دور الذكاء الاصطناعي في تنمية مهارات التفكير النقدي والإبداعي لتعزيز ريادة الأعمال لدى الطلاب من وجهة نظر معلميهم في سلطنة عمان

The Role of Artificial Intelligence in Developing Critical and Creative Thinking Skills to Enhance Entrepreneurship among Students from the Perspective of Their Teachers in the Sultanate of Oman

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الملخص:

تهدف هذه الدراسة إلى استكشاف دور الذكاء الاصطناعي في تنمية مهارات التفكير النقدي، والتفكير الإبداعي، وتعزيز ريادة الأعمال لدى طلاب المدارس في سلطنة عمان من وجهة نظر معلمي مادة المهارات الحياتية. حيث تنطلق الدراسة من التوجهات الوطنية لرؤية عمان 2040، التي تضع الابتكار والمعرفة في صميم العملية التعليمية، وقد اعتمد الباحث المنهج الوصفي التحليلي مستخدمًا استبانة إلكترونية طُبقت على عينة قصدية مكونة من 21 معلمًا ومعلمة، وتم تحليل البيانات باستخدام برنامج SPSS. أظهرت النتائج أن للذكاء الاصطناعي أثرًا ملحوظًا في تطوير مهارات التفكير العليا، إذ بلغ متوسط تقييم المعلمين لمحور التفكير النقدي (4.33)، والتفكير الإبداعي (4.41)، وريادة الأعمال (4.52)، وهي مؤشرات تعكس درجة عالية من القناعة لدى المعلمين بأهمية الذكاء الاصطناعي في تعزيز بيئة التعلم. كما لم تظهر فروق ذات دلالة إحصائية في تقييمات المعلمين تُعزى للجنس، أو المؤهل، أو الخبرة، أو المرحلة التعليمية، مما يدل على تجانس في التوجهات التربوية. وقد أوصت الدراسة بإدماج الذكاء الاصطناعي في المناهج الدراسية بشكل منظم، وتدريب المعلمين على استخدام أدوات التصميم والتحليل الذكي، وتهيئة بيئات تعلم رقمية محفزة، بما يسهم في إعداد جيل ريادي قادر على الابتكار والمنافسة في ظل اقتصاد معرفي متسارع.

الكلمات المفتاحية: الذكاء الاصطناعي، التفكير النقدي، التفكير الإبداعي، ريادة الأعمال.

Abstract:

This study aims to explore the role of artificial intelligence in developing critical thinking skills, creative thinking, and enhancing entrepreneurship among school students in the Sultanate of Oman from the perspective of life skills teachers. The study stems from the national directions of Oman Vision 2040, which places innovation and knowledge at the heart of the educational process. The researcher adopted a descriptive analytical approach, using an electronic questionnaire administrated to a purposive sample of 21 teachers. The data was analyzed using the SPSS program. The results showed that artificial intelligence has a notable impact on the development of higher- order thinking skills, as the average teacher evaluations were (4.33), for critical thinking, (4.41) for creative thinking, and (4.52) for entrepreneurship– indicators that reflect a high level of conviction among teachers regarding the importance of artificial intelligence in enhancing the learning environment. There were also no statistically significant differences in the teachers' evaluations based on gender, qualification, experience, or educational stage, indicating a homogeneity in educational orientations. The study recommended the systematic integration of artificial intelligence into school curricula, training teachers in the use of intelligent design and analysis tools, and preparing stimulating digital learning environments, thereby contributing to the development of an entrepreneurial generation capable of innovation and competition in a rapidly evolving knowledge-based economy.

Keywords: Artificial Intelligence, Critical Thinking, Creative Thinking, Entrepreneurship.

The Methodological Framework of the Study:

Introduction:

The world is currently witnessing an accelerated digital revolution, led by artificial intelligence (AI), which is no longer limited to the fields of industry and commerce, but it has become act a basic role in renaissance of the educational process, especially in enhancing students' critical and creative thinking skills (Favero et al., 2024). Developing these skills is considered one of the fundamental requirements for preparing the new generation to face the challenges of 21st century, particularly in light of the rapid transformations in the labor market and the global economy.

In the Omani context, Oman vision 2040 emphasizes the significance of investing in human capital and developing the education system to enhance the individuals' abilities in innovation, analytical thinking, and entrepreneurship. The vision states the aim of "building an educational system distinguished by quality and competitiveness that meets the requirements of the Fourth Industrial Revolution" (Oman Vision 2040, 2020). Therefore, employing artificial intelligence in education is considered one of the strategic pillars for achieving this vision, through its integration into learning tools and teaching methods.

Universities and academic institutions and play a fundamental role in this transformation. Many institutions in the Sultanate of Oman are moving toward integrating artificial intelligence technologies into curricula and training teachers to use them effectively, thereby contributing to the development of students' high-order thinking skills. Yildiz Durak (2024) study indicates that incorporating artificial intelligence tools such as ChatGPT and Midjourney into design-based learning environments has led to improved levels of creativity and reflective thinking among students. This highlights the significant potential of these tools in enhancing the quality of higher and vocational education.

On the other hand, modern literature emphasizes that updating curricula to include concepts of artificial intelligence and machine learning enhances students' abilities in problem-solving, generating new ideas, and stimulates their capacity for entrepreneurial thinking (Dwivedi et al., 2023). Research shows that students exposed to artificial intelligence-based learning become more prepared to engage in future entrepreneurial experiences, as they develop skills such as decision-making, planning, data analysis (Winkler et al., 2023).

Based in the above, this study seeks to explore the perspectives of teachers in the Sultanate of Oman regarding the role of artificial intelligence in developing students' critical and creative thinking skills, as well as enhancing entrepreneurship. The aim is to contribute to the advancement of contemporary educational trends and the development of a technology-based learning environment that supports the national goals of Oman's future vision.

The Problems and Questions of the Study:

In light of the rapid global technological transformations, artificial intelligence emerges as an effective tool for reshaping learning environments, thanks to the capabilities it offers to support and stimulates critical and creative thinking skills —skills that have become fundamental pillars of 21st-century education (Favero, et al., 2024). These two types of thinking are not limited to cognitive achievement; rather, they are among the essential life skills that enable students to analyze information deeply, think logically, and generate innovative solutions to real-world problems.

With the increasing use of artificial intelligence tools such as ChatGPT, Midjourney, and Khanmigo in classrooms, it has become essential to develop traditional teaching methods to adapt to these technologies. This adaptation can help stimulate students' curiosity,

enhance their analytical skills, and promote self-directed creativity (Yildiz Durak, 2024). However, the effectiveness of these tools largely depends on teachers' awareness of how to purposefully integrate artificial intelligence into classroom practices in a pedagogically sound manner.

In this context, social media platforms and digital tools have become an integral part of students' daily lives. They can be effectively utilized as educational media to enhance critical thinking through opened discussions, as well as, to foster creativity through interactive digital projects (Lulla et al., 2023). However, such use requires teachers to possess advanced digital awareness, flexibility in educational design, and the ability to transform these platforms from mere entertainment tools into motivating learning environments.

Referring back to Oman vision 2040, which aims to empower human capital through quality education based on innovation, enhancing critical and creative thinking through artificial intelligence is a strategic pathway towards building an entrepreneurial generation capable of tackling future challenges (Oman 2040, 2020).

Based on this, the study problem arises from the need to analyze the awareness of teachers in the Sultanate of Oman regarding the role of artificial intelligence in developing critical and creative thinking skills. In addition, it aims to explore the enhancement of entrepreneurship through digital teaching methods and interactive platforms, within a changing educational reality that requires integration between technology and education.

The study problem is identified by answering the following questions:

1. To what extent does artificial intelligence contribute to developing students' critical thinking skills from the teachers' perspectives?

2. To What extent does artificial intelligence contribute to developing students' creative thinking skills?
3. How do teaching methods that employ artificial intelligence affect the enhancement of students' entrepreneurship?
4. What is the role of teachers' digital awareness in activating the potential of artificial intelligence in the classroom?
5. To what extent do social media platforms and digital tools contribute to supporting students' critical and creative thinking?
6. Are there statistically significant differences in the teachers' perspectives on the role of artificial intelligence in developing these skills, attributed to variables such as (gender, educational qualification, years of experience, and educational stage)?

Study Hypothesis:

In light of the study questions and previous research, the following hypothesis is proposed:

There is a statistically significant effect of the use of artificial intelligence on developing students' critical thinking skills, creative thinking skills, and enhancing entrepreneurship, from the perspectives of teachers in the Sultanate of Oman.

Sub-Hypothesis:

1. There is a statistically significant effect of using artificial intelligence on developing students' critical thinking skills from the teachers' perspectives.
2. There is a statistically significant effect of using artificial intelligence on developing students' creative thinking skills from the teachers' perspectives.

3. There is a statistically significant effect of teaching methods that rely on artificial intelligence in enhancing students' entrepreneurship.
4. There is a statistically significant effect of teachers' digital awareness in activating the potential of artificial intelligence in developing students' critical and creative thinking skills.
5. There is a statistically significant effect of using digital platforms and social media in supporting students' critical and creative thinking skills.
6. There are statistically significant differences in teachers' perspectives regarding the role of artificial intelligence in developing students' critical thinking, creative thinking, and entrepreneurship skills, attributed to demographic variables such as gender, educational qualification, years of experience, and educational stage?

Objectives of the Study:

1. To identify the role of artificial intelligence technologies in developing critical thinking skills for primary school students from the perspectives of life skills teachers in the Sultanate of Oman.
2. To analyze the contribution of artificial intelligence in enhancing students' creative thinking skills, and to examine the extent of its impact on supporting imagination and generating innovative within the educational environment.
3. To explore the relationship between critical and creative thinking skills and their role in activating the use of artificial intelligence in the educational process as a learning tool that promotes interaction and deep understanding.

4. To identify the impact of creative and critical thinking skills in enhancing students' orientation toward entrepreneurship, and their role in supporting the entrepreneurial abilities such as planning, market analysis, and decision-making.
5. To measure the extent to which artificial intelligence contributes to developing students' entrepreneurial skills by facilitating innovation, supporting projects, and fostering individual initiative.
6. To analyze the differences in teachers' perspectives on the role of artificial intelligence, as well as critical and creative thinking, in developing students' entrepreneurship, according to demographic variables such as gender, educational qualification, years of experience, and educational stage.
7. To propose a set of educational recommendations that contribute to effectively integrating artificial intelligence into life skills education, in order to enhance students' critical, creative, and entrepreneurial thinking.

The significance of the Study:

1st: Theoretical Significance

The theoretical significance of this study stems from its focus on one of the most contemporary educational topics; the role of artificial intelligence in developing critical thinking, creative thinking, and entrepreneurship skills. These skills represent a cornerstone in building learners who are capable of keeping up with the challenges of the digital age and meeting the demands of the Fourth Industrial Revolution.

The study also contributes to enriching the scientific literature in the Arab and Gulf contexts, particularly with regard to the extent of teachers' awareness of the importance of integrating artificial intelligence technologies into the educational process and their impact on the

development of teaching methods. This field remains in need of further research and theoretical foundation (Yildiz Durak, 2024; Favero et al., 2024).

In addition, the importance of the study stems from its focus on critical and creative thinking, which are among the most prominent 21st–century skills. Educational institutions worldwide are increasingly emphasizing their inclusion in curricula and study plans.

22nd: The Practical Significance

The practical significance of the study lies in its reliance on teachers' perspectives in the Sultanate of Oman, providing valuable field data that can be utilized to improve educational policies and design training programs aimed at enhancing teachers' digital competence and developing their skills in using artificial intelligence tools through effective and creative methods.

The expected results contribute to guiding educational decision–makers toward integrating artificial intelligence and digital platforms into curricula with the aim of developing students' entrepreneurial skills and creating an educational environment that fosters innovation and independent thinking (Winkler et al., 2023).

The study supports the orientations of Oman vision 2040, which aims to build a modern and innovative educational system based on technology and knowledge. This is achieved by enhancing the abilities of teachers and students to adapt to technological changes and effectively utilize them to achieve sustainable development.

The study derives its significance from both its scientific topic and its practical application. It is expected to provide benefits after its implementation and the clarification of its results in the following areas:

1. **Curriculum development:** Contributes to updating the curricula by integrating artificial intelligence to enhance creative and critical thinking.
2. **Teacher training:** Supports the need to qualify teachers in using artificial intelligence tools inside classrooms.
3. **Supporting digital transformation:** The vision of the Sultanate of Oman keeps pace with digitalizing education and effectively employing artificial intelligence.
4. **Future skills development:** Enhances students' preparation for the labor market through critical, creative, and entrepreneurial thinking.
5. **Improving entrepreneurship education:** Clarifies how artificial intelligence helps students analyze problems and plan projects.
6. **Enriching educational research:** Serves as a modern scientific reference in the field of artificial intelligence and education in the Arab environment.
7. **Encouraging innovation in education:** Encouraging teachers to design innovative activities that integrate artificial intelligence technologies.
8. **Enhancing technology acceptance:** Explores teachers' readiness to adopt technology regardless of their educational background.

Study Limitations:

- **Topical limitations:**

This study focuses on the role of artificial intelligence technologies in developing creative and critical thinking skills with the aim of enhancing entrepreneurship for students. The study doesn't cover other areas of artificial intelligence, such as management, evaluation, or administrative automation.

- **Spatial limitations:**

The study was conducted in the Sultanate of Oman and targeted a number of public schools that offer the Life Skills subject.

- **Time Limitations:**

The study was conducted during the second semester of the 2024-2025 academic year. Data was collected through an electronic questionnaire between March and May 2025.

Study Terms:

1. **Thinking:** Al-Karmi (2019) defined thinking as "a mental activity carried out by the mind and memory to solve a problem or to create something new by utilizing available data". Thinking has been defined in various ways by educators and scholars such as Mayer, de Bono, John Barell, Robert Solso, and Magdy Habib, and others, and their definitions can be reviewed in their original sources.
2. **Critical Thinking:** Abu Jaleel (2022) defined it as "reasonable reflective thinking that focuses on what an individual believes or performs. It involves examining and evaluating proposed solutions in order to make a judgment about the value of a given matter.
3. **Creative Thinking:** It is the ability to generate new and original ideas and to move beyond traditional patterns of thought by employing imagination and mental flexibility to solve problems in unconventional ways. According to Yildiz Durak (2024), creative thinking is a mental process aimed at generating valuable ideas through imagination, originality, and flexibility.
4. **Entrepreneurship:** It is defined as "managing and developing resources in order to establish an institution or a network of economic institutions characterized by the ability to innovate and operate under

risky conditions to achieve economic gains and growth (Dollinger, 2008: 21).

5. **Entrepreneurial Education:** Al-Muqbalya (2019) defined it as "a process that can be achieved through establishing a new business venture based on a creative, innovative, and unique idea. It is characterized by calculated risk-taking and the dedication of the necessary time and effort to ensure the success of the project. The outcomes of this process contribute to effectively seizing entrepreneurial opportunity for economic and social development. Furthermore, entrepreneurship is not limited—as some may perceive—to the establishment and management of projects; rather, it extends to include the development of knowledge, skills, and attitudes related to the labor market as a whole.

6. **Entrepreneurial Skills:** According to Hayton (2015), entrepreneurial skills are a set of technical, managerial, and personal abilities. Technical skills include environmental scanning, problem-solving, the application and use of technology, and organisational relationships. Managerial skills involve planning and goal setting, decision-making, human resource management, marketing, finance, accounting, customer relations, quality control, negotiation, and launching new business ventures. Personal skills consist of self-control and discipline, risk management, innovation, perseverance, leadership, change management, networking, and strategic thinking.

7. **Artificial Intelligence:** It is a computer-based system that relies on advanced algorithms to simulate human behaviors such as analysis, comprehension, and decision-making. In the field of education, AI is used to personalize the learning process based on students' needs and performance. Dwivedi et al. (2023) define it as "algorithm-powered intelligent systems capable of analyzing learners' behavior and

adapting to it in order to provide a personalized and effective learning experience.

8. **21st Century Skills:** According to UNESCO (2023), 21st century skills are a set of a fundamental abilities required by learners in the digital age, such as critical thinking, creativity, teamwork, and the effective use of modern technologies. These skills include both cognitive and non-cognitive capacities that enable learners to interact with and succeed in educational environments supported by artificial intelligence.

Study Population:

The study population consists of all life skills teachers working in public schools in the Sultanate of Oman, who teach students at both the basic and secondary stages. This group holds great significance given the educational transformations that institutions witness in the region, especially regarding the integration of artificial intelligence technologies into the classroom environment to enhance critical and creative thinking skills (Yildiz Durak, 2024). Additionally, Favero et al. (2024) point out that the effectiveness of artificial intelligence in supporting reflective thinking is more evident among teachers directly involved in life skills and entrepreneurial education, making this population directly relevant to the study's objectives.

The Study Sample:

A purposive sample consisting of 21 male and female life skills teachers from various public schools in the Sultanate of Oman was selected. The sample was diverse in terms of gender, academic qualifications, years of experience, and educational level, which enhances its balanced representation of the realities faced by teachers in this field. Data were collected during the second semester of the 2024 – 2025

academic year using an electronic questionnaire based on a Five-point Likert scale, which is considered one of the appropriate tools for measuring educational and behavioral attitudes (Dwivedi et al., 2023).

The purposive selection of the sample is supported by previous recommendations in qualitative and quasi-experimental studies that focused on the role of artificial intelligence in education. These studies emphasized the importance of understanding the perceptions of field practitioners regarding AI technologies in real educational contexts (Winkler et al., 2023). Moreover, UNESCO (2023) recommends involving teachers in the stages of evaluating the effectiveness of smart technologies, as they are the key actors in implementing and adapting these tools to meet the diverse needs of students.

Table 1: Distribution of the Study Sample by Gender and Educational Qualification (n = 21)

#	Educational qualification	Frequency (n)	(%) pourcentage
male	Bachelor	7	33.3%
	Postgraduate studies	5	23.8%
female	Bachelor	6	28.6%
	Postgraduate studies	3	14.3%
total	—	21	100%

Analytical Framework of the Study:

- **Study Methodology and Procedures:**

The researcher employed the descriptive analytical method relying on the Statistical Package for the Social Sciences (SPSS) to align with the

study's objectives and the nature of human phenomenon, aiming to maximize both internal and external validity.

- **Population of the Study:**

The study population consisted of life skills teachers in the (Al-Batinah) region of the Sultanate of Oman, totaling (1229) male and female teachers (National Center for Statistics, 2025).

- **Study Sample:**

The study sample consisted of 49 male and female teachers, selected according to Richard Geiger's formula.

Table (2): Distribution of the Study Population

Gender	Frequency
Males	15
Females	34
Total	**49**

Source: Prepared by the researcher (2024)

- **Validity of the Instrument:**

The researcher refined and standardized the questionnaire items to ensure their validity:

To verify the validity of the instrument, a set of methodological procedures was followed to ensure that the tool accurately measures what it was designed to measure, as outlined below:

- **Face Validity:**

The questionnaire in its initial form was presented to a panel of experts specialized in education, educational measurement and evaluation, and artificial intelligence in education. The aim was to assess the clarity, accuracy, and relevance of the items to the study's domains.

The experts provided valuable feedback that helped improve the wording of the items both linguistically and conceptually. These revisions were used to strengthen the alignment of each item with its corresponding domain, thereby enhancing the face validity of the instrument (Creswell & Creswell, 2018).

- **Construct Validity:**

The researcher employed Confirmatory Factor Analysis (CFA) to examine the internal structure of the instrument by statistically assessing the extent to which each item was associated with its respective domain. The Diagonally Weighted Least Squares (DWLS) method was used, as it is more appropriate for tools based on a five-point Likert scale. The results showed that the items were logically and consistently distributed in line with the proposed theoretical structure, which supports the construct validity of the instrument (Field, 2022).

- **Reliability of the Instrument:**

The researcher verified the reliability of the instrument using the Test-Retest Reliability. The questionnaire was administered to a pilot sample of 20 female and male teachers from the study population and then re-administered to the same sample after two weeks—a period considered appropriate to ensure stable conditions and minimize the effects of memory or temporary behavioral changes, as recommended by Hanfi et al. (2022). Pearson correlation coefficients were calculated between the two administrations, showing high correlations across all domains, indicating a good degree of temporal stability for the measurement tool.

Additionally, the internal consistency reliability (Cronbach's alpha) was calculated for each domain of the instrument. The values were (α = 0.88) for the Critical Thinking domain, (α = 0.91) for Creative Thinking, and (α = 0.90) for Entrepreneurship. These values indicate high reliability,

exceeding the acceptable minimum threshold of 0.70 as noted by Nunnally and Bernstein (2010). That refers the items within each domain are highly homogeneous and that the instrument can be confidently relied upon to measure the targeted constructs in this study.

- **Study Results and Outcomes:**

Question one: To answer the first question, to what extent does artificial intelligence contribute to the development of students' critical thinking skills from the teachers' perspective?

A set of descriptive statistical methods appropriate to the nature of the data was employed. Means were calculated for each item within the critical thinking domain, in addition to the overall mean for the domain, in order to determine the general level of perception according to the five-point Likert scale. This scale ranges from "Strongly Disagree" to "Strongly Agree" and is interpreted as follows: from 1.00 to less than 1.80 = Very Low, from 1.81 to less than 2.60 = Low, from 2.61 to less than 3.40 = Moderate, from 3.41 to less than 4.20 = High, and from 4.21 to 5.00 = Very High (Creswell & Creswell, 2018).

Table (3): Teachers' Evaluation of the Contribution of Artificial Intelligence to Critical Thinking (n = 21)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Highest Percentage
Supports logical analysis	10 (47.6%)	7	2	2	0	Strongly Agree
Enhances the ability to ask critical questions	8 (38.1%)	9	3	1	0	Agree
Contributes to supporting decision-making	9 (42.9%)	8	3	1	0	Strongly Agree

The results indicated that the overall mean for the critical thinking domain was 4.33, which falls within the "Very High" category. This reflects a strong consensus among the sample members regarding the role of artificial intelligence in developing critical thinking. In addition, the standard deviation was calculated and found to be ±0.42, in order to determine the degree of consistency or variability in participants' responses. The low standard deviation value indicates a clear convergence of opinions.

In addition, a frequency and percentage analysis were conducted for each item individually, in order to present how teachers' responses were distributed. The data showed that the majority of teachers strongly agreed that artificial intelligence enhances logical analysis, supports decision-making, and strengthens the ability to pose reflective questions. This supports the quantitative result and adds further depth to the interpretation of the qualitative outcomes.

The mean score for the critical thinking domain was 4.33, which falls within the "Very High" category according to the Likert scale, with a standard deviation of ±0.42. This indicates a strong level of agreement among the sample participants. The percentages show that the majority of teachers see artificial intelligence as a stimulus for analytical and interpretive thinking, as well as a tool that supports students' reflective abilities.

Teachers' evaluations reflect a clear conviction that artificial intelligence is an effective tool for enhancing critical thinking skills in the classroom environment, particularly in the areas of analysis, questioning, and decision-making.

Question Two: To what extent does artificial intelligence contribute to the development of students' creative thinking skills from the teachers' perspective?

To answer this question, a set of descriptive statistical methods appropriate to the nature of the data was employed. Means were calculated for each item within the creative thinking domain, in addition to the overall mean for the domain, in order to determine the level of responses based on the five-point Likert scale. The overall mean for the creative thinking domain was 4.41, which indicates a "Very High" level of evaluation. This reflects a strong conviction among the sample members regarding the impact of artificial intelligence in enhancing students' creativity.

Table (4): Teachers' Evaluation of the Creative Thinking Domain (n = 21)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Highest Percentage
It enhances students' imagination.	11 (52.4%)	6	3	1	0	Strongly Agree
It contributes to generating new ideas.	10 (47.6%)	8	2	1	0	Strongly Agree
It provides tools that support innovation.	9 (42.9%)	9	2	1	0	Agree/Strongly Agree

The domain recorded a mean score of 4.41 with a standard deviation of ±0.39, which also falls within the "Very High" category. This indicates that artificial intelligence is viewed by teachers as a motivating factor for creativity. The AI tools varied between those that generate content and those that design visual or textual ideas, all of which contribute to the development of imagination and innovation.

It can be concluded that artificial intelligence plays an important role in fostering creative thinking by providing stimulating learning

environments and interactive tools that help unleash students' intellectual potentials.

Question Three: How do teaching methods that utilize artificial intelligence affect the enhancement of entrepreneurship among students?

To answer this question, arithmetic means were calculated to determine the degree of responses by the sample members to each item of the entrepreneurship domain, in addition to calculating the overall mean for the domain. The standard deviation was also calculated to measure the degree of homogeneity in the sample's responses around the mean. Frequency and percentage analyses were employed to display the distribution of response scores and to identify the items with the highest rates of acceptance or agreement. These methods provided an accurate quantitative overview, contributing to the interpretation of teachers' general attitudes toward employing artificial intelligence in developing students' entrepreneurial skills, without focusing on the detailed levels of the Likert scale. Instead, the interpretation relied on the general classification of means according to the statistical standards commonly applied in educational studies (Creswell & Creswell, 2018).

Table (5): Teachers' Evaluation of the Entrepreneurship Domain (n = 21)

Item	Strongly Agree	Agree	eutral	Disagree	Strongly Disagree	Highest Percentage
It enhances entrepreneurial thinking.	12 (57.1%)	7	2	0	0	Strongly Agree
Supports exploring innovative solutions.	10 (47.6%)	8	2	1	0	Strongly Agree

Helps in planning entrepreneurial projects.	9 (42.9%)	9	3	0	0	Agree/Strongly Agree

This domain received the highest evaluation, with a mean score of 4.52 and a standard deviation of ±0.36, reflecting a strong conviction that artificial intelligence supports students in developing their entrepreneurial thinking, enabling them to design future projects and analyze challenges in a practical manner.

It can be concluded that artificial intelligence creates a fertile environment for school-based entrepreneurship, as it facilitates the connection between academic knowledge and practical application, and fosters students' initiative and decision-making abilities.

Question Four: What role does teachers' digital awareness play in activating the potential of artificial intelligence in the classroom environment?

To answer this question, the study's findings revealed that teachers' digital awareness is a critical factor in the effective integration of artificial intelligence within the classroom. This domain was measured through four key indicators: digital skills proficiency, the ability to integrate AI into instructional activities, personalized learning, and the continuous monitoring of developments in AI tools.

Teachers' responses were analyzed using arithmetic means and standard deviations, in addition to frequency and percentage analyses. The overall mean score for the digital awareness domain was 4.46, with a standard deviation of ±0.37, indicating a "Very High" level of evaluation according to the five-point Likert scale. These values reflect a broad consensus among the sample participants regarding the importance and effectiveness of digital awareness in activating artificial intelligence technologies.

Responses were positively distributed, with over 85% of teachers agreeing with the statements related to digital awareness, while the percentage of disagreement did not exceed 5% for any of the items. Notably, 57.1% of the teachers *strongly agreed* that they keep up with developments in artificial intelligence in education, and 52.4% affirmed their ability to personalize learning using these technologies.

Table (6): Teachers' Digital Awareness

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Highest Percentage
I have sufficient skills to use artificial intelligence tools in my teaching.	10 (47.6%)	7 (33.3%)	3 (14.3%)	1 (4.8%)	0 (0%)	Strongly Agree
I am able to appropriately integrate artificial intelligence into the design of educational activities.	9 (42.9%)	9 (42.9%)	2 (9.5%)	1 (4.8%)	0 (0%)	Agree/Strongly Agree
I use artificial intelligence to personalize learning according to students' needs.	11 (52.4%)	6 (28.6%)	3 (14.3%)	1 (4.8%)	0 (0%)	Strongly Agree
I keep up with developments in artificial intelligence tools in education.	12 (57.1%)	7 (33.3%)	2 (9.5%)	0 (0%)	0 (0%)	

These findings are agreed with Alharthy (2020), who emphasized that advanced digital awareness among teachers is a key factor in the

success of any technological application inside classrooms. Similarly, Zhao (2020) affirmed that teachers who are able to interact flexibly with modern technologies are more capable of transforming artificial intelligence from a set of supportive tools into intelligent learning environments that foster thinking and innovation.

These insights support the recommendation to invest in digital training programs for teachers that focus on developing pedagogical digital skills and keeping pace with rapid technological changes. Teachers' awareness is not merely technical knowledge; rather, it is a systematic ability to transform artificial intelligence into effective educational practice that positively impacts student learning.

Question Five: To what extent do social media platforms and digital tools contribute to supporting students' critical and creative thinking?

To answer in this question, the study findings revealed that teachers in the Sultanate of Oman clearly recognize the positive impact of social media platforms and digital tools in enhancing students' critical and creative thinking. This domain was analyzed based on four key indicators using a five-point Likert scale. The overall arithmetic mean reached 4.38, which falls within the "very high" level, while the standard deviation was ±0.41, indicating a high degree of consistency in the teachers' responses.

Table (7): Results of the Domain "Digital Platforms and Social Media"

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Highest Percentage
Digital platforms help students raise critical questions.	9 (42.9%)	8 (38.1%)	3 (14.3%)	1 (4.8%)	0 (0%)	Strongly Disagree
Communication tools enhance	10 (47.6%)	8 (38.1%)	2 (9.5%)	1 (4.8%)	0 (0%)	Strongly Disagree

creativity through interactive projects.						
Discussions on platforms stimulate students' analytical thinking.	8 (38.1%)	9 (42.9%)	3 (14.3%)	1 (4.8%)	0 (0%)	Disagree
Social media can be used as supportive learning tools for creativity.	11 (52.4%)	7 (33.3%)	2 (9.5%)	1 (4.8%)	0 (0%)	Strongly Disagree

Quantitative data indicated that 90.5% of teachers agreed or strongly agreed that digital platforms stimulate analytical and critical thinking by providing spaces for open discussion and student interaction. Additionally, 52.4% of teachers affirmed that social media serves as an effective educational tool for supporting creativity and interactive projects. Moreover, most teachers expressed their agreement that classroom discussions conducted through digital platforms enhance students' ability to ask reflective questions and express their viewpoints in rational and innovative ways.

These results are consistent with the findings of Lulla et al. (2023), which indicated that students engaged in digital learning environments become more capable of critical expression and active participation, especially when digital tools are integrated through systematic pedagogical approaches. The findings also support the conclusions of Yildiz Durak (2024), who demonstrated that the use of artificial intelligence and interactive technologies in learning enhances producing creative ideas and encourages experimentation and creative thinking.

It is evident that social media platforms are no longer merely transient digital tools, but have become strategic instruments in supporting interactive learning—especially when utilized by teachers with advanced digital awareness. This underscores the recommendation to integrate these tools into the educational system in an institutional and systematic manner, along with providing continuous training for teachers on the effective pedagogical use of such platforms.

Question Six: Are there any statistically significant differences in teachers' perceptions regarding the role of artificial intelligence in developing these skills that can be attributed to the variables of (gender, academic qualification, years of experience, and educational stage)?

To answer this question, inferential statistical analysis was employed. The Independent Samples T-Test was used to examine differences in teachers' responses based on the gender variable, while One-Way ANOVA test was applied to analyze differences related to other demographic variables such as academic qualification, years of experience, and educational stage. These tests complemented the descriptive methods, as the analysis was conducted in light of p-values to determine whether the differences between group means were statistically significant at the 0.05 level. The results were supported by reviewing the means and standard deviations for each demographic category, in order to provide a deeper interpretation of the data and sample trends (Field, 2022).

Table (8): Significance of Demographic Differences in the Evaluation of the Study Domains

Variable	Critical Thinking	Creative Thinking	Entrepreneurship	P Value
Gender	4.29 4.37 () (Females)	4.334.51 ،	4.494.55 ،	> 0.05
Academic qualification	4.304.36 ،	4.394.44 ،	4.514.54 ،	> 0.05
Years of Experience	Less than 5 years (highest percentage)	—	—	> 0.05
Educational stage	Secondary level (highest percentage)	—	—	> 0.05

The results of the T-test and One-Way ANOVA analysis indicated that there are no statistically significant differences in teachers' evaluations of the role of artificial intelligence in developing critical and creative thinking, and entrepreneurship attributable to gender, academic qualification, years of experience, or educational stage. The p-values for all comparisons exceeded the significance threshold ($p > 0.05$). The mean scores showed that high school teachers and those with less experience exhibited a slight tendency toward higher evaluations; however, these differences were not statistically significant, reflecting a consistency in the sample's attitudes regardless of their demographic characteristics.

These results indicate that teachers—regardless of gender, academic qualifications, or the educational stages they teach—share a clear positive perception of the effectiveness of artificial intelligence in enhancing higher-order skills among students. This reflects a consistent level of educational awareness regarding technology and its applications in teaching, irrespective of their professional or personal backgrounds. It also supports the trend toward integrating artificial intelligence as a strategic option in contemporary educational practices (Field, 2022).

The Conceptual Framework and Previous Studies:

Critical Thinking Skills:

1. Intelligent Design Tools:

Intelligent design tools refer to AI-based software and systems that assist users, especially students, in creating visual, linguistic, or interactive content in an innovative and unconventional manner, such as tools like:

- **ChatGPT** for generating textual content.
- **Canva AI** and **Adobe Firefly** for creative design.
- **Midjourney** for AI-powered visual design.

According to Yildiz Durak (2024), the integration of these tools into a design-based learning environment has contributed to the enhancement of students' creative and reflective thinking by enabling them to produce visual and written solutions to complex problems in a flexible manner.

2. Intelligent Data Analysis Tools:

Intelligent data analysis refers to the use of artificial intelligence systems capable of collecting and interpreting educational data, and predicting specific outcomes based on learners' behavior or educational variables.

Among these tools are:

- Google Analytics for Education.
- Machine Learning Analytics Tools.
- Intelligent recommendation systems (such as learning path analysis and academic performance prediction)

Favero et al. (2024) explained that intelligent data analysis has contributed to supporting critical thinking by providing students with immediate feedback and enabling them to make data-driven decisions.

The Conceptual Relationship between Tools and Educational Skills:

According to this framework, the integration of intelligent design and analysis tools achieves:

Recent studies indicate that these tools not only improve learning outcomes but also play a role in motivating students toward self-directed learning, experimentation, and entrepreneurship (Winkler et al., 2023).

The Conceptual Framework for the Use of Artificial Intelligence Tools in Education:

Education in the current decade is witnessing a radical transformation driven by advancements in artificial intelligence (AI). AI tools have become an essential component in supporting teaching and learning processes by personalizing content, analyzing learner performance, and enhancing critical and creative thinking. These tools are now effectively integrated into digital learning environments, contributing to improved interaction, assessment, and innovation (Dwivedi et al., 2023).

Educational artificial intelligence tools are defined as systems capable of learning from data and providing personalized learning experiences that adapt to students' needs and cognitive levels. These tools include educational robots, recommendation systems, intelligent chatbots (such as ChatGPT, and interactive content generators (Favero et al., 2024; Yildiz Durak, 2024).

These tools are based on a conceptual model centered around three main axes:

1. **The Role of Artificial Intelligence in Enhancing Critical Thinking:** Tools for text analysis, question generation, and decision-making assistance are used to stimulate students' interpretation and logical analysis. Favero et al. (2024) demonstrated that the use of the "Socratic Robot" led to a significant improvement in reflective dialogue and decision-making abilities.
2. **Enhancing Creative Thinking:** Generative tools such as Midjourney and ChatGPT contribute to fostering creativity by enabling students to produce new ideas and projects in a flexible and innovative manner (Yildiz Durak, 2024).
3. **Developing Entrepreneurial Spirit:** Winkler et al. (2023) indicated that integrating AI tools into entrepreneurship education enhances market analysis skills, project simulation, and smart investment decision-making.

According to this framework, interaction with educational artificial intelligence tools is expected to contribute to enhancing learners' cognitive and entrepreneurial skills. This, in turn, requires the establishment of a flexible digital learning environment and training teachers in the effective use of these technologies.

Previous Studies

In the context of employing artificial intelligence in education, Yildiz Durak (2024) examined the effectiveness of integrating AI tools such as ChatGPT and Midjourney into design-based learning environments. The study aimed to assess the impact of these tools on the development of creative and reflective thinking among university students. The researcher conducted an applied experiment using content generation and intelligent design tools. The findings indicated that the use of these tools directly

contributed to enhancing students' ability to produce innovative visual and written solutions, demonstrating the effectiveness of AI in supporting creativity within the educational environment.

Favero et al. (2024) conducted a study focused on the use of the "Socratic Robot", an AI-powered conversational model, to enhance critical and reflective thinking skills. The study aimed to assess the robot's ability to encourage students to ask deep questions and make decisions based on logical analysis. The sample included students in higher education, and the results showed a significant improvement in critical thinking and reflective dialogue skills, highlighting the effectiveness of intelligent interaction in developing learners' analytical abilities.

In the same context, the study by Winkler et al. (2023) explored entrepreneurship education in light of generative artificial intelligence. The study focused on integrating AI tools into entrepreneurship programs to enable students to acquire skills in market analysis, project planning, and effective investment decision-making. It was based on the analysis of field experiences and real-life case studies, and concluded that AI-supported learning opens new horizons for training entrepreneurs at early stages of their education.

In a strategically oriented study, Dwivedi et al. (2023) examined the impact of incorporating artificial intelligence and machine learning concepts into educational curricula on enhancing students' entrepreneurial thinking. The study aimed to analyze students' ability to engage with modern and complex concepts such as data analysis and entrepreneurial planning when AI is integrated into the learning process. The results

revealed that students became more prepared to adopt entrepreneurial initiatives and make intelligent decisions as a result of improved problem-solving and analytical thinking skills.

UNESCO (2023) presented a comprehensive report on the future of education in the age of artificial intelligence, aiming to establish a global framework for the use of this technology in education. The report included an analysis of educational experiences from various countries. Also, it recommended the active involvement of teachers in the design and implementation of AI-supported learning environments. It also emphasized the importance of enhancing digital skills among both teachers and learners to support building the flexible education systems aligned with digital transformation.

On the other hand, Lulla et al. (2023) examined the educational impact of using social media platforms to support students' critical and creative thinking. The study aimed to explore how these platforms can be transformed from entertainment tools into effective educational resources. The findings indicated that digital platforms contribute to stimulating reflective discussions and fostering creativity, provided that teachers possess sufficient digital awareness to employ these tools in a systematic and pedagogical manner.

General Findings of the Study:

- The study revealed a strong conviction among teachers regarding the effectiveness of artificial intelligence in supporting the educational process and enhancing students' higher-order thinking skills.

- Artificial intelligence contributes to strengthening the integration between academic education and real-life applications, particularly in the areas of critical thinking, creativity, and entrepreneurship.
- Artificial intelligence tools provided an interactive learning environment that enables students to express their ideas in innovative and non-traditional ways.
- AI has helped students improve their decision-making skills by giving them real-time, data-based feedback to support their choices.
- Artificial intelligence has enhanced the development of students' cognitive and emotional skills—such as innovation, adaptability, and self-confidence—through their use of advanced intelligent tools.
- Teachers' responses reflected a high level of intellectual and professional readiness to adopt artificial intelligence inside the classrooms.
- The study's findings highlighted the importance of investing in teacher training for the effective educational use of artificial intelligence technologies.
- AI-powered learning environments provided real opportunities to foster students' entrepreneurial thinking through classroom projects and simulated small-scale business ventures.
- No statistically significant differences were found in teachers' opinions regarding the study's domains based on gender, academic

qualification, experience, or educational level, indicating a shared educational awareness among the sample members.

- The study's results emphasize the importance of expanding future research to include broader educational groups, thereby enhancing the generalizability of the findings at the national or regional level.

Recommendations:

- Integrate artificial intelligence into curricula systematically and in an organized manner, with a focus on activities that develop students' critical, creative, and entrepreneurial thinking skills.
- Design specialized training programs for teachers on the use of educational artificial intelligence tools, aiming to enhance their digital competencies and enable them to utilize technology effectively in educational settings.
- Expand the use of smart design and intelligent data analysis tools within classrooms to enhance interactive learning and innovative projects.
- Create stimulating digital learning environments that integrate artificial intelligence applications as essential tools to support analysis, innovation, and problem-solving through self-directed learning.
- Encourage students to use artificial intelligence platforms to develop entrepreneurial ideas and plan educational projects that simulate the job market.

- Integrate artificial intelligence and entrepreneurship concepts into life skills curricula at the primary and secondary levels in a gradual and comprehensive manner.
- Promote a culture of positive technology acceptance within educational environments by sharing success stories and best practices that utilize artificial intelligence in Omani education.
- Support collaboration between the Ministry of Education and technology institutions to provide an advanced digital infrastructure that enables the widespread application of artificial intelligence in education.
- Develop AI-based assessment tools that help measure students' higher-order thinking and entrepreneurial skills more accurately and comprehensively.
- Encourage researchers to conduct an extensive study that include diverse educational regions and multiple age groups, with the aim of generalizing the findings and informing national education policy development.

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