based on data analysis . . . and making intelligent future predictions."

Subtheme 2: Adaptive and personalized learning. AI in OL environments can also trends, determining learner needs and characteristics, and setting objectives. The resulting data and information could pave the way for personalized and adaptive learning designed to suit students' needs, take into account their individual differences, and develop their skills and competencies. In this regard, Interviewee FA noted that "these environments can also provide methods and tools for analyzing data and learners' characteristics to develop adaptive learning systems in a way that aids in determining goals, priorities, self-direction, and flexibility in learning." DS proposed that "AI tools could be used to develop ML systems, allowing us to customize learning according to the needs of each student. Intelligent analytics could provide direct feedback and personalized guidance to each student, enhancing their skills and motivation to succeed."

Dhananjaya et al. (2024) noted that data on student behavior, including task time, difficult question types, and interactions with learning materials, may be gathered and analyzed using AI-powered algorithms. This information allows for the identification of patterns that inform teaching methodology improvement, curriculum design, and teacher performance.

Subtheme 3: Skills acquisition and performance improvement. AI-powered OL helps personalize learning and develop adaptive learning, considering the diversity of students' abilities and their individual differences. Therefore, it has the potential to enhance all students' learning, aid them in achieving learning objectives, and develop their abilities.

DH pointed out that "these environments and tools could develop the skills to accomplish simple and complex tasks and improve performance." These outcomes are consistent with Lin et al. (2018) and Abbas et al. (2023), who suggested that AI has the potential to increase student performance and achievement.

Theme 2: Knowledge production and dissemination skills

The applications of AI in OL environments could be effective in producing and disseminating knowledge and boosting entrepreneurship and innovation skills. Interviewee SK said, "The most prominent skill developed through AI is knowledge searching and disseminating skills." Shaltout (2017) pointed out that OL can be effective in producing knowledge and that students in OL environments must learn the standards for producing digital knowledge based on technological and research skills in order to reach the level of producing knowledge without simply quoting or transferring it." FA explained this by saying, "The tools and applications [provided by OL platforms and AI] help in producing knowledge, encouraging the processes of innovation, creativity, and entrepreneurship."

Shaltout (2017) implied that OL offers benefits for knowledge dissemination:

> In order to spread knowledge, I must access social media platforms. . . . I need to have publishing skills, know how to deal with electronic learning platforms, publish digital repositories and learning packages, and access digital libraries and social media networks.

Theme 3: Lifelong learning, training, and development skills

As some studies indicate, lifelong learning is considered one of the most important KBE skills (Anaekwe, 2020; Kefela, 2010). AI-powered OL provides opportunities for lifelong learning, regardless of the boundaries of time, place, or age. As Shaltout (2017) explained,

> We will learn for knowledge. . . . Employing technology, knowledge production standards, and research [through online learning] bring us to the conclusion that we will learn for knowledge and that learning is not limited to a certificate. Now, I have brought my students to continuous learning . . . for the sake of work or for the sake of development within work, and this is an important point: learning for the sake of work. Every one of us must learn to develop their work to develop what they offer.

FA declared, "AI-powered OL, through its high flexibility, provides the opportunity for lifelong learning and training through online courses that transcend the restrictions of time, place, and age."

Theme 4: Effective communication skills

In today's KBE, effective communication skills are increasingly recognized as essential for success. According to the OECD (2001) and White et al. (2012), the KBE requires communication skills. Ramaila and Molwele (2022) suggested that technology integration could foster the acquisition of communication skills. Zurita et al. (2015) found that a blended learning environment has a positive impact on students' meaningful learning and communication skills.

Actually, OL environments equipped with various tools enhance communication, and when AI is added to OL platforms, they can serve to improve the communication skills of students. Interviewee SK implied that empowering OL by AI will "enhance communication skills." Interviewee AA confirmed this by saying, "I expect that effective communication skills will be at the forefront of the KBE skills improved by OL platforms supported by AI." Interviewee FM stated that AI-powered OL would "strengthen the aspect of communication through dialogue, discussion, interaction with students, forums, and interviews." Interviewee FA emphasized that "these tools can support communication skills through various tools that provide opportunities for synchronous and asynchronous interaction and video conferences. . . . Blended learning, which combines OL and traditional education, would help overcome the problem of direct communication."

Theme 5: Interaction, collaboration, and teamwork skills

Study participants suggested that OL empowered by AI would enhance students' collaboration and improve teamwork skills by providing communication opportunities, stimulating student interaction and engagement, and facilitating the work and projects of collaborative groups. Interviewee DH suggested that OL and AI tools could "enhance cooperation and facilitate the participation process between individuals through smart platforms."

FA likewise stated, "The application of AI-powered OL can encourage cooperative learning and group project learning because these tools facilitate the process of group communication and participation in implementing cooperative projects. This, in turn, supports teamwork skills, leadership, motivation, and working within teams." These results are consistent with Lin et al. (2018), Crompton and Song (2021), and Abbas et al. (2023). Dhananjaya et al. (2024) showed that "AI technologies can create a dynamic and interactive learning environment, providing tailored learning experiences for students and insights for educators to provide targeted support and guidance" (p. 34019).

Theme 6: Critical and creative thinking skills

OL and AI tools could be used to fuel critical and creative thinking by providing immediate feedback and posing problems that require innovative solutions. FM noted that "OL and AI tools can develop innovation and creative and critical thinking skills by solving problems, promoting motivation, and providing feedback." DS proposed that AI would be effective in supporting students' creative thinking in OL courses "by using applications to develop innovative economic and knowledge policies."
FA stated, "These tools and apps help produce knowledge and thus encourage the process of innovation, creativity and entrepreneurship." FA also emphasized that "employing these technological tools with new learning and teaching strategies—discussion, conversation, simulation, virtual learning, and augmented reality—could be effective in improving creative thinking and critical thinking skills." Gill et al. (2024) revealed that AI ChatGPT can help students improve their understanding of text by generating customized questions and providing feedback on students' answers, and that it can also be applied to enhance their analytical and critical thinking skills.

Theme 7: Technological and digital skills

AI represents a digital and information technology revolution, whereas OL represents an advanced electronic and technological environment. The combination of these two technologies stimulates students' interaction with technology in an effective and continuous manner, nourishing their technological skills and preparing them for the upcoming technological developments and transformations that will lead to jobs and shape work environments.
DS suggested that "OL and AI can be used to design policies that enhance digital transformation." FA observed, "Of course, AI-powered OL has a critical role in developing students' digital and technological skills in a way that qualifies them to use these tools and deal with technical problems in the future."

Theme 8: Discipline and integrity skills

AI applications are viewed with some fear and doubt by teachers and educationalists because they can be a means of plagiarism, cheating, and fraud. However, some participants in the study pointed out that setting policies for the use of AI and employing advanced applications to detect plagiarism can be helpful in detecting plagiarism and fraud. Additionally, determining the electronic submission dates of assignments in OL courses is a way to reinforce integrity and discipline skills. MS said, "AI

itself can be programmed so that if it is asked about illegal things, it will answer that this thing is illegal... Therefore, it can be useful for these issues." In this regard, FA noted,

> OL and AI tools could precisely and firmly control and determine the times for submitting assignments and projects, which contributes to the development of discipline skills, respecting appointments, and time management. Despite the constant fear of AI applications, developing AI policies and tools that work with online learning platforms to reveal and control academic plagiarism and cheating would enhance the values of honor, scientific integrity, and personal accountability.

The following figure illustrates the most prominent themes derived from the qualitative data, which represent the role of AI-powered OL in improving students' KEB skills.
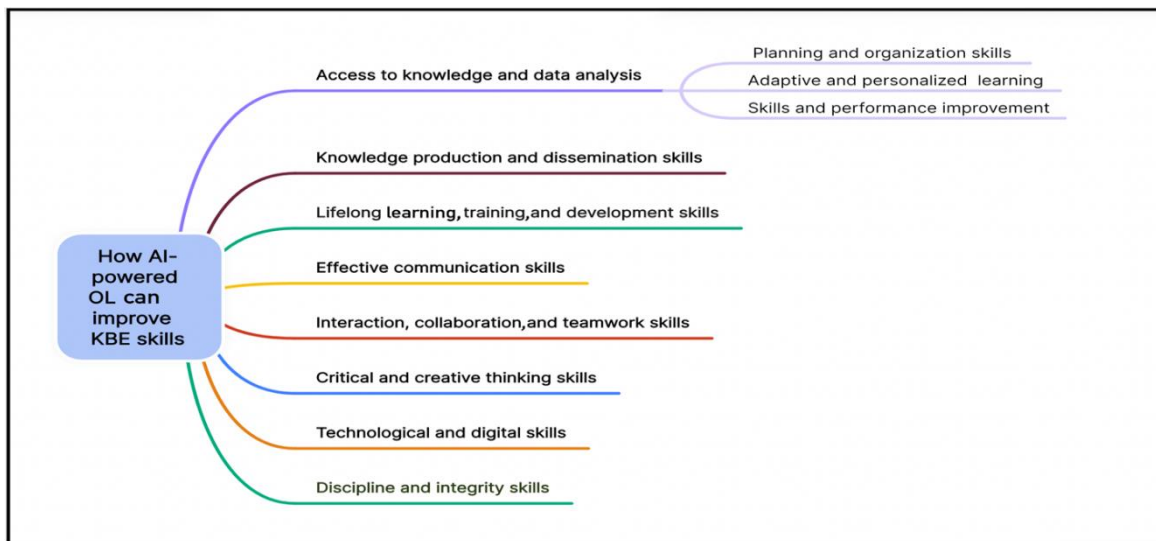

Figure 1: The role of AI-Powered OL in improving KBE skills

Second Sub-question: What Are Some Suggestions for Applying AI-Powered OL Effectively to Promote KBE Skills?

Thematic analysis of the qualitative data revealed the following main themes regarding the second study question.

Theme 1: Redesigning and reconstructing course plans and content

Some participants suggested that course plans and content should be redesigned and reconstructed to apply AI in OL environments to support KBE skills. In this regard, AA proposed "designing course plans based on KBE skills and reconstructing course content in line with the characteristics of AI-powered OL applications."

Theme 2: Training, qualifying, and motivating faculty members

Faculty members are the heart of the educational process in higher education institutions. Most of the study participants believed that training and qualifying faculty members play a key role in

enhancing the quality of OL courses, as skilled faculty employ AI applications in their OL courses to apply modern learning designs and methods, develop students' skills, and achieve objectives.

For example, AA suggested "requalifying faculty members through training programs linked to motivational factors to apply modern technologies." FA recommended "providing intensive training programs to qualify faculty members for optimal use of these environments and tools." Abbas et al. (2023) noted that although AI tools in higher education have the potential to facilitate improvement in students, their responsible usage requires ethical considerations, teacher preparation, and successful implementation strategies.

Theme 3: Developing university infrastructure

The appropriate, sustainable, and systemic application of OL and AI in institutions requires the development of a strong infrastructure that includes hardware, software, laboratories, applications, staff, equipment, and internet access. Rahiman and Kodikal (2024) demonstrated that in order for universities and other educational institutions to develop and implement AI-powered tools and solutions, policymakers must support and create platforms by offering financial aid and an infrastructure support system. AA recommended "developing the university and classroom infrastructure as required for OL and AI." FM suggested "providing comprehensive online learning centers and programs that serve students and faculty members," while DH recommended "establishing research centers for online learning and artificial intelligence."

Theme 4: Constructing effective AI models for personalized and adaptive learning

As indicated by some studies (e.g., Chen et al., 2020; Crompton & Song, 2021), AI can be usefully applied to personalizing learning and intelligent tutoring. Dhananjaya et al. (2024) recommended some AI applications that can facilitate adaptive learning and seamless interaction and that hold promising potential for personalized learning, including NeuroSky EEG, Fluxy AI, RFID and NFC, AlterEgo, AI chatbots, virtual proctoring, and twinning technology. Moreover, OL with AI may play a significant role in supporting these applications in transforming education. In particular, some participants suggested developing AI models to apply personalized and adaptive learning in an OL environment to improve students' KBE skills.

In this regard, DS proposed "using AI technologies to analyze the needs of each student and provide learning content tailored to their level and skills." In the same context, FA emphasized "developing adaptive and flexible learning applications compatible with the specific learning needs of each student." MS suggested that OL courses need to be reformulated into more precise instructional designs, such as adaptive learning. AI tools should be added at the beginning of OL courses to interact with learners, explore their characteristics and abilities, and provide them with tools and content according to their needs. DS provided additional detail, saying, "Using machine learning technologies to develop learning models that adapt to students' interactions and improve their learning experience, these models can include the use of AI to analyze behavior patterns and provide personalized learning guidance."

Theme 5: Activating OL assessment methods, immediate feedback, and improvement guidance

Participants indicated the importance of taking advantage of the capabilities of AI in the online learning environment by activating assessment methods and immediate feedback, tracking student performance, identifying the causes of deficiencies and how to address them, and providing

development guidance that improves students' performance and skills. MS said, "We can interact with AI, and ask it to formulate some evaluation methods …based on the information we enter."

AA recommended "activating online assessment methods based on smart tracking measurement tools to support decision-making processes required by the organizational structure related to electronic intelligence." DS suggested "using AI to provide immediate feedback on students' performance on assignments and tests. Data analytics can be used to identify strengths and weaknesses, immediately provide improvement guidance to students, and link them to KBE skills." Finally, Dhananjaya et al. (2024) indicated that AI would be useful in automated grading and assessment, such that the "system automatically grades and assesses student work, such as assignments, quizzes, and tests or exams. The system can use certain techniques, such as ML and natural language processing (NLP), to analyze student responses and provide feedback" (p. 34031).

Theme 6: Applying recent educational theories, strategies and transformations

In educational development processes, educational experts stress the importance of various technologies and online learning tools, highlighting their potential in implementing educational theories and strategies centered around active learning focused on student activity and interaction. They should also be used to provide practical learning experiences that help students interact, acquire and apply knowledge, and improve their learning experiences and skills.

The study participants highlighted the significance of this topic. For example, DS recommended "including interactive applications and economic simulations that enable students to experience economic scenarios in a practical way. AI can be used to improve the accuracy of these experiences and embody them realistically." Additionally, DS noted that "the development of AI-powered OL can bring a major transformation in teaching KBE skills, as it can help enhance the effectiveness of learning and motivate students to develop their skills."

FM emphasized the importance of "supporting OL with specialists not only in the technological and technical aspects but also in education and instructional technology." Due to the necessity of applying new learning strategies, FA suggested that "new learning strategies supported by technology should be applied to develop KBE skills." In addition, FA recommended "adopting hybrid OL environments supported by AI applications in all academic courses."

Theme 7: Establishing a clear, well-thought-out vision, plans, and usage policies

Educational processes constitute a comprehensive and integrated system. Therefore, when adopting recent technology or projects, it is necessary to establish a clear vision based on thoughtful foundations, consider each element of the system, take into account all possible obstacles and how to overcome them, organize procedures, and define tasks, timetables, etc.

Furthermore, it is essential to enact rules, especially regarding policies for AI usage, to avoid the inappropriate use of these applications. DH declared that "it is significant to develop a clear vision and a well-thought-out strategy … and to establish policies to use these technologies without causing any harm." SK suggested "accepting AI, benefiting from its applications, and addressing the negatives." MS indicated that it is important to "set standards for using AI… in order to determine how to deal with academic issues and what is permissible." Moreover, MS said, "Universities must now move towards setting standards for academic integrity in dealing with AI to preserve rights and intellectual property."

Abbas et al. (2023) noted that responsible AI usage requires ethical considerations. Gill and Kaur (2023), Gill et al. (2024), and Seghier (2023) emphasized that restricting or banning the AI software ChatGPT will not make the issue go away. Accepting it and creating clear rules and guidelines for its use in academic contexts are preferable. Addressing privacy and safety concerns is one of the major implementation challenges of AI. Rahiman and Kodikal (2024) demonstrated that as more students submit personal information to online learning platforms, it is critical to ensure that it is kept private and secure. Therefore, precise policies and standards for the application of AI must be established in higher education.

Theme 8: Raising awareness of the importance of AI-powered OL

Sometimes, especially in the educational field, new technology is received with doubts, fear, and caution, which generates a kind of resistance. Increasing stakeholders' awareness of the importance of a given technology and the effective role it can play may contribute to creating acceptance and motivation to adopt and benefit from it. In this regard, a study by Rahiman and Kodikal (2024) affirmed that awareness plays a key role in AI adoption within the higher education system, mediated by attitude and behavior.

A number of the participants noted the need to raise awareness of the importance of OL and AI. FA emphasized that "it is important to create sufficient awareness of the importance of online learning supported by AI applications in universities and for officials to adopt these strategies and technologies." DH recommended "spreading awareness through the media about the importance of AI." Shaltout (2017) explained,

> When online learning has been implemented within educational institutions such as schools and universities, it has not been implemented well. Therefore, there has been confrontation between supporters and old-timers [traditionalists] or rejection by various stakeholders. This is a crucial point. Awareness is necessary, and we should gently convince these people that online learning will not eliminate their roles and jobs. To implement online learning, we must raise awareness among those inside the institutions.

Theme 9: Promoting a culture of lifelong learning and training

As previously mentioned, AI-powered OL facilitates opportunities for lifelong learning, continuous training, and career development. To seize these opportunities, a culture of lifelong learning, learning for the sake of learning, and continuous training and improvement should be promoted. Shaltout (2017) pointed out the value of spreading the culture of "learning for the sake of knowledge [and] learning for work and development."

Figure 2 summarizes the participants' suggestions outlined above for applying AI-powered OL to improve KBE skills.
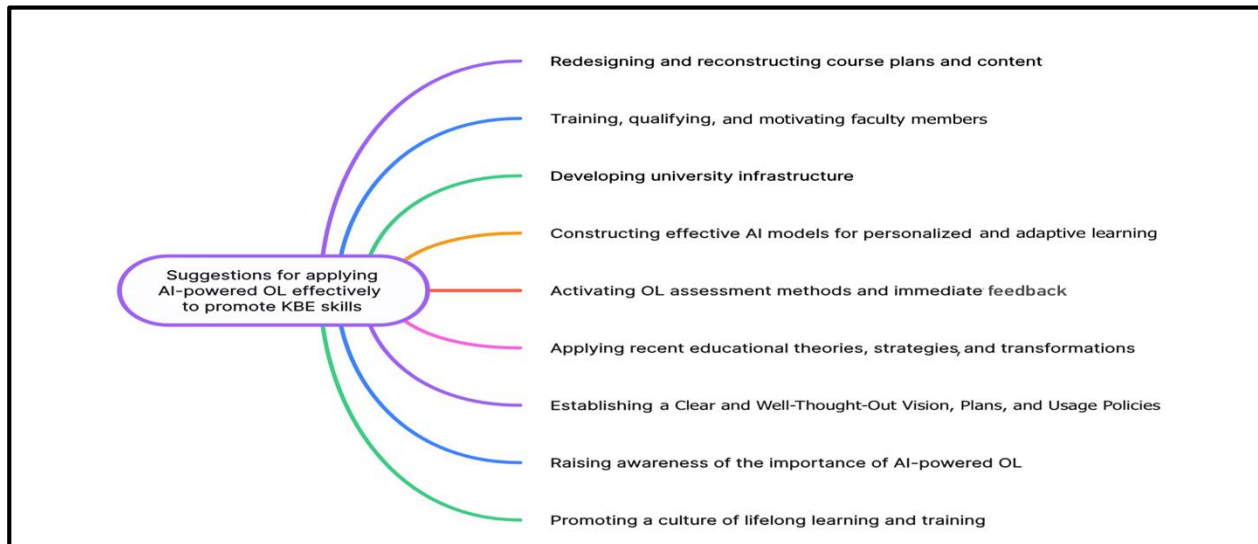
Figure 2: Suggestions for applying AI-powered OL to improve KBE skills

DISCUSSION

AI and OL represent the most prominent educational transformations that have imposed their presence recently due to rapid developments in digital development. Integrating AI applications into the OL environment can enhance the efficiency and quality of the educational process and sharpen students' skills, particularly those linked to KBE, which are becoming increasingly critical.

The current qualitative study's findings demonstrated how OL empowered by AI could improve KBE competencies, such as knowledge production and dissemination, data analysis, access to knowledge, training and development, effective communication, interaction, teamwork and collaboration, critical and creative thinking, technological and digital competencies, discipline and integrity, achievement competencies, and performance enhancement. These findings partially align with several studies that examined the function of AI in skill iswas, 2023; Cantú-Ortiz et al., 2020; Channa et al., 2021; Chen et al., 2020; Dhananjaya et al., 2024; Dilmurod & Fazliddin, 2021; Gill & Kaur, 2023; Gill et al., 2024; Kaddoura et al., 2022; Ng et al., 2021; Poquet & De Laat, 2021; Seghier, 2023; Su & Yang, 2022; Taherdoost & Madanchian, 2023; Wanyan & Liu, 2019).

The conclusions also partially agree with those of earlier studies regarding the role of OL in the acquisition of particular KBE competencies (Abdal Majeed & Al-Omari, 2020; Abdul Hakim & Mahjoub, 2018; Abu Elella, 2013; Bin Saghir & Bin Riala, 2020; Hasan et al., 2023; Ramaila & Molwele, 2022; Zurita et al., 2015). Furthermore, the outcomes of the current study are consistent with those of studies demonstrating the benefits of integrating AI into OL contexts, such as those by Bagunaid et al. (2022), Dhananjaya et al. (2024), Gill et al. (2024), Kavitha and Lohani (2019), Lin et al. (2018), and Rahiman and Kodikal (2024).

These advantages, however, can only materialize and be effective if AI is employed to support OL in a systematic manner that incorporates learning designs created in compliance with contemporary educational theories and new learning strategies. Moreover, there are several issues with online learning technology and current personalized recommendation systems, including inadequate infrastructure and funding, student discontinuity, language difficulties, difficulty choosing study resources, and a lack of understanding of the content (Dhananjaya et al., 2024).

The current study yielded various suggestions by participants to activate the role of AI-powered OL in fostering students' KBE skills. They suggested redesigning and reconstructing course plans and content, training, qualifying and motivating faculty members, developing university infrastructure, constructing effective AI models for personalized and adaptive learning, activating OL assessment methods, and providing immediate feedback and improvement guidance.

Additionally, the results underscore the importance of applying recent educational theories, methods, and strategies, providing practical learning experiences, and promoting a culture of lifelong learning and training. To achieve and maintain ethical considerations, integrity, and values, as well as to avoid fraud and plagiarism, the participants recommended establishing a clear, well-thought-out vision, plans, and usage policies.

CONCLUSION AND RECOMMENDATIONS

Based on the results of this qualitative study, it can be concluded that supporting OL environments with AI applications should have a positive impact on developing students' KBE-related skills. Drawing on these findings, the researcher suggests that initiating the utilization of these resources and reaping their advantages should be prioritized.

However, it is worth noting the necessity of properly applying AI in OL courses in accordance with instructional designs, educational theories, and new educational strategies. Accordingly, the researcher recommends optimizing the integration of online learning and AI to promote KBE skills based on a number of suggestions presented in the study, such as redesigning course plans and content, developing university infrastructure, constructing effective AI models for personalized and adaptive learning, and qualifying faculty members.

Further studies could be conducted to develop ethical guidelines, especially concerning the privacy, integrity, and proper use of AI. In addition, further qualitative and quantitative research could be conducted to develop procedural proposals for the effective application of AI in OL.

Finally, it would be beneficial to carry out additional exploratory and descriptive research on the use of AI in personalized learning, evaluation procedures, and student performance analysis in order to create adaptive learning models for both traditional and online learning that support KBE skills.

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