Journal of Infrastructure, Policy and Development 2024, 8(11), 8532.
https://doi.org/10.24294/jipd.v8i11.8532

Review

Exploring the impact of generative AI technologies on education: Academic expert perspectives, trends, and implications for sustainable development goals

Ibrahim Alshamsi[1], Kaneez Fatima Sadriwala[2], Fouad Jameel Ibrahim Alazzawi[3], Boumedyen Shannaq[1,*]

[1] University of Buraimi, AlBuraimi 512, Oman
[2] University of Nizwa, Nizwa, Oman
[3] Osol Al-Elm University College, Baghdad, Iraq
*** Corresponding author:** Boumedyen Shannaq, boumedyen@uob.edu.om

CITATION

Alshamsi I, Sadriwala KF, Alazzawi FJI, Shannaq B. (2024). Exploring the impact of generative AI technologies on education: Academic expert perspectives, trends, and implications for sustainable development goals. Journal of Infrastructure, Policy and Development. 8(11): 8532. https://doi.org/10.24294/jipd.v8i11.8532

ARTICLE INFO

Received: 12 August 2024
Accepted: 14 September 2024
Available online: 9 October 2024

Abstract: This study provides empirical data on the impact of generative AI in education, with special emphasis on sustainable development goals (SDGs). By conducting a thorough analysis of the relationship between generative AI technologies and educational outcomes, this research fills a critical gap in the literature. The insights offered are valuable for policymakers seeking to leverage new educational technologies to support sustainable development. Using Smart-PLS4, five hypotheses derived from the research questions were tested based on data collected from an E-Questionnaire distributed to academic faculty members and education managers. Of the 311 valid responses, the measurement model assessment confirmed the validity and reliability of the data, while the structural model assessment validated the hypotheses. The study's findings reveal that New Approaches to Learning Outcome Assessment (NALOA) significantly contribute to achieving SDGs, with a path coefficient of 0.477 ($p < 0.001$). Similarly, the Use of Generative AI Technologies (UGAIT) has a notable positive impact on SDGs, with a value of 0.221 ($p < 0.001$). A Paradigm Shift in Education and Educational Process Organization (PSEPQ) also demonstrates a significant, though smaller, effect on SDGs with a coefficient of 0.142 ($p = 0.008$). However, the Opportunities and Risks of Generative AI in Education (ORGIE) study did not find statistically significant evidence of an impact on SDGs ($p = 0.390$). These findings highlight the potential opportunities and challenges of using generative AI technologies in education and underscore their key role in advancing sustainable development goals. The study also offers a strategic roadmap for educational institutions, particularly in Oman to harness AI technology in support of sustainable development objectives.

Keywords: generative AI; smart education; sustainable development goals; educational systems

1. Introduction

Currently, we are observing significant changes in the use of artificial intelligence (AI), propelled by a new generation of robust generative AI models that can produce wholly original datasets (Anderson, 2020; Shannaq, 2024a). Projections indicate that these breakthroughs will have a substantial impact on the progress of society in the next five to 10 years. Artificial Intelligence (AI) is undergoing fast development and becoming a readily available tool in many fields and for a diverse range of users (Rashid Al-Shamsi and Shannaq, 2024; Yusuf et al., 2024). From this standpoint, it is highly important to analyze the possible influence of generative AI advancement on education. Will this result in a revolutionary change in the fundamental principles of

education, or merely include the introduction of novel technological innovation? In what manner will it be relevant to the particular obstacles encountered within the educational domain? The assessment of the potential advantages and drawbacks of including generative AI into higher education is of utmost importance, and it is imperative to expedite its integration into educational environments (Alasadi and Baiz, 2023; Al-Shamsi et al., 2024; Kamalov et al., 2023).

The worldwide community views the implementation of Generative AI, a digital technology that may produce visual, textual, or animated information, as a crucial element of educational digitalization. This technology has the potential to bring about significant changes in educational practices (Olney et al., 2024; Shannaq et al., 2019). In addition, the Organization for Economic Co-operation and Development (OECD) (Lehtonen, 2020) highlighted important principles and suggestions, such as:

- Enhancing knowledge generation and skill development through innovative educational technologies facilitated by generative AI.
- Guaranteeing technology accessibility for educators and students.
- Facilitating the education of persons with disabilities, particularly those with dyslexia or in need of ongoing guidance and mentoring, using generative AI.

1.1. Problem statement

The incorporation of generative artificial intelligence products into educational institutions offers both prospects and obstacles. While artificial intelligence (AI) has the potential to transform personalized learning and broaden access to educational opportunities, there are worries about data privacy, fair access, and the potential devaluation of critical thinking abilities resulting from over dependence on automated technologies. These problems have the potential to impact the caliber of educational achievements and hinder the advancement towards the Sustainable Development Goals (SDGs) established by the United Nations, namely those pertaining to education (SDG 4), innovation (SDG 9), and the decrease of inequality (SDG 10). For policymakers and educators to mitigate dangers and leverage the advantages of AI for sustainable development, it is crucial to have a comprehensive knowledge of how these technologies affect educational results.

1.2. Contribution to the research

This work contributes to the current body of knowledge by providing a thorough examination of the viewpoints of professional experts on the use of generative AI in the field of education, with specific emphasis on Oman. This paper analyses the responses of university administrators and stakeholders, offering valuable insights into the implementation and regulation of new technologies in educational settings. Furthermore, hypotheses are formulated and examined to give empirical proof of the efficacy of AI technology in attaining Sustainable Development Goals (SDGs).

1.2.1. An argument in support of using Oman as a case study

For a number of important reasons, Oman was selected to serve as the case study. To begin, Oman is a member of the Gulf Cooperation Council (GCC), which is a region that is actively participating in the pursuit of technology improvements and digital transformation across a variety of sectors, including education. As part of its

Vision 2040, which is in line with the global Sustainable Development Goals (SDGs), the nation has made major investments in the incorporation of artificial intelligence (AI) and other digital technologies into its educational system. Nevertheless, in spite of these efforts, difficulties like gaps in digital infrastructure, uneven access to technology, and the requirement for educators to acquire additional skills, continue to be prominent. As a result, Oman is an ideal candidate for investigating the influence that artificial intelligence technologies have on education. As an additional point of interest, Oman is an example of a developing nation that successfully combines traditional educational methodologies with contemporary technology innovation. This duality offers a one-of-a-kind environment in which to investigate the ways in which artificial intelligence technologies might either worsen or relieve current educational disparities, notably those that are associated with Sustainable Development Goal 4 (Quality Education) and Sustainable Development Goal 10 (Reduced Disparities).

The purpose of this research is to develop insights that may be applied to other nations that are in comparable phases of digital transformation. According to the World Economic Forum, Oman has been aggressively incorporating artificial intelligence (AI) in its educational system. However, the country is facing hurdles in establishing equitable access to technology throughout urban and rural regions. It was noted in a report that was published in 2022 by the Ministry of Education in Oman that only 68% of students who live in rural areas have access to dependable digital infrastructure. This highlights a significant digital divide that may influence the successful implementation of artificial intelligence in education.

The significance of Oman as a case study is highlighted by these figures, which also lend credence to the more general assertion that incorporating AI into educational settings continues to be a difficulty, particularly in developing nations.

1.3. Research gap

Although the use of generative artificial intelligence (AI) in education is becoming more widely discussed, less attention has been paid to the implications of this technology specifically in Arab contexts, most notably in Oman. In order to close this gap, this study examines how these technologies are used and viewed in Omani educational institutions and evaluates their effect on the nation's advancement toward the SDGs. Additionally, the study shows that in order to maximize the advantages and minimize the hazards of generative AI in education, localized techniques are required.

1.4. Significance of the work

With an emphasis on Oman, this research offers crucial insights on the uptake and effects of generative AI technologies in the Arab educational context. Policymakers, educators, and other stakeholders in the area will benefit from the results, which will provide guidance on how to effectively integrate these technologies to improve learning outcomes and help to meet the Sustainable Development Goals. The research intends to direct the creation of efficient techniques that are in line with the educational and cultural landscape of Oman and comparable contexts by emphasizing both the benefits and constraints of Generative AI in education.

Focusing on trends in Generative AI Technologies and sustainable development

goals, the research formulates research questions mapped to independent variables including Use of Generative AI Technologies (UGAIT), Development of Text Recognition Technologies for AI-generated Texts (DTRTAIT), New approaches to learning outcome assessment (NALOA), Paradigm Shifts in Education and Educational Process Organization (PSEPQ), and Opportunities and Risks of Generative AI in Education (ORGIE), with Sustainable Development Goals (SDGs) as the dependent variable.

A study's objectives, hypotheses, and research questions are developed methodically, taking into account the study's particular setting, the literature review, and the research topic. The research questions, which attempt to address specific aspects like the effects of these technologies on educational outcomes, the opinions of academic experts, and the actions taken by educational institutions, are based on the research problem, which in this case is the impact of generative artificial intelligence (AI) technologies on education within the framework of SDGs. The gaps in the literature, particularly with regard to the effects of generative AI in the Arab world, notably in Oman, also influence these topics. These questions directly relate with the research objectives, each of which describes the goals of the study (e.g., assessing the efficacy of generative AI in improving student learning outcomes). These goals are set up to be quantifiable and reachable, guaranteeing that they will provide useful information to address the research issue. The theoretical framework and prior study findings feed hypotheses, which are testable predictions drawn from the goals. They show how factors, such as the use of generative AI technology and the advancement of the SDGs, are projected to relate to one another. The unique cultural and educational background of Oman is taken into account while creating these components, as well as the concerns of important stakeholders including students, legislators, and instructors.

This strategy guarantees that the study covers pertinent topics and offers insightful information. To assess the impact of generative AI technologies on educational outcomes and test the hypothesis that these technologies have a positive effect on SDG achievement in Oman, a research question might, for instance, examine how these technologies affect SDG achievement in the Omani educational context. Through the methodical development of these elements, the research guarantees that it tackles the important problems and offers valuable perspectives to the domain.

1.4.1. Research question

How do various factors related to generative AI and educational technologies influence progress towards achieving Sustainable Development Goals (SDGs)?

1.4.2. Research objectives

- To explore the impact of the use of generative AI technologies (UGAIT) on progress towards SDGs.
- To evaluate the influence of the development of text recognition technologies for AI-generated texts (DTRTAIT) on progress towards SDGs.
- To examine the relationship between new approaches to learning outcome assessment (NALOA) and progress towards SDGs.
- To explore the effect of paradigm shifts in education and educational process organization (PSEPQ) on progress towards SDGs.

- To assess the opportunities and risks of generative AI in education (ORGIE) and their effect on progress towards SDGs.

1.4.3. Research hypotheses

H1: There is a significant positive relationship between the use of generative AI technologies (UGAIT) and progress towards SDGs.

H2: The development of text recognition technologies for AI-generated texts (DTRTAIT) significantly contributes to progress towards SDGs.

H3: New approaches to learning outcome assessment (NALOA) positively influence progress towards SDGs.

H4: Paradigm shifts in education and educational process organization (PSEPQ) lead to improved progress towards SDGs.

H5: The opportunities and risks of generative AI in education (ORGIE) have a significant effect on progress towards SDGs.

This study employs a structured methodology to investigate how Generative AI in Education applications used in teaching and learning, can positively shape the growing integration of generative AI in education, exemplified by platforms like ChatGPT-4o, and has sparked debates on its implications for the educational landscape. Diverse viewpoints range from advocating for restricted access until fundamental changes in education occur. This study presents a comprehensive analysis of academic expert opinions on the matter, alongside responses from university professors and stakeholders, aiming to provide a holistic view of the discourse.

2. Literature review

A significant research assesses the contribution of ChatGPT in management education, specifically examining its efficacy in fostering active learning, critical thinking, and creativity. The paper analyses the influence of artificial intelligence on student involvement and its incorporation into conventional education, while considering ethical issues such as the genuineness of knowledge and prejudice. Results indicate that ChatGPT improves teaching approaches but emphasize the need of meticulous deployment, infrastructure, and ethical reflections. The study provides vital knowledge for educators and institutions and adds novel viewpoints to the discussion on artificial intelligence in education (Leelavathi and Surendhranatha, 2024; Ratten and Jones, 2023).

A study that investigates how teachers, students, and administrative staff in Oman assess the role that ChatGPT plays in education have analyzed the influence that artificial intelligence has on education in Arab nations. It does this by evaluating the influence that artificial intelligence has on the process of refining material, creating emails, and explaining complicated activities, particularly for those who do not use English as their first language. Despite the fact that ChatGPT is highly appreciated for its ability to assist in academic assignments, there are issues around excessive dependency and academic integrity. The findings provide direction for educational policies and research in the future within the framework of Oman's educational system (Syahrin and Akmal, 2024).

At the University of A'Sharqiyah, which is located in the Sultanate of Oman, a recent study was conducted to investigate the role that artificial intelligence (AI) plays

in improving the quality of instruction. In this study, qualitative research methodologies were utilized to conduct interviews with four experienced educators. Personalized learning, grading automation, and virtual help were some of the uses of artificial intelligence that were discussed during the interviews. Other topics that were covered included, how AI may improve education and teaching qualityensuring ethical and inclusive practices. With a heavy emphasis on ethical usage, openness, and education on AI ethics, the findings indicated a variety of viewpoints regarding the benefits of artificial intelligence. One of the most important proposals is to encourage the use of artificial intelligence in education while also addressing ethical concerns (Al Matari et al., 2023; Shannaq et al., 2024).

Higher education institutions (HEIs) play a crucial role in bridging this gap through curriculum updates and infrastructure improvements. Concurrently, global initiatives like the SDGs underscore the importance of Education for Sustainable Development (ESD). As digital technologies reshape industries, AI integration in education, exemplified by ChatGPT, emerges as a transformative force, albeit with ethical considerations and the need for curriculum alignment. This paper critically examines AI's integration, emphasizing ChatGPT, within ESD's context, offering insights for navigating educational evolution in a tech-driven era effectively (Shannaq, 2024b). This work explores search engines' vital role in the digital economy, facilitating access to information, products, and services. It underscores query formulation's significance in efficient information retrieval, particularly for businesses in today's data-rich landscape. The study introduces the Interactive Digital Associative Tool (IDAT) to bolster human memory and conceptual thinking by linking Google search results with related terms. This fosters insightful connections and better query formulation, enhancing profitability and productivity. The IDAT's online accessibility fosters conceptual innovation in education and business amid digital transformation, aiming to improve human-computer interaction (HCI). An experiment with 14 users demonstrated a proficiency increase in query formulation from 51.0% to 88%, with query time reduced from 113.0 to 61.0, underscoring IDAT's significant impact.

In (Wang, 2023) Generative AI, like ChatGPT, is gaining traction for its transformative potential in various sectors, notably higher education. While some see it as revolutionary for learning, others raise concerns about its impact on academic integrity and student capabilities. As ChatGPT-like models become more prevalent, understanding their effects on higher education and devising mitigation strategies is crucial. This paper conducts a literature review to assess generative AI's influence on higher education, emphasizing both opportunities and challenges. It concludes with four strategies for HEIs to navigate the use of Generative AI effectively while addressing associated concerns.

The study (Shannaq, 2024c) presents a structured approach developed from a case study at the University of Buraimi, Oman, aiming to address challenges in formative assessment within Omani educational systems. By adapting and modernizing formative assessment, the model caters to Arabic cultural backgrounds and enhances classroom participation. Leveraging the Moodle Learning System, the solution transforms formative assessment into a digital format. Results show a 90% success rate and a 10% improvement in academic performance, indicating digital

formative assessment's potential in enhancing student learning outcomes amidst cultural and participation challenges.

According to (Bahroun et al., 2023) in an era of rapid technological progress, generative artificial intelligence (GAI) emerges as a transformative influence, reshaping education. This review, following the PRISMA framework, offers a thorough examination of GAI in education. Synthesizing insights from 207 research papers, it pinpoints research gaps and future paths. Ethical concerns, interdisciplinary collaboration, and transparent AI models are emphasized, alongside a bibliometric analysis highlighting ChatGPT's prominence and the growing interest in GAI research. As in (Shannaq et al., 2023) an extensive examination of the telecommunications industry's external environment, encompassing both industry-wide and regional markets for wired and wireless communication services, was conducted. The study evaluated the potential application of foreign companies' experience and crisis management measures from other sectors. Additionally, a thorough analysis of factors shaping enterprise competitiveness in the market was undertaken, utilizing the competitiveness polygon method. Competitive positions were assessed based on a wide array of service criteria, leading to the development of an integrated SWOT strategy comprising SO, WO, ST, and WT strategies. This strategic analysis aims to establish a unique position for long-term enterprise sustainability amidst changing economic conditions, including downturns (Segumpan and McAlaney, 2023).

The years 2020 and 2021 prompted a reassessment of traditional educational paradigms due to the pandemic's impact, particularly on universities. Higher education, crucial for societal progress, faced challenges. Oman's higher education leadership aimed to adapt new norms, transitioning from face-to-face teaching. This study addressed pandemic-induced shortcomings in higher education and proposed solutions for sustainable university development during those unprecedented times. In (Al-Shamsi et al., 2023) the author opines that the existing literature often examines Quality of Service (QoS) evaluation independently, hindering a comprehensive understanding of service quality management. Analytical techniques aid in decision-making to enhance service quality, attracting customers and driving sales and profit growth in the Telecommunication sector. The study compared service quality between private and public telecom companies in Oman, focusing on customer satisfaction through a customized SERVQUAL model with six dimensions. Analysis of 62 responses using statistical tools revealed similar service quality levels between private and public companies, except for reliability.

As global efforts intensify to meet the United Nations' Sustainable Development Goals (SDGs), Generative AI emerges as a powerful tool to tackle intricate sustainability challenges Ratten and Jones, (2023) and Yusuf et al. (2024). This form of AI excels at generating new content like images, music, and text by learning from extensive datasets, offering creative solutions and fostering innovation for sustainable development. This article explores how Generative AI can advance SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action), focusing on its potential applications in optimizing energy management and supporting sustainable urban planning. They examine a case study in Athens, Greece, where Generative AI is employed to enhance energy efficiency, promote renewable energy adoption, and inform urban planning strategies, aligning with the city's vision of a greener, resilient

future. As in (Shakir et al., 2024; Shannaq and Al Shamsi, 2024) the key topics included leveraging AI for SDG progress, challenges in AI adoption for developing nations, ethical considerations, implications for information ecosystems, and language barriers. Conclusions emphasized the importance of improving connectivity and affordability, establishing ethical frameworks, implementing balanced regulations, and fostering multi stake holder collaboration for effective AI deployment and capacity building.

In (Jungwirth and Haluza, 2023; Sadriwala et al., 2024; Shannaq et al., 2024) recent years have witnessed significant advancements in Artificial Intelligence (AI), prompting recognition of its potential across diverse sectors. However, concerns have arisen regarding AI's impact on achieving the Sustainable Development Goals (SDGs). The study aimed to assess AI's contributions and potential influence on sustainable development, particularly in societal domains. Analysis of GPT-3 responses, a leading language model, revealed its broad capabilities for contributing to SDGs, underscoring the need for proper regulations to ensure responsible AI use. Additionally, the study suggested enhancing GPT-3's neural language processing skills by avoiding mimicry of weak human writing styles with more errors in longer texts.

The transformational potential, ethical issues, and effects on educational results are the main topics of the literature that is currently available on the integration of generative AI technology in education. Research has looked at the role artificial intelligence (AI) can play in a number of educational contexts, such as higher education and the Sustainable Development Goals (SDGs), with a particular focus on the consequences of technological breakthroughs.

By offering a thorough examination of the effects of generative AI technologies on education within the unique cultural and educational setting of Oman, our research closes this gap. Our study closes the knowledge gap between localized educational practices in the Arab world and global AI discourses by concentrating on the opinions and trends of academic experts. We investigate the ways in which these technologies impact Oman's aims for sustainable development, providing specifically regional insights. Our study contributes to a more nuanced understanding of how Generative AI can be leveraged to achieve educational and sustainable development objectives in Arab countries by addressing the need for empirical data and analysis regarding the adoption and effectiveness of AI-driven educational tools in Oman.

3. Materials and methods

The proposed conceptual model in this study is depicted in **Figure 1** and elaborated upon to provide a thorough understanding of each step. In this work we use the Partial Least Squares Structural Equation Modeling (PLS-SEM). More information about the PLS-SEM is available in (Hair et al., 2024; Hair, Gabriel, et al., 2019). To assess the efficacy of various factors related to generative AI and educational technologies influence progress towards achieving SDGs.

The proposed methodology in this work employs a descriptive analytical approach to assess the present situation, utilizing both quantitative and qualitative analysis and to investigate the efficacy of generative AI and educational technologies. The objective of this study aims to investigate the impact of several factors on progress

towards SDGs. Firstly, it seeks to explore the influence of the use of generative AI technologies (UGAIT) on SDGs. Secondly, it aims to evaluate the impact of the development of text recognition technologies for AI-generated texts (DTRTAIT) on SDGs. Thirdly, the study examines the relationship between new approaches to learning outcome assessment (NALOA) and progress towards SDGs. Furthermore, it explores the effect of paradigm shifts in education and educational process organization (PSEPQ) on SDGs. Lastly, the research aims to assess the opportunities and risks associated with generative AI in education (ORGIE) and their effect on progress towards SDGs.

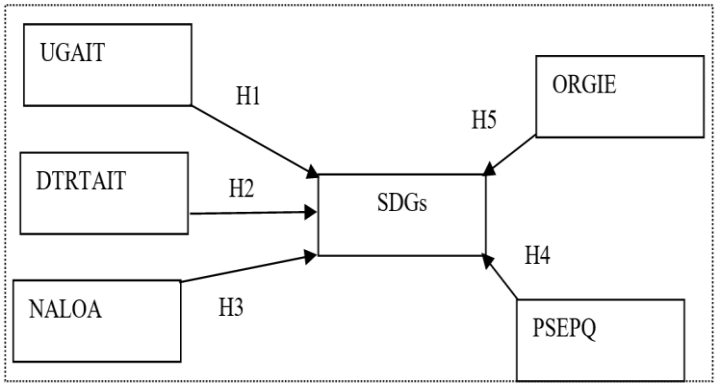

Figure 1. Conceptual framework.

The survey can be accessed by visiting (Navigating Generative AI in Education, 2024) and its structure with variables and their indicators as well as the abbreviation of each variable and indicators for the simple use in the Smart-PLS4 software and a sample of the survey structure explained in **Table 1**.

Table 1. Sample of the questionnaire structure.

Demographic Information			
Age	Experience	Country of PHD holder	specialization major
Dependent Variable 1: IV_SDG			
Indicators	(IV_SDG)-1 → (IV_SDG)-2 → (IV_SDG)-3 → (IV_SDG)-4 → (IV_SDG)-5		
Independent Variable 2: → DV(NALOA)			
Indicators	DV(NALOA)-1 → DV(NALOA)-2 → DV(NALOA)-3 → DV(NALOA)-4 → DV(NALOA)-5		
Independent Variable 3: DV(ORGIE)			
Indicators	DV(ORGIE)-1 → DV(ORGIE)-2 → DV(ORGIE)-3 → DV(ORGIE)-4 → DV(ORGIE)-5		
Independent Variable 4: DV(PSEPQ)			
Indicators	DV(PSEPQ)-1 → DV(PSEPQ)-2 → DV(PSEPQ)-3 → DV(PSEPQ)-4 → DV(PSEPQ)-5		
Independent Variable 5: DV(DTRTAIT)			
Indicators	DV(DTRTAIT)-1 → DV(DTRTAIT)-2 → DV(DTRTAIT)-3 → DV(DTRTAIT)-4 → DV(DTRTAIT)-5		
Independent Variable 6: DV(UGAIT)			
Indicators	DV(UGAIT)-5 → DV(UGAIT)-4 → DV(UGAIT)-3 → DV(UGAIT)-2 → DV(UGAIT)-1		

The survey consisted of seven sections. The first section aimed to collect demographic information about faculty members, including details such as age, years

of experience, specialty major, and country of PhD graduation. Section two, through six questions focused on different aspects called independent variables, included the Use of Generative AI Technologies (UGAIT), Development of Text Recognition Technologies for AI-generated Texts (DTRTAIT), New Approaches to Learning Outcome Assessment (NALOA), Paradigm Shift in Education and Educational Process Organization (PSEPQ), and Opportunities and Risks of Generative AI in Education (ORGIE). Sustainable development goals were considered as the dependent variable (IV_SDG). Each independent variable consisted of five questions or indicators. **Table 1** presents the structure of the survey, illustrating the organization of these sections.

3.1. Data collection and sampling process

Following a thorough review of pertinent literature and the identification of research problems, questions, hypotheses, and objectives, a clear understanding of the required data was obtained. Consequently, a questionnaire was developed, comprising five independent variables and one dependent variable. Each variable consisted of five indicators to accurately represent them. To ensure clarity and simplicity for respondents, all questions underwent expert review to prevent ambiguity or misunderstanding.

Subsequently, the questionnaire was created and uploaded to Google Drive as an E-questionnaire (Navigating Generative AI in Education, 2024) to streamline distribution and data collection processes. Before dissemination, a strict adherence to the sampling process was followed. The population was defined solely as instructors working in higher institutions in the Gulf countries, based on their availability via email or mobile phones. Most participants were affiliated with universities in Oman, while others were recruited from previous professional relationships and engagements in webinars and conferences. The E-questionnaire was administered from 1 September 2023 to 22 March 2024.

The sampling frame was established using instructor emails, employing a non-probability sampling design due to constraints in time and email availability. A sample size of 789 professors was determined in line with research objectives and population variability. Within this sampling framework, convenience sampling was utilized, targeting instructors best positioned to provide relevant information.

On 22 March 2024, 311 responses were received from the initially contacted 789 professors. Based on previous literature, it was concluded that a sample size of 250 or more would yield comparable results. Therefore, 311 responses were considered sufficient for subsequent analysis and research progression. References to prior studies by Hair, L.D.S. Gabriel, et al. (2019) guided the decision-making process regarding sample size considerations.

3.2. Data cleaning process

After retrieving the data from Google Form in CSV format, we commenced the data cleaning process using SPSS software. Initially, we scrutinized the minimum and maximum values within our dataset. Our data utilized a five-point Likert measurement scale, ranging from strongly disagree to strongly agree, with the minimum value

recorded as one (1) and the maximum value as five (5). Since these values were automatically generated by Google Form, the risk of manual data entry errors was eliminated.

Subsequently, we addressed any missing data, which were absent due to all questions in the Google Form being designated as mandatory entries. Moving forward, we conducted outlier detection to identify any extreme values. However, no outliers were detected, as all data were auto-calculated by Google Form.

In the fourth step of data cleaning, we examined for any anomalous responses by calculating the standard deviation. The standard deviation for all variables ranged between 0.85836 and 2.006025. As per statistical guidelines (Hair, Page, et al., 2019), (Hair et al., 2021; Hair, Risher, et al., 2019) values falling within plus or minus 2 standard deviations (SD) are considered close to the true value.

4. Data analysis and results

4.1. Reliability and validity

Reliability and validity were evaluated using Cronbach's Alpha and Composite Reliability (CR). Initially, any items with factor loadings below 0.700 were removed from the dataset. The construct of Development of Text Recognition Technologies for AI-generated Texts (DTRTAIT) was excluded from the analysis due to its lack of significant relationship with the dependent variable and its inconsistency with the IV_SDG variable. This decision was made after conducting thorough tests, including AVE and HTMT, and examining the standard deviation between the two variables. More than 35 records had a standard deviation of 0.000, while others were less than 0.2, possibly due to similar responses across variables. Consequently, removing the DTRTAIT construct ensures a more coherent and accurate model, addressing reliability and precision concerns. All indicators with factor loadings below the recommended threshold of 0.7 were eliminated, as illustrated in **Figure 2** before removal and **Figure 3** after removal.

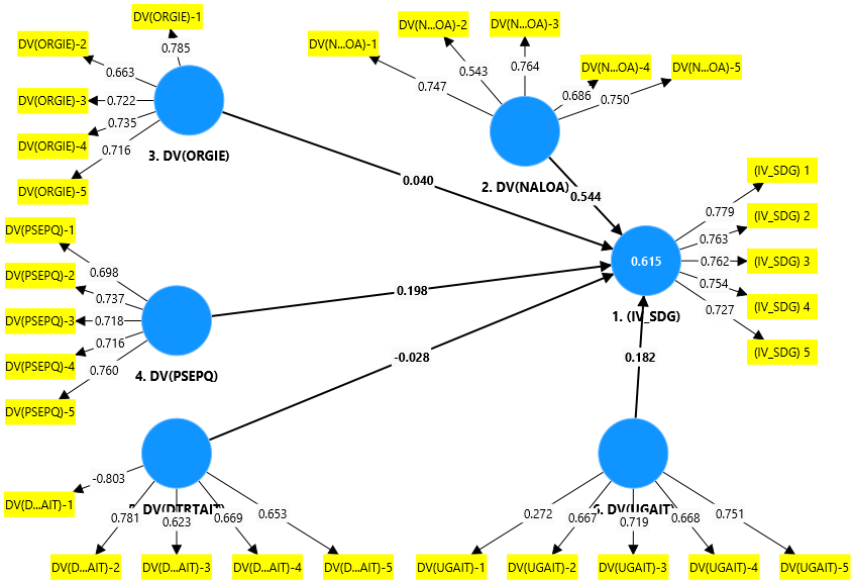

Figure 2. Constructs and indicators values before removing process.

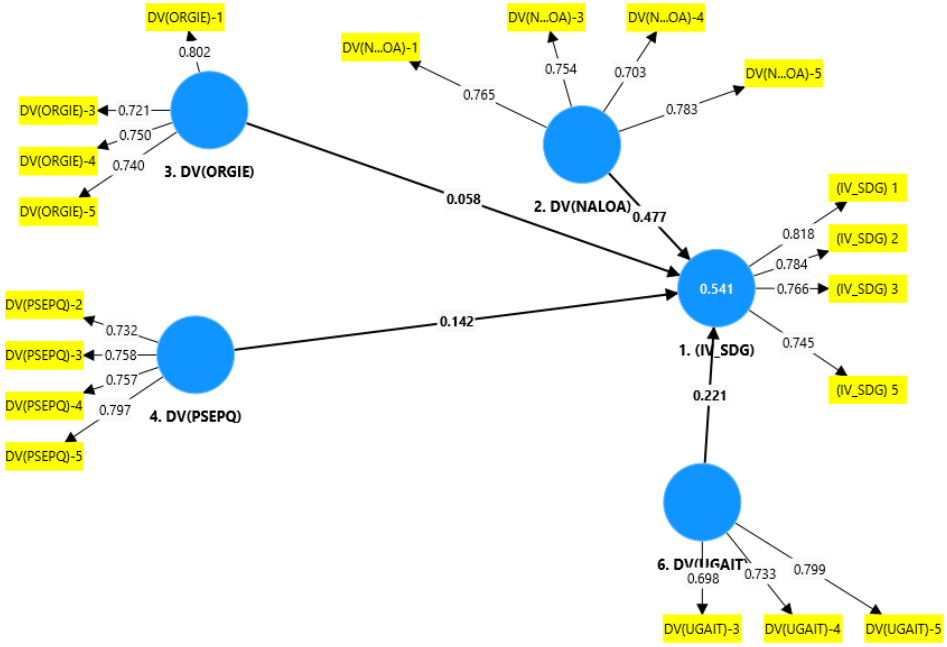

Figure 3. Constructs and indicators values after removing process.

The reliability and validity of the remaining items, along with their factor loadings, are presented in **Table 2**. All alpha values and CRs surpassed the recommended threshold of 0.700, indicating strong reliability. Convergent validity was confirmed by Average Variance Extracted (AVE) and CR values, all of which were equal to or greater than 0.500 and 0.700, respectively. Discriminant validity was established through cross-loadings, where factor loadings exceeded cross-loadings for all items, indicating distinctiveness. Additionally, multicollinearity was assessed with Variance Inflation Factor (VIF) values below 5 for each indicator, suggesting the absence of multicollinearity issues. Finally, **Table 3** displayed the cross-factor loadings of all items, showing that factor loadings consistently outweighed their cross-loadings, further affirming discriminant validity.

Table 2. Item loadings, reliability and validity.

	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
1. Sustainable development goals (SDG)		0.783	0.783	0.860	0.607
(IV_SDG) 1 < -1. (IV_SDG)	0.818				
(IV_SDG) 2 < -1. (IV_SDG)	0.784				
(IV_SDG) 3 < -1. (IV_SDG)	0.766				
(IV_SDG) 5 < -1. (IV_SDG)	0.745				
2. New Approaches to Learning Outcome Assessment (NALOA)		0.743	0.747	0.838	0.565
DV(NALOA)-1 < -2. DV(NALOA)	0.765				
DV(NALOA)-3 < -2. DV(NALOA)	0.754				
DV(NALOA)-4 < -2. DV(NALOA)	0.703				
DV(NALOA)-5 < -2. DV(NALOA)	0.783				

Table 2. (*Cintinued*).

	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
3. Opportunities and Risks of Generative AI in Education (ORGIE)		0.750	0.771	0.840	0.568
DV(ORGIE)-1 < -3. DV(ORGIE)	0.802				
DV(ORGIE)-3 < -3. DV(ORGIE)	0.721				
DV(ORGIE)-4 < -3. DV(ORGIE)	0.750				
DV(ORGIE)-5 < -3. DV(ORGIE)	0.740				
4. Paradigm Shift in Education and Educational Process Organization (PSEPQ),		0.759	0.764	0.846	0.580
DV(PSEPQ)-2 < -4. DV(PSEPQ)	0.732				
DV(PSEPQ)-3 < -4. DV(PSEPQ)	0.758				
DV(PSEPQ)-4 < -4. DV(PSEPQ)	0.757				
DV(PSEPQ)-5 < -4. DV(PSEPQ)	0.797				
5. Use of Generative AI Technologies (UGAIT)		0.609	0.630	0.788	0.554
DV(UGAIT)-3 < -6. DV(UGAIT)	0.698				
DV(UGAIT)-4 < -6. DV(UGAIT)	0.733				
DV(UGAIT)-5 < -6. DV(UGAIT)	0.799				

4.1.1. Discussion about DTRTAIT exclusion

The choice to omit the Development of Text Recognition Technologies for AI-generated Texts (DTRTAIT) variable was decided based on numerous factors:

4.1.2. Focus on educational impact

The major goal of our research is to investigate the function of Generative AI technologies in enhancing educational results and supporting the Sustainable Development Goals. While DTRTAIT is important in the larger context of AI, it is more concerned with technological breakthroughs and the detection of AI-generated information than with affecting teaching, learning, or knowledge transfer processes. As a result, integrating DTRTAIT in the current study would have shifted the focus away from the educational components we wanted to investigate.

4.1.3. Relevance to professors' opinions

Our research is centered on the opinions of Arab professors, notably those in Oman, on the integration of artificial intelligence in education. Professors are more likely to focus on how AI technologies improve learning outcomes and curriculum delivery than on the practicalities of text recognition. As a result, the omission of DTRTAIT allowed us to keep the study's relevance to the target audience and its practical consequences in an educational setting.

4.1.4. Future research potential

Although DTRTAIT was omitted from our analysis, we acknowledge its significance for future research. The growth and identification of AI-generated material will undoubtedly have an influence on educational tools, evaluations, and

content validation procedures. We feel that DTRTAIT requires distinct, focused study to properly appreciate its ramifications, notably in academic integrity and content verification.

4.2. Discriminant validity

Discriminant validity was further confirmed using criteria proposed by Fornell and Larcker and the Heterotrait-Monotrait method (HTMT), with results reported in **Tables 3** and **4**.

Table 3. Fornell-Larcker criterion.

	1. (IV_SDG)	2. DV(NALOA)	3. DV(ORGIE)	4. DV(PSEPQ)	6. DV(UGAIT)
1. (IV_SDG)	0.779				
2. DV(NALOA)	0.684	0.752			
3. DV(ORGIE)	0.523	0.606	0.754		
4. DV(PSEPQ)	0.475	0.459	0.592	0.761	
6. DV(UGAIT)	0.527	0.484	0.413	0.359	0.745

Table 4. Heterotrait-monotrait ratio (HTMT).

	1. (IV_SDG)	2. DV(NALOA)	3. DV(ORGIE)	4. DV(PSEPQ)	6. DV(UGAIT)
1. (IV_SDG)					
2. DV(NALOA)	0.892				
3. DV(ORGIE)	0.664	0.794			
4. DV(PSEPQ)	0.610	0.611	0.781		
6. DV(UGAIT)	0.737	0.687	0.594	0.525	

4.3. Structural model

Structural model evaluation was the subsequent phase of our analysis, aimed at examining the proposed hypotheses. **Table 5** presents the results used to test the direct hypothesis.

Table 5. Path coefficients, STDEV, *T* values, *p* values.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	*P* values
2. DV(NALOA) → 1. (IV_SDG)	0.477	0.478	0.061	7.752	0.000
3. DV(ORGIE) → 1. (IV_SDG)	0.058	0.059	0.067	0.860	0.390
4. DV(PSEPQ) → 1. (IV_SDG)	0.142	0.142	0.054	2.645	0.008
6. DV(UGAIT) → 1. (IV_SDG)	0.221	0.223	0.059	3.733	0.000

4.4. Hypothesis testing

A two-tailed test with a 95% significance level and a *t*-value of −1.96 was chosen, as no assumptions were made regarding the sign of the coefficient. This decision was influenced by the results reported in (Hair, L.D.S. Gabriel, et al., 2019).

Table 5 demonstrates the results of the hypothesis, revealing a significant impact of DV(UGAIT) on IV-SDG (B = 0.221, t = 3.733, p = 0.000) hence, H1 was supported. DV(DTRTAIT) was removed therefore H2 not applicable for testing. DV(NALOA) resulted (B = 0.477, t = 7.752, p = 0.000) hence, H3 was supported. DV(PSEPQ) resulted (B = 0.142, t = 2.645, p = 0.008) hence H4 was supported. A non-significant impact of DV(ORGIE) on SDG was found (B = 0.058, t = 0.860, p = 0.390) hence, H4 was rejected.

5. Discussion

The growing integration of generative AI in education, exemplified by the emergence of platforms like ChatGPT, has sparked debates on its implications for the educational landscape. Diverse viewpoints range from advocating for restricted access to such technologies until fundamental changes are made in education itself. This research paper presents a comprehensive analysis of academic expert opinions on the matter, alongside responses from university administrations and actions taken by stakeholders, providing a holistic view of the discourse. Focusing on trends in Generative AI Technologies and sustainable development goals, this study formulates research questions mapped to independent variables including Use of Generative AI Technologies (UGAIT), Development of Text Recognition Technologies for AI-generated Texts (DTRTAIT), New Approaches to Learning Outcome Assessment (NALOA), Paradigm Shift in Education and Educational Process Organization (PSEPQ), and Opportunities and Risks of Generative AI in Education (ORGIE). Sustainable development goals serve as the dependent variable. This study seeks to explore the relationship between educational technologies and approaches and their impact on sustainable development goals.

The discussion highlights a significant research gap in the current literature on Generative AI technologies in education, particularly within the Arab educational context, such as Oman. While existing studies have explored the transformative potential, ethical considerations, and impact of AI on educational outcomes, they often focus on global perspectives or technological advancements, lacking a deep dive into the cultural and educational specifics of Arab countries. Our study addresses this gap by offering a comprehensive analysis of the impact of Generative AI technologies on education in Oman, emphasizing the perspectives and trends among academic experts. This localized approach bridges the gap between global AI discussions and the unique educational practices in the Arab world. By exploring how these technologies influence sustainable development goals in Oman, our research provides insights that are directly relevant to the region. Moreover, our study contributes empirical data and analysis on the adoption and effectiveness of AI-driven educational tools in Oman, enhancing the understanding of how Generative AI can be leveraged to achieve educational and sustainable development objectives in Arab countries. This work significantly contributes to the field by offering a much-needed localized perspective, addressing the intersection of AI, education, and sustainable development within a specific cultural context. It also offers practical implications for educators, policymakers, and stakeholders, guiding the responsible and effective integration of AI in education to advance sustainable development goals in Oman and the broader

Arab region.

5.1. Variants of generative AI tools in education

When it comes to the use of Generative Artificial Intelligence (GAI) tools for educational purposes, the disparity between free and commercial versions of frequently utilized systems such as ChatGPT is an essential aspect to take into consideration. Basic functionality is provided by the free version, which enables users to interact with artificial intelligence for the purpose of generating content, learning a language, and receiving assistance with challenging inquiries. On the other hand, commercial versions, such as ChatGPT Plus, provide access to more complex artificial intelligence models, greater regulation, and faster reaction times than the free version. It is important for educational institutions and teachers who want to use artificial intelligence for academic reasons to make this distinction. There is a possibility that paid versions will offer more individually tailored information that is more in line with academic requirements, as well as enhanced safety features and increased precision. Furthermore, the regulatory procedures that are incorporated into premium versions of GAI tools are meant to prevent misuse, which is essential in educational contexts where the quality and dependability of the information that is created are of the utmost importance.

The availability of these cutting-edge resources, on the other hand, has the potential to create a gap in educational equity. Premium artificial intelligence services may be within the financial means of institutions that have greater resources, while other institutions may be restricted to free versions, which may have an effect on the quality of AI-driven learning experiences. This gives rise to more general concerns over accessibility and the digital divide, particularly in developing nations such as Oman or other such places. Teachers and policymakers are able to make better informed judgments on how to effectively integrate artificial intelligence technologies into learning settings by addressing both free and commercial forms of GAI tools. This allows them to guarantee that the integration of these technologies is fair and of high quality across a variety of educational contexts.

5.2. Discussion of results and answering research questions

The table presents the findings regarding the associations between different aspects of Generative AI and educational technologies (independent variables) and their influence on the advancement of Sustainable Development Goals (SDGs) (dependent variable). The factors analyzed comprise the application of Generative AI technologies (UGAIT), novel methods for evaluating learning outcomes (NALOA), changes in educational paradigms and educational process organization (PSEPQ), and the potential benefits and drawbacks of using Generative AI in education (ORGIE).

5.2.1. New approaches to learning outcome assessment (NALOA) and SDGs (research hypothesis h3)

Result: The path coefficient for the relationship between NALOA and progress towards SDGs is 0.477, with a t-statistic of 7.752 and a p-value of 0.000.

Interpretation: This result illustrates a robust and strong positive relationship between NALOA and progress towards SDGs. The low p-value and high t-statistic

support the robustness of this finding.

Response to Research Question: This finding demonstrates that modern assessment methods, most likely made possible by AI technologies, positively contribute to educational goals that are aligned with SDGs.

Recommendation: To improve their contributions to reaching the SDGs, educational institutions should keep innovating and implementing new evaluation techniques, especially those that use AI.

5.2.2. Opportunities and risks of generative ai in education (ORGIE) and SDGs (research hypothesis h5)

Result: The path coefficient for ORGIE and SDGs is 0.058, with a t-statistic of 0.860 and a p-value of 0.390.

Interpretation: This result suggests that there is no significant relationship between ORGIE and progress towards SDGs. The high *p*-value and low *t*-statistic indicate that opportunities and risks related to Generative AI in Education (ORGIE) do not strongly impact SDGs.

Response to Research Question: The hypothesis that ORGIE significantly affects SDGs is not supported. The research objective to assess this effect is only partially achieved, indicating that these opportunities and risks are significant but may not directly influence SDGs in a measurable way.

Recommendation: Policymakers and educators should concentrate on other variables that more directly contribute to the SDGs, even if managing the potential and dangers of generative AI in education is still important.

5.2.3. Education and the educational process organization (PSEPQ) and SDGs: Paradigm shifts (research hypothesis h4)

Result: With a *t*-statistic of 2.645 and a *p*-value of 0.008, the path coefficient for PSEPQ and SDGs is 0.142.

Answer to Research Question: This finding confirms that paradigm shifts in education significantly contribute to progress towards SDGs. The research objective is achieved, highlighting the significance of evolving educational processes and organizational structures in supporting SDGs.

Interpretation: This result demonstrates a moderate and significant positive relationship between paradigm shifts in education and progress towards SDGs. The significant *t*-statistic and low *p*-value indicate the reliability of this finding.

Recommendation: To further strengthen their contributions to accomplishing the SDGs, educational institutions should support and spearhead paradigm shifts, especially those that are in line with sustainable development.

5.2.4. Use of generative AI technologies (UGAIT) and SDGs (research hypothesis h1)

Result: The path coefficient for UGAIT and SDGs is 0.221, with a *t*-statistic of 3.733 and a *p*-value of 0.000. Interpretation: The results demonstrate a significant positive relationship between UGAIT and progress towards SDGs. The low *p*-value and high *t*-statistic confirm the significance of this relationship.

Answer to Research Question: This finding satisfies the research objective to investigate this impact.

Recommendation: Educational systems should continue to integrate Generative AI technologies to promote progress towards achieving SDGs, especially in contexts like Oman where these technologies can have a significant impact.

6. Conclusion and suggestions

The findings suggest that while opportunities and risks related to generative AI (ORGIE) do not directly affect SDG progress, new approaches to learning outcome assessment (NALOA), paradigm shifts in education (PSEPQ), and the use of generative AI technologies (UGAIT) all significantly contribute to it.

Suggestions

- Adoption of Innovative Assessment Techniques: To improve educational results in line with the SDGs, educational institutions should embrace and support emerging AI-driven assessment techniques.
- Promote Educational Paradigm Shifts: Leaders in education and policymakers should advocate for and carry out changes in educational practices that are consistent with the objectives of sustainable development.
- Boost Use of Generative AI: Organizations should employ generative AI technologies more often in order to take advantage of their beneficial effects on the SDGs, provided that they are applied sensibly and efficiently.
- Pay Attention to Things Other Than AI dangers and potential: Although there are dangers and potential associated with generative AI in education, more attention should be paid to elements like instructional strategies and evaluation techniques that have a greater direct impact on the SDGs.

These conclusions and suggestions offer educational institutions especially those in Oman a road map for strategically utilizing IA technology to further sustainable development objectives.

Author contributions: Conceptualization IA; methodology, KFS, FJIA and BS; software, BS; validation, BS; formal analysis, IA; investigation, IA and BS; resources, IA and BS; data curation, BS and IA; writing—original draft preparation, IA; writing—review and editing, IA, KFS, FJIA and BS; visualization, KFS, FJIA and BS; supervision, IA; project administration, IA and BS; funding acquisition, IA. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

References

Al Matari, A., Mukit, A., Al.Saadi, S., et al. (2023). Artificial Intelligence and the Future of Teaching in Higher Education at A'Sharqiyah University (ASU) in Oman. In: Proceedings of International Pelita Bangsa. pp. 182-200.

Al-Ani, W. (2016). Alternative education needs in Oman: accommodating learning diversity and meeting market demand. International Journal of Adolescence and Youth, 22(3), 322–336. https://doi.org/10.1080/02673843.2016.1179204

Alasadi, E. A., & Baiz, C. R. (2023). Generative AI in Education and Research: Opportunities, Concerns, and Solutions. Journal of Chemical Education, 100(8), 2965–2971. https://doi.org/10.1021/acs.jchemed.3c00323

Al-Shamsi, I. R., Shannaq, B., & Devarajanayaka, K. M. (2023). A Comparative Analysis of the Service Quality in Public and Private Company Telecommunication Services. Advances in Information and Communication. Springer Nature Switzerland. pp. 167–186. https://doi.org/10.1007/978-3-031-28076-4_15

Al-Shamsi, I. R., Shannaq, B., Adebiaye, R., et al. (2024). Exploring biometric attendance technology in the Arab academic environment: Insights into faculty loyalty and educational performance in policy initiatives. Journal of Infrastructure, Policy and Development, 8(9), 6991. https://doi.org/10.24294/jipd.v8i9.6991

Bahroun, Z., Anane, C., Ahmed, V., et al. (2023). Transforming Education: A Comprehensive Review of Generative Artificial Intelligence in Educational Settings through Bibliometric and Content Analysis. Sustainability, 15(17), 12983. https://doi.org/10.3390/su151712983

Hair, J. F., Gabriel, M. L. D. S., da Silva, D., et al. (2019). Development and validation of attitudes measurement scales: fundamental and practical aspects. RAUSP Management Journal, 54(4), 490–507. https://doi.org/10.1108/rausp-05-2019-0098

Hair, J. F., Hult, G. T. M., Ringle, C. M., et al. (2021). Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R. In Classroom Companion: Business. Springer International Publishing. https://doi.org/10.1007/978-3-030-80519-7

Hair, J. F., Page, M., & Brunsveld, N. (2019). Essentials of Business Research Methods. Routledge. https://doi.org/10.4324/9780429203374

Hair, J. F., Risher, J. J., Sarstedt, M., et al. (2019). When to use and how to report the results of PLS-SEM. European Business Review, 31(1), 2–24. https://doi.org/10.1108/ebr-11-2018-0203

Hair, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. (2024). Advanced issues in partial least squares structural equation modeling (Second edition). Sage.

Jungwirth, D., & Haluza, D. (2023). Artificial Intelligence and the Sustainable Development Goals: An Exploratory Study in the Context of the Society Domain. Journal of Software Engineering and Applications, 16(04), 91–112. https://doi.org/10.4236/jsea.2023.164006

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New Era of Artificial Intelligence in Education: Towards a Sustainable Multifaceted Revolution. Sustainability, 15(16), 12451. https://doi.org/10.3390/su151612451

Leelavathi, R., & Surendhranatha, R. C. (2024). ChatGPT in the classroom: navigating the generative AI wave in management education. Journal of Research in Innovative Teaching & Learning. https://doi.org/10.1108/jrit-01-2024-0017

Lehtonen, M. (2020). Harder governance built on soft foundations: experience from OECD peer reviews. Journal of Environmental Policy & Planning, 22(6), 814–829. https://doi.org/10.1080/1523908x.2020.1793746

Olney, A. M., Chounta, I.-A., Liu, Z., et al. (2024). Artificial Intelligence in Education. In: Proceedings of 25th International Conference; 8–12 July 2024; Recife, Brazil. https://doi.org/10.1007/978-3-031-64302-6

Rashid Al-Shamsi, I., & Shannaq, B. (2024). Leveraging clustering techniques to drive sustainable economic innovation in the India–Gulf interchange. Cogent Social Sciences, 10(1). https://doi.org/10.1080/23311886.2024.2341483

Ratten, V., & Jones, P. (2023). Generative artificial intelligence (ChatGPT): Implications for management educators. The International Journal of Management Education, 21(3), 100857. https://doi.org/10.1016/j.ijme.2023.100857

Sadriwala, K. F., Shannaq, B., & Sadriwala, M. F. (2024). GCC Cross-National Comparative Study on Environmental, Social, and Governance (ESG) Metrics Performance and Its Direct Implications for Economic Development Outcomes. In: Awwad, B. (editor). The AI Revolution: Driving Business Innovation and Research. pp. 429–441.

Segumpan, R. G., & McAlaney, J. (2023). Challenges and Reforms in Gulf Higher Education. Routledge. https://doi.org/10.4324/9781003457299

Shakir, M., Al Farsi, M. J., Al-Shamsi, I. R., Shannaq, B., & Ghilan Al-Madhagy, T.-H. (2024). The Influence of Mobile Information Systems Implementation on Enhancing Human Resource Performance Skills: An Applied Study in a Small Organization. International Journal of Interactive Mobile Technologies (iJIM), 18(13), 37–68. https://doi.org/10.3991/ijim.v18i13.47027

Shannaq, B. (2024). Unveiling the Nexus: Exploring TAM Components Influencing Professors' Satisfaction With Smartphone Integration in Lectures: A Case Study From Oman. TEM Journal, 2365–2375. Portico. https://doi.org/10.18421/tem133-63

Shannaq, B. (2024b). Digital Formative Assessment as a Transformative Educational Technology. In: Arai, K. (editor). Advances in Information and Communication. Springer Nature Switzerland. pp. 471–481. https://doi.org/10.1007/978-3-031-54053-0_32

Shannaq, B. (2024c). Enhancing Human-Computer Interaction: An Interactive and Automotive Web Application - Digital Associative Tool for Improving Formulating Search Queries. In: Arai, K. (editor). Advances in Information and Communication. Springer Nature Switzerland. pp. 511–523. https://doi.org/10.1007/978-3-031-54053-0_35

Shannaq, B., & Al Shamsi, I. (2024). Integrating Digital Transformation: Analyzing New Technological Processes for Competitiveness and Growth Opportunities in the Oman Economy. In: Awwad, B. (editor). The AI Revolution: Driving Business Innovation and Research. Springer Nature Switzerland. pp. 443–454. https://doi.org/10.1007/978-3-031-54383-8_34.

Shannaq, B., Adebiaye, R., Owusu, T., et al. (2024). An intelligent online human-computer interaction tool for adapting educational content to diverse learning capabilities across Arab cultures: Challenges and strategies. Journal of Infrastructure, Policy and Development, 8(9), 7172. https://doi.org/10.24294/jipd.v8i9.7172

Shannaq, B., Al Shamsi, I., & Abdul Majeed, S. N. (2019). Management Information System for Predicting Quantity Martials. TEM Journal, 1143–1149. Portico. https://doi.org/10.18421/tem84-06

Shannaq, B., Devarajanayaka, K. M., Shakir, M., et al. (2023). Generating an integrated SWOT strategy from the SERVQUAL survey results-the need for a comparative assessment of telecommunication companies in Oman. The second international conference on emerging technology trends in internet of things and computing, 3015, 020001. https://doi.org/10.1063/5.0188360

Shannaq, B., Saleem, I., & Shakir, M. (2024). Maximizing Market Impact: An In-Depth Analysis of the Market Penetration Strategy and Its Effective Tools for Sales Growth and Brand Expansion in the E-commerce Markets of Oman and Bahrain. In: Awwad, B. (editor). The AI Revolution: Driving Business Innovation and Research. Springer Nature Switzerland. pp. 277–291. https://doi.org/10.1007/978-3-031-54379-1_25

Syahrin, S., & Akmal, N. (2024). 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, 1(1), 73–89. https://doi.org/10.24093/awej/chatgpt.4

Wang, T. (2023). Navigating Generative AI (ChatGPT) in Higher Education: Opportunities and Challenges. Available online: https://link.springer.com/chapter/10.1007/978-981-99-5961-7_28 (accessed on 2 June 2024).

Yusuf, A., Pervin, N., & Román-González, M. (2024). Generative AI and the future of higher education: a threat to academic integrity or reformation? Evidence from multicultural perspectives. International Journal of Educational Technology in Higher Education, 21(1). https://doi.org/10.1186/s41239-024-00453-6