Salud, Ciencia y Tecnología. 2026; 6:2703
doi: 10.56294/saludcyt20262703

ORIGINAL

The Role of Artificial Intelligence Applications in Improving Research Competencies among Graduate Students

El papel de las aplicaciones de inteligencia artificial en la mejora de las competencias investigativas entre los estudiantes de posgrado

Haneya Salim Nasser Al Darii[1], Ahmad MJ O Alfawair[1] ✉, Khalifa Ahmed Al Qassabi[1], Rabia AlMur AlDhuhli[1], Saif Nasser AL Azri[1]

[1]University of Nizwa. Nizwa, Sultanate of Oman.

Cite as: Al Darii HSN, Alfawair AMO, Al Qassabi KA, AlDhuhli RA, Al Azri SN. The Role of Artificial Intelligence Applications in Improving Research Competencies among Graduate Students. Salud, Ciencia y Tecnología. 2026; 6:2703. https://doi.org/10.56294/saludcyt20262703

Submitted: 25-09-2025 **Revised:** 18-11-2025 **Accepted:** 12-12-2025 **Published:** 01-01-2026

Editor: Prof. Dr. William Castillo-González

Corresponding author: Ahmad MJ O Alfawair ✉

ABSTRACT

This study aimed to determine the degree of contribution of artificial intelligence (AI) applications to developing research skills and improving the quality of scientific research among postgraduate students at the University of Nizwa. It also sought to identify the university's role in supporting research quality, highlight the challenges facing the development of research skills, and explore the risks that AI applications may pose to research quality. The study sample consisted of (108) postgraduate students, and a correlational descriptive method was employed. Data were collected using a questionnaire comprising (45) items distributed across four dimensions. The results showed that the degree of contribution of AI applications to developing research skills and improving the quality of scientific research among postgraduate students was high. The findings also indicated that the degree of contribution of the University of Nizwa to supporting research quality was high, while the challenges facing the development of research skills were moderate. In contrast, the risks associated with AI use were found to have a high impact on research quality.

Keywords: Scientific Research; Postgraduate Studies; Artificial Intelligence Applications.

RESUMEN

Este estudio tuvo como objetivo determinar el grado de contribución de las aplicaciones de inteligencia artificial (IA) al desarrollo de las habilidades de investigación y a la mejora de la calidad de la investigación científica entre los estudiantes de posgrado de la Universidad de Nizwa. Asimismo, buscó identificar el papel de la universidad en el apoyo a la calidad de la investigación, destacar los desafíos que enfrenta el desarrollo de las habilidades investigativas y explorar los riesgos que las aplicaciones de IA pueden representar para la calidad de la investigación. La muestra del estudio estuvo compuesta por 108 estudiantes de posgrado, y se empleó un método descriptivo correlacional. Los datos se recopilaron mediante un cuestionario compuesto por 45 ítems distribuidos en cuatro dimensiones. Los resultados mostraron que el grado de contribución de las aplicaciones de IA al desarrollo de las habilidades investigativas y a la mejora de la calidad de la investigación científica entre los estudiantes de posgrado fue alto. Los hallazgos también indicaron que el grado de contribución de la Universidad de Nizwa al apoyo de la calidad de la investigación fue alto, mientras que los desafíos que enfrenta el desarrollo de las habilidades de investigación fueron moderados. En cambio, se encontró que los riesgos asociados con el uso de la IA tuvieron un impacto elevado en la calidad de la investigación.

Palabras clave: Investigación Científica; Estudios de Posgrado; Aplicaciones de Inteligencia Artificial.

INTRODUCTION

In an age characterized by rapid global transformations fueled by the digital revolution and ongoing technological progress, artificial intelligence (AI) has emerged as one of the most influential innovations shaping contemporary life.[1] It has introduced a profound qualitative shift across numerous fields, most notably in education, scientific research, and the understanding of human and social behavior.[2] Today, AI applications serve as indispensable tools that enrich educational processes, strengthen students' learning capacities, and open new pathways for the development of research and cognitive skills. They facilitate the analysis of data, ease access to information, and assist in idea generation, time management, and the organization of research stages. Moreover, they foster critical thinking and help refine evaluative and analytical abilities.[3]

Among the various academic groups, postgraduate students are among the primary beneficiaries of AI applications. The nature of their studies demands advanced levels of analysis, investigation, and innovation—areas in which AI can play a transformative role.[4] Through intelligent systems, graduate students and researchers can enhance their research competencies by systematically exploring social issues, designing structured approaches for information and data collection, and employing advanced technological tools to achieve accurate and reliable scientific outcomes.[5] AI is particularly valuable in areas such as big social data analysis, forecasting social trends, and digital content interpretation.[6] The overarching aim of these applications is to harness computing power and machine learning to develop a deeper and more precise understanding of human and societal behavior.[7]

AI technologies also support researchers throughout all phases of their academic work—from the initial conceptualization of research ideas and the organization of content in accordance with scientific and ethical standards, to the analysis of results, interpretation of findings, and accurate presentation of conclusions and recommendations within shorter timeframes. This contribution has led to remarkable academic progress, as a growing number of researchers rely on AI tools to enhance the quality and rigor of their studies. The expanding influence of AI has consequently drawn the attention of educators across disciplines, given its far-reaching implications for the future of humanity and the various dimensions of life it affects. Indeed, scientific research has always been a cornerstone of human advancement, with empirical studies and experiments continually improving the quality of life.[8]

The progress of nations and societies is now inseparable from the advancement of scientific research and its supporting tools. Accordingly, research skills have become a fundamental requirement for all members of academic institutions, especially students and researchers, regardless of their field of specialization. We are living in an era where true progress depends on solid scientific foundations, and the cultivation of competent researchers and critical thinkers capable of sustaining this progress is deeply tied to the strength of academic inquiry.[9] Building upon these considerations, the present study seeks to investigate the actual use of artificial intelligence applications in scientific research among postgraduate students at the University of Nizwa.

This study aims to investigate the extent to which intelligent technologies influence the research skills of university students and how these tools can be effectively harnessed to enhance the quality of scientific research while promoting intellectual engagement and creativity within academia. Findings from previous research have produced differing perspectives on this issue. For instance, [10] found that the use of artificial intelligence applications in improving scientific research writing skills was relatively limited. Their study also highlighted that female university students showed a low level of reliance on AI tools that could support the development of essential time management skills for conducting research. In contrast, [11] reported that AI applications made a significant contribution to the enhancement and development of research skills. Given these divergent results and in light of prior studies examining the role of AI applications in developing research competencies among postgraduate students, the need arose to conduct the present study. The purpose of this research is to identify the degree to which AI applications contribute to the development of research skills among postgraduate students at the University of Nizwa.

The theoretical significance of this study lies in its academic contribution to the Arabic library by connecting two variables that, to the researchers' knowledge, have not previously been examined together in Oman: artificial intelligence applications and research skills among postgraduate students. The topic is particularly relevant today due to the rapid expansion of AI technologies and their growing impact on higher education. This research may also serve as a foundation for future studies addressing similar themes, helping to shed light on the key challenges and obstacles that hinder the effective integration and use of AI within universities. The practical significance of the study is reflected in its potential to assist universities and the Ministry of Higher Education in developing clearer educational policies that incorporate artificial intelligence applications into postgraduate programs. Additionally, the findings may help researchers and postgraduate students better understand the extent to which AI contributes to the quality of scientific research, encouraging them to strengthen their skills and make more effective use of these technologies in their academic pursuits.

METHOD

The descriptive research method was utilized to ensure the reliability of the results and their relevance to the nature of the collected data. The data collection process for this study was designed to accurately examine the role of artificial intelligence (AI) applications in improving research competencies among graduate students. A correlational descriptive research method was employed to capture the relationships between AI application use, research skill development, and perceived research quality. The study targeted postgraduate students at the University of Nizwa, and a total of 108 participants were selected using a purposive sampling approach to ensure the inclusion of students actively engaged in research activities. Data were collected through a structured questionnaire developed specifically for this study based on relevant literature and the research objectives. The instrument consisted of 45 items distributed across four key dimensions: the contribution of AI applications to developing research skills, the university's role in supporting research quality, challenges facing research skill development, and risks associated with AI use in scientific research. The questionnaire was administered electronically to facilitate accessibility and encourage participation, particularly given the participants' varying schedules and academic commitments. Prior to distribution, the questionnaire underwent expert review to ensure clarity, validity, and alignment with the study variables. Participants were informed of the purpose of the research, assured of confidentiality, and given the option to withdraw at any stage. Responses were collected over a defined period during which reminders were sent to improve the response rate. After data collection was completed, responses were reviewed for completeness and accuracy before being prepared for statistical analysis. This systematic approach ensured the reliability and validity of the data used to evaluate the impact of AI applications on research competencies among graduate students.

Population and Sample

The population of this study consisted of all postgraduate students enrolled in the College of Sciences and Arts at the University of Nizwa during the academic year 2024/2025, totaling 339 students, according to statistics issued by the Deanship of Admission and Registration. To enhance the objectivity and generalizability of the findings, a random sampling method was employed to select participants. The final sample included 108 postgraduate students, representing 31,9 % of the total research population. The sample comprised 16 male students (14,8 %) and 92 female students (85,2 %), of whom 101 were master's students (93,5 %) and 7 were doctoral students (6,5 %). This distribution ensured adequate representation of the student body and supported the validity of the research outcomes (see table 1).

Table 1. Demographic Profile

Variable	Category	Number	Percentage
Gender	Male	16	14,8 %
	Female	92	85,2 %
Academic Qualification	Master's	101	93,5 %
	Doctorate	7	6,5 %
Table		108	100 %

Data Analysis Process

Once data collection was completed, the responses were screened for accuracy and completeness. The data were then coded and entered into the Statistical Package for the Social Sciences (SPSS) for analysis. The data analysis process involves using descriptive statistics such as means, standard deviations, and percentages to describe participant characteristics and measure the degree of contribution across the study's dimensions. Inferential statistical procedures were also applied where appropriate, including Pearson's correlation coefficients to confirm construct validity and Cronbach's Alpha to assess reliability. The descriptive research method guided the analytical approach to ensure that the findings aligned with the study objectives and accurately reflected the role of AI applications in improving research competencies among graduate students.

Research Instrument (Validity and Reliability)

To ensure the validity of the research instrument, ten expert reviewers specializing in educational administration were consulted. The experts unanimously agreed that all items of the questionnaire were appropriate and relevant for measuring the intended constructs. They suggested minor modifications to the wording of four items, which were subsequently revised. No items were removed from the instrument. Pearson's correlation coefficients were calculated to examine the relationship between the questionnaire items and their respective themes. The correlation values for the theme "The Role of Artificial Intelligence Applications in Supporting the Quality of Scientific Research" ranged from 0,562 to 0,762. For the theme "The Role of Nizwa

University in Supporting the Quality of Scientific Research," the values ranged from 0,618 to 0,844. Meanwhile, correlation values for the theme "Challenges Facing the Development of Research Skills" ranged from 0,618 to 0,853, and those for "Risks of Using Artificial Intelligence" ranged from 0,496 to 0,805. All these correlation coefficients were found to be statistically significant at the 0,01 level, confirming the construct validity of the instrument.

To verify the reliability of the questionnaire, a pilot sample consisting of (30) male and female students was selected. Based on the data collected, the reliability coefficient was determined using Cronbach's Alpha. The Cronbach's Alpha value for the axis "Role of Artificial Intelligence Applications in Supporting the Quality of Scientific Research" was (0,890), while the value for the axis "Role of Nizwa University in Supporting the Quality of Scientific Research" was (0,891). The axis "Challenges Facing the Development of Research Skills" recorded a value of (0,881), and the axis "Risks of Using Artificial Intelligence" showed a value of (0,924). These coefficients indicate that all scales demonstrate a high level of internal consistency, confirming their suitability and reliability for the purposes of the present study.

Ethical Aspects of the Research

This study adhered to essential ethical standards to ensure the protection, dignity, and rights of all participants. Prior to data collection, participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without penalty. Informed consent was obtained digitally as part of the questionnaire introduction. Confidentiality and anonymity were strictly maintained; no identifying information was collected, and responses were used solely for academic research purposes. Data were stored securely and accessed only by researchers. Furthermore, the study ensured that no harm—physical, psychological, or academic—would result from participation. Ethical approval was obtained in accordance with the guidelines of the University of Nizwa, ensuring full compliance with institutional research ethics policies.

RESULTS

The first objective of the study is to Identify the role of artificial intelligence applications in supporting the quality of scientific research. To achieve this objective, means and standard deviations were conducted for the items related to the role of AI applications in supporting research quality (table 2).

Table 2. Means and Standard Deviations for the Role of AI Apps in Supporting Research Quality

No.	Statement	Mean	Std Value	Rank	Level
1	They contribute to speeding up the research process and saving time.	4,59	0,56	1	Very High
2	They enable access to high-quality electronic knowledge sources.	4,15	0,77	8	High
3	They help me develop modern research skills.	4,01	0,94	11	High
4	They allow me to complete research tasks in record time	4,45	0,70	3	Very High
5	They make information accessible at any time.	4,51	0,65	2	Very High
6	AI tools help me receive knowledge from multiple sources.	4,31	0,80	5	Very High
7	Artificial intelligence is used to generate new sentences and simplify information	4,44	0,74	4	Very High
8	They help locate, read, and understand scholarly works through AI applications.	4,15	0,84	9	High
9	AI applications assist in paraphrasing research ideas.	4,25	0,87	6	Very High
10	I obtain accurate citations using AI applications.	3,70	1,02	12	High
11	AI applications play an important role in advancing scientific research.	4,21	0,82	7	Very High
12	I use ChatGPT in academic research or research projects.	4,03	1,03	10	High
Total		4,23	0,55		Very High

The findings in table 2 revealed that the mean level of the role of artificial intelligence applications in supporting the quality of scientific research was (4,23) with a standard deviation of (0,55), indicating a "very high" level. The statement "They contribute to speeding up the research process and saving time" recorded the highest mean score (4,59), reflecting students' appreciation of the importance of accelerating access to research information. In contrast, the statement "Obtaining accurate documentation" achieved the lowest mean score (3,70), indicating challenges in relying on these tools for academic referencing.

The second objective of the study is to analyze the role of the University of Nizwa in promoting the quality of scientific research. To achieve this objective, means and standard deviations were conducted for the items related to the role of AI applications in supporting research quality (table 3).

Table 3. Means and Standard Deviations for the Role of the University of Nizwa in Promoting the Quality of Scientific Research

No.	Statement	Mean	Std Value	Rank	Level
1	The university provides specialized units for the statistical analysis of research data.	3,54	0,92	9	High
2	The university library provides up-to-date references needed by students.	3,90	0,82	2	High
3	It develops research skills at the undergraduate level	3,84	0,89	3	High
4	It intensifies practical training on using the Statistical Package for the Social Sciences (SPSS) program in postgraduate statistics courses.	3,66	1,06	6	High
5	It offers specialized training courses in research design.	3,64	0,97	8	High
6	It trains students on the steps of scientific research.	3,94	1,00	1	High
7	It increases practical activities that enhance research skills.	3,69	0,98	5	High
8	It holds specialized training courses to develop research skills for postgraduate students	3,65	1,02	7	High
9	It trains students to practice analytical and critical writing in postgraduate research projects	3,74	0,98	4	High
Total		3,73	0,70		High

Data presented in table 3 show that the overall mean of the University of Nizwa's role in supporting the quality of scientific research reached (3,73) with a standard deviation of (0,70), indicating a "high" level. The statement "Training students on the steps of scientific research" ranked first with a mean of (3,94), followed by "Providing up-to-date references in the university library" with a mean of (3,90). This reflects the university's emphasis on equipping students with the foundational knowledge and essential research skills. Moreover, the results indicate that the university contributes to developing students' research capabilities through undergraduate courses and applied activities such as workshops and training programs in research design. However, some aspects—such as providing specialized data analysis units and offering intensive practical training in SPSS—scored relatively lower, suggesting the need to strengthen technical and applied support for postgraduate scientific research.

The third objective of the study is to determine the challenges that hinder the development of research skills among postgraduate students at the university. To achieve this objective, means and standard deviations were conducted for the items related to the role of AI applications in supporting research quality (table 4).

Table 4. Means and Standard Deviations for the Challenges Facing the Development of Research Skills

No.	Statement	Mean	Std Value	Rank	Level
1	Weakness of academic qualification programs in conducting field research in postgraduate programs.	3,48	0,87	4	High
2	Lack of guides for student researchers that include research skills to help them prepare their studies.	3,61	0,92	1	High
3	Teaching methods do not reach the appropriate level to provide students with research skills.	3,16	1,05	7	Moderate
4	Some faculty members do not sufficiently encourage students' intellectual independence.	3,25	1,16	6	Moderate
5	Reliance on examinations instead of scientific research as course requirements in postgraduate studies.	3,50	1,16	3	High
6	Lack of regular scientific activities such as workshops that develop research skills.	3,46	1,09	5	High
7	Lack of training in statistical analysis at the postgraduate level.	3,52	1,11	2	High
8	I face difficulty in understanding or using the concept of artificial intelligence in scientific research.	2,98	1,10	8	Moderate
Total		3,37	0,78		Moderate

The results presented in table 4 indicate that the overall mean of the challenges facing the development of research skills among postgraduate students reached (3,37) with a standard deviation of (0,78), reflecting a "moderate" level. This suggests the presence of several obstacles that may hinder the effective enhancement of students' research capabilities. The highest-rated challenge was "Lack of guides for student researchers that include research skills" with a mean of (3,61), followed by "Lack of training in statistical analysis" with a mean of (3,52). These findings point to notable gaps in research guidance and practical training. Other challenges included "Reliance on examinations instead of research projects" and "Lack of regular scientific activities such as workshops", both emphasizing insufficient opportunities for applied learning. In contrast, moderately rated items such as "Inadequate teaching methods for developing research skills" and "Limited encouragement of intellectual independence" highlight the need for a more interactive educational environment that promotes critical thinking and creativity among postgraduate students.

The last objective of the study is to determine the risks of using artificial intelligence on the quality of scientific research. Table 5 shows the means, and standard deviations were for the items related to the risks of using artificial intelligence on the quality of scientific research.

Table 5. Means and Standard Deviations for the Risks of Using AI on the Quality of Scientific Research

No.	Statement	Mean	Std	Rank	Level
1	It reduces the researcher's ability to avoid bias when writing research.	3,83	0,83	8	High
2	It negatively affects the researcher's creativity and innovation.	3,73	1,03	14	High
3	It leads to a decline in the researcher's critical thinking skills.	3,81	1,07	9	High
4	It decreases the researcher's ability to understand and interpret research results.	3,54	1,07	16	High
5	It reduces the researcher's respect for others' rights and intellectual property	3,64	1,09	15	High
6	It lessens the researcher's personal skill in writing research papers.	3,74	1,03	13	High
7	The researcher's personal information may be shared through applications.	3,88	0,86	5	High
8	Using applications reduces the confidentiality of scientific research	3,80	0,92	10	High
9	There is a possibility of researchers being spied on.	3,78	0,92	11	High
10	There is a risk of research ideas and results being stolen.	3,86	0,92	7	High
11	The accuracy of information obtained using AI tools cannot always be verified.	3,93	0,87	2	High
12	Errors may occur in interpreting results or analyzing data using AI applications.	3,88	0,87	6	High
13	Repetition of information obtained through AI applications.	3,95	0,89	1	High
14	Limited diversity in research methodologies due to overreliance on AI tools.	3,75	0,97	12	High
15	Risk of data manipulation within research.	3,89	0,82	4	High
16	Lack of security and confidentiality for individuals' personal information.	3,90	0,94	3	High
Total		3,81	0,65		High

The results presented in table 5 reveal that the overall mean for the risks of using artificial intelligence on the quality of scientific research reached (3,81) with a standard deviation of (0,65), indicating a "high" level of perceived risk. The highest-rated statement was "Repetition of information obtained through AI applications" with a mean of (3,95), followed by "Uncertainty regarding the accuracy of information" with (3,93), and "Lack of security and confidentiality of personal data" with (3,90). These results reflect a clear concern among students regarding excessive dependence on AI tools in academic research. Furthermore, the findings highlighted several risks associated with privacy violations, idea theft, reduced critical thinking, and a decline in researchers' personal analytical and writing skills. Such findings underscore the importance of raising students' awareness of responsible and ethical AI usage and providing adequate academic guidance to mitigate these risks while maximizing the potential benefits of technological innovation in research practices.

DISCUSSION

The findings of this study indicated that artificial intelligence (AI) applications play an active role in

supporting the quality of scientific research among postgraduate students at the University of Nizwa. The results showed that students make extensive use of these applications to accelerate the research process, access knowledge from diverse sources, and complete research tasks efficiently. This demonstrates that AI has become a key element of the modern era and a central tool in enhancing research practices. It also reflects students' awareness of the importance of employing such technologies, in line with the global trend toward adopting AI to improve efficiency, speed up outcomes, and ensure the quality of research outputs. These findings are consistent with [11] study, which found that AI applications significantly contribute to the development of research skills. However, they differ from the findings of [10], which revealed weak student reliance on AI tools for improving field research skills.

Regarding the role of the university, the results indicated that the University of Nizwa provides tangible support to its students in research activities through the availability of libraries, training courses, and academic programs that enhance research competencies. The university strives for academic excellence and higher global ranking, which drives it to develop its research environment and adopt strategies that integrate modern technology. It also works to provide a supportive infrastructure for developing students' research skills by offering workshops, specialized training, and technical assistance. However, these results contrast with those of a [12] study, which found that the level of training course provision was weak. Concerning the challenges, the study revealed several obstacles hindering the development of research skills, including limited practical training, a lack of instructional guides, and insufficient focus on scientific research within some courses. These findings align with [13] study, which reported that the challenges faced in developing research skills were of a moderate degree.

Finally, the results concerning the risks of using AI shed light on several negative aspects associated with these tools, such as reduced creativity, repetitive content, and privacy violations. This calls for academic and institutional interventions to regulate the use of AI and establish clear ethical guidelines. Such findings can be interpreted through real experiences encountered by students while using AI tools, including cases of fraud, phishing attempts targeting personal information, or cyberattacks through social media, email, or smart applications leading to unauthorized data access or computer breaches. However, these findings are consistent with [14] study, which also concluded that the risks associated with researchers' use of AI applications in academic research were of a high degree and emphasized the need to regulate AI use within academic settings to prevent overreliance on such tools and the subsequent weakening of researchers' independent analytical and intellectual capacities.

CONCUSION AND RECOMMENDATIONS

In light of the study findings, it becomes evident that artificial intelligence (AI) applications serve as an effective tool in enhancing the quality of scientific research among postgraduate students at the University of Nizwa. These applications contribute to accelerating access to information, improving accuracy in research tasks, and broadening knowledge sources. Moreover, university plays a significant role in providing a supportive research environment through training and academic preparation. However, certain aspects still require improvement, particularly in technical and statistical support, as well as in offering specialized academic guidance. Despite the multiple advantages of AI use, the study revealed some challenges and risks associated with these applications, including the decline in certain research skills, potential privacy violations, and uncritical dependence on pre-generated content.

Accordingly, the study recommends enhancing the university's role in developing research skills through specialized training programs, particularly those focusing on statistical applications and modern data analysis software. It further calls for the creation of guiding manuals that explain the ethical and safe use of AI applications in scientific research. The study emphasizes the need to integrate critical thinking and academic writing skills more extensively into course curricula to promote research independence and reduce excessive reliance on AI tools. Additionally, it encourages faculty members to provide intellectual and methodological support through active supervision and specialized feedback on the use of AI in research preparation. Finally, the study recommends introducing a dedicated course on AI applications to train students in their proper and effective use in scientific research.

REFERENCES

1. Hamad DNA, Ahmed A, Hammouri Q. A proposed concept for developing an intelligent personal assistant to support university students: an analytical study of their opinions. ECIS 2025 TREOs. 2025;Paper 31.

2. Hanandeh A, Hammouri Q, Al Tweijer A, Kilani Q, Abualfalayeh G, Khasawneh MA. Data-driven transformation: the influence of analytics on organizational behavior in IT service companies. Int J Data Netw Sci. 2024;8(4):2037–46. doi:10.5267/j.ijdns.2024.7.005

3. Hanandeh R, Qawasmeh EF, Alserhan AF, Hanandeh A, Hammouri Q, Halim M, Darawsheh SR. Utilizing business intelligence and digital transformation and leadership to enhance employee job satisfaction and business added value in Greater Amman Municipality. Int J Data Netw Sci. 2023;7(3):1077–84. doi:10.5267/j.ijdns.2023.5.016

4. Awad N. Integrating the learning of science, technology, engineering, and mathematics through a sound, waves and communication systems course: exploring cognitive and affective aspects. In: STEM in Science Education and S in STEM: From Pedagogy to Learning. Leiden: Brill; 2021. p. 150–75. doi:10.1163/9789004446076_008

5. Majadly H, Awad N, Amasha M. Online learning in higher education—learners' perceptions, interaction, flexibility and challenges. Int J Instr. 2024;17(3):545–64. doi:10.29333/iji.2024.17330a

6. Awad N, Santos I, Assadi N. Instructors' perceptions of teaching online during emergency remote teaching: the case of a teacher education college. J Educ Online. 2022;19(3):n3. doi:10.9743/JEO.2022.19.3.4

7. Nusairat NM, Dalbah LS, Hammouri Q, Al Gasawneh JA, Akhuirshaideh DA, Alnasser TZ, Anuar M. Student e-learning experience: a nexus among e-learning quality, student engagement and resulting satisfaction. In: 2023 International Conference on Business Analytics for Technology and Security (ICBATS); 2023. p. 1–5. doi:10.1109/ICBATS57792.2023.10111129

8. Hamdan I, Al-Omari B. The reality of empowering postgraduate students in Jordanian universities with research procedures based on the Conger and Kanungo model. Sci J Fac Educ Assiut Univ. 2022;38(7):311–28. doi:10.21608/mfes.2022.268194

9. Aulls MW, Shore BM. Inquiry in education. Volume I: the conceptual foundations for research as a curricular imperative. London: Routledge; 2023.

10. Abu Saleh MN, Nassar AS. The role of artificial intelligence applications in developing research skills among postgraduate students. Cairo J Soc Work. 2024;44(1):136–70. doi:10.21608/cjsw.2024.313028.1128

11. Al-Shammari M. Value chain co-creation in public service organizations: a proposed model. In: 2024 IEEE Conference on Technologies for Sustainability (SusTech); 2024 Apr; [conference location unknown]. New York: IEEE; 2024. p. 264–8.

12. Zamiri M, Esmaeili A. Strategies, methods, and supports for developing skills within learning communities: a systematic review of the literature. Adm Sci. 2024;14(9):231. doi:10.3390/admsci14090231

13. Ipanaqué-Zapata M, Figueroa-Quiñones J, Bazalar-Palacios J, Arhuis-Inca W, Quiñones-Negrete M, Villarreal-Zegarra D. Research skills for university students' thesis in e-learning: scale development and validation in Peru. Heliyon. 2023;9(3):e13770. doi:10.1016/j.heliyon.2023.e13770

14. Vasylyshyna N, Skyrda T, Lazorenko N, Kravets I. Legal perspective on artificial intelligence and academic integrity within university education process participants' research activity: new possibilities along with new limitations. Sci J Int Acad Appl Sci Lomza. 2024;96(4):59–82. doi:10.58246/xr3thd36

FINANCING

No financing.

CONFLICT OF INTEREST

None.

AUTHORSHIP CONTRIBUTION

Conceptualization: Haneya Al Darii, Ahmad Alfawair, Khalifa Al Qassabi and Saif AL Azri .
Data curation: Haneya Al Darii, Khalifa Al Qassabi and Rabia AlDhuhli.
Formal analysis: Ahmad Alfawair, Khalifa Al Qassabi and Saif AL Azri .
Research: Haneya Al Darii, Ahmad Alfawair and Rabia AlDhuhli.
Methodology: Haneya Al Darii, Khalifa Al Qassabi and Saif AL Azri .
Project management: Haneya Al Darii.
Resources: Khalifa Al Qassabi, Saif AL Azri.

Software: Ahmad Alfawair.
Supervision: Haneya Al Darii.
Validation: Ahmad Alfawair, Khalifa Al Qassabi and Saif AL Azri .
Display: Rabia AlDhuhli.
Drafting - original draft: Haneya Al Darii, Ahmad Alfawair and Khalifa Al Qassabi.
Writing - proofreading and editing: Rabia AlDhuhli and Saif AL Azri.