

Features of Applying Artificial Intelligence in the Eighth Grade Science Curriculum in the Sultanate of Oman

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This research investigated effective features of including artificial intelligence (AI) in the 8th grade science curriculum in the Sultanate of Oman. It was an endeavor to know the effectiveness of applying AI applications in education and the educational strategies on which the science curriculum is based. Its population included all staff dealing with the 8th grade textbook of public education schools in Oman. Sixty participants formed the study sample, which was randomly selected and an e-questionnaire was designed. The results emphasized the effective role of using AI in increasing the level of performance in learning science. Moreover, there was a moderate improvement in teachers' performance and a high improvement in the educational strategies. Most importantly, there were no obvious differences at 0.05 in the experts' agreement concerning the application of AI in the 8th grade science curriculum in the Sultanate of Oman as a function of occupation, with teachers achieving greater scores. This point reflects that teachers are more agreeing concerning the application of AI in the 8th grade science curriculum.

Keywords: artificial intelligence, AI application, eighth grade science curriculum, Sultanate of Oman

INTRODUCTION

In the age of digitalization, our world has experienced a rapid development of computers and their applications. This great development is associated with the emergence and development of AI. Importantly, AI not only concerns the technological aspect but also economic, educational, and social aspects. This highly advanced technology has been designed to increase individuals' levels without taking their positions altogether as it lacks the natural human senses. Artificial intelligence (AI) is also a system that is contingent upon human experience and knowledge.

The focus on the educational system has increased over the past decades as researchers have emphasized the need to update and develop the components, processes, and methods of education so as to cope with the modern technology. This urgent need to use technology in education is also a response to certain factors associated with economy, politics, culture, and society in our pace-gathering time, which has many intervening variables.

Therefore, this issue is fueled by cognitive and technological challenges along with globalization and the accompanying changes to our modern societies. In this context, it has been necessary to enhance the curricula in order to meet those challenges. Of paramount importance in the development of curricula is the understanding of and mastery over technology, improving life skills, and mastering, developing, and employing cognitive tools to teach teachers and learners a new way of thinking while emphasizing core values and appreciating nationality (Saada & Ibrahim, 2014).

All this made it necessary to reconsider our curricula in an attempt to confront those challenges. This can be done by developing and making essential changes in the curricula and not settling for superficial changes. Rather, the main components of the curricula, the roles of those involved with them, and their relationship with society should be enhanced. Moreover, the curricula should be in line with the requirements of the 21st century (Hashemi & Azzawi, 2010).

Meanwhile, the curricula of natural sciences are among those that undergo continuous development processes in an attempt to relate sciences and their applications to human life, the environment, and to local and international society. Moreover, the curricula are employed to address human problems and concerns. This is especially true as the future directions of science emphasize the role of the social, complementary context, teaching students various skills (as per the concept of life-long learning), and active participation in society.

It has been noticed that AI applications for education, especially the third wave, aim at creating partnerships with pedagogists and educators (Weber, 2019). Besides, recent research has proved that the use of AI technologies in education is critical for developing flexible and editable curricula (Gocen & Aydemir, 2020). In this respect, Sekeroglu, Dimililer, and Tuncal (2019) emphasized that AI could help teachers develop personalized types of education for their students. Other scholars, like Liang, Hwang, Chen, and Darmawansah (2021), paid much attention to the application of AI and its various usages in language education.

As an interdisciplinary field, “AI in Education” (AIEd) suggests applying AI. The purpose is to facilitate the instructional process, enhance students’ learning, and promote the transformation of educational systems (Chen et al., 2020; Holmes et al., 2019; Hwang et al., 2020; Ouyang & Jiao, 2021).

Thus, it is obvious that existing knowledge regarding the application of AI in the educational field has been greatly focused on different topics that including higher education (Zawacki-Richter et al., 2019), e-learning (Tang et al., 2021), mathematics (Hwang & Tu, 2021), language (Liang et al., 2021), medicine (Khandelwal et al., 2019; Lee et al., 2021), programming (Le et al., 2013), and special education (Drigas & Ioannidou, 2012).

Regarding its use in the educational field in the Sultanate of Oman, AI is currently used in the form of applications and programs based on AI metrics. It is expected that the future will observe an expansion in this field in order to serve all sectors of education. Moreover, experts believe that AI systems can serve the function of school administration in order to mitigate the burden of responsibility on administrators and to provide a higher quality service. This can be done by transforming the school’s administrative system into electronic systems that rely on AI. As a result of these systems, proper administrative decisions can be facilitated, talented students can be discovered and reinforced, and students with learning difficulties can be recognized and provided with special programs. Moreover, the learning process of each student can be monitored and guardians of students can be contacted directly and without any human effort (The Ministry of Education, 2019).

Musa (2019) stressed that artificial intelligence-based smart applications help learners overcome learning through a single method. Thus, private smart lessons, for example, and the various teaching platforms have become suitable to the tendencies and needs of each student. The student or learner enters in those applications his or her data, preferences, educational level, and the desired method in which they want to learn. This is one of the most important characteristics of learning through smart applications that are based on AI. That is, there is no single way for a student to learn. Thus, these applications consider the individual differences and give the learner a higher chance of self-study. These applications, moreover, have changed the preferences of teachers, too. The former source of knowledge and information has now become the director of the teaching process.

As Afifi (2014) pointed out, all elements of the education system, including supervisors, directors, administrators, teachers, and students, should have one objective so as to make the most of AI applications in education. These applications can, in turn, allow for reaching efficient, quality education outputs. To this end, teachers should be provided with sufficient training. Moreover, an attempt should be made to reconsider the curricula and scholastic credits containing information technologies, especially in credits

related to engineering, mathematics, and science. The selected applications should reinforce education. Financial support from the decision-makers is also needed.

Research Problem

The Omani Ministry of Education attaches much significance to the development and teaching of curricula in response to new scientific, technological, and cognitive developments. Thus, priority was given to international expertise to conform to the significant development of this sphere and to place the science curriculum in line with international standards (Ministry of Education, 2019). The Ministry worked on the curricula in general and on the curricula of sciences and mathematics in particular. For these curricula to be implemented for the first time in the Omani community, they are first subject to discussion and dispute by teachers, educational supervisors, and students' guardians. To explicate, some pinpoint that these curricula are beyond the level of students and contain no activities and trainings that can help the teacher and the student understand knowledge. Others, taking an antithetical stance, believe these curricula are modern, improve thinking, and are in line with the knowledge era. Still, I believe both viewpoints are not premised upon scientific bases or research studies. Therefore, the research problem would be to identify the implications of applying AI in the 8th grade science curriculum in the Sultanate of Oman.

Research Questions

This research attempts to answer the following primary question:

- What are the features of applying AI in the 8th grade science curriculum in the Sultanate of Oman?

A number of sub-questions are raised:

1. What is the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman in developing learners' performance?
2. What is the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman in developing teachers' performance?
3. What is the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman in developing educational strategies?
4. Are there significant differences ($\alpha = 0.05$) in the degree to which experts agree on applying AI in the 8th grade science curriculum in the Sultanate of Oman as a function of gender and career?

Research Objectives

The present study aimed to achieve the following main objective:

- To determine the features of applying AI in the 8th grade science curriculum in the Sultanate of Oman.

A number of sub-objectives emerge:

1. To know the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman in developing learners' performance.
2. To know the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman in developing teachers' performance.
3. To know the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman in developing educational strategies.
4. To show if there are significant differences ($\alpha = 0.05$) in the degree to which experts agree on applying AI in the 8th grade science curriculum in the Sultanate of Oman as a function of gender and career.

Hypotheses

The following hypotheses are formulated.

H1. *There are no significant differences ($\alpha = 0.05$) in the degree to which experts agree on applying AI in the 8th grade science curriculum in the Sultanate of Oman as a function of gender.*

H2. *There are no significant differences ($\alpha = 0.05$) in the degree to which experts agree on applying AI in the 8th grade science curriculum in the Sultanate of Oman as a function of career.*

The following sub-hypotheses emerge:

1. The application of AI in the 8th grade science curriculum in the Sultanate of Oman is effective in developing learners' performance from the experts' viewpoint.
2. The application of AI in the 8th grade science curriculum in the Sultanate of Oman is effective in developing teachers' performance from the experts' viewpoint.
3. The application of AI in the 8th grade science curriculum in the Sultanate of Oman is effective in developing educational strategies from the experts' viewpoint.

Research Significance

This study derives its significance from the importance of its mission as it seeks to highlight the effectiveness of using AI in the 8th grade science curriculum in the Sultanate of Oman. Moreover, it gives feedback to those in charge of the science curriculum in the Sultanate of Oman, including the developers and decision-makers. This, in turn, will help incorporate AI into the science curriculum. Importantly, this study, to the best of the researcher's knowledge, is among the first studies to investigate the use of AI in education and it is the first study to focus on the 8th grade science curriculum in the Sultanate of Oman.

Research Limits

- **Subject:** Eighth grade science curriculum in the Sultanate of Oman
- **Time:** The study was performed in the academic year 2020–2021 A. D.
- **Place:** Eighth grade public schools in the Sultanate of Oman
- **Participants:** Teachers and employees, including supervisors and administrators that have experience with the public school 8th grade curriculum in the Sultanate of Oman.

Research Terms

- **AI:** AI has been defined by Mahmood (2020: 182) as follows: "One field of computer sciences and one of the primary bases upon which technology is premised in our time. It assumes that intelligence can be described with high precision, to the point that it can be simulated by a machine."
- **I would operationally define this concept as follows:** "A science that is concerned with manufacturing smart tools that act as humans."

Curriculum

Vakil and Mofti (2008: 24) defined this concept as follows: "The accumulation of expertise provided by the school for students in order to help them reach a comprehensive growth in all domains (intellectual, cultural, religious, social, physical, psychological, and technical). This growth would in turn help modify the behaviors of students and achieve the desired educational objectives."

I would operationally define this concept as follows: "It is the 8th grade science curriculum in the Sultanate of Oman for the academic year 2020–2021 A.D. It comprises the accumulation of expertise that has been provided by the school to help students achieve certain educational outputs by their ultimate abilities."

Artificial Intelligence and Modern Education: A Theoretical Background

In recent years, artificial intelligence has been the subject of many studies that investigate the components of AI and its applications in different fields. In this respect, AI-Hosaini (2002: 173) pointed out that AI is a thinking method comprising a set of algorithms that allow a computer to solve problems.

AI programs and systems, therefore, are programmed in any of the programming languages. Still, several programming languages, due to having facilities for the programmer, are dedicated to developing AI programs and systems. Thus, a programmer often enters data and the language does the searching process. Most notable are the languages, Prolog and Lisp.

This concept has also been defined by Mahmoud (2020: 182) as follows: “A field of computer sciences and a principle upon which modern technology is premised, it was developed based on the assumption that intelligence can be described with high precision such that a computer may simulate it.” Moreover, “It is the computer’s ability to simulate human mind.”

In this context, Othman and Jamil (2012: 224) argued that “AI is part of computer sciences aiming to design smart systems that possess the same characteristics of human mind. It may describe things, events and processes using its qualitative features as well as logical and calculative relations.”

AI is better defined as a representation of human intelligence with the intent to produce tools, programs, and applications similar to but even more capable than humans. AI, due to its smart features, has succeeded in performing complicated functional tasks. Such features include dealing with hypotheses simultaneously with high precision and speed, solving problems similar to humans, and simulating human mind, behavior, and innovation. This will, in turn, help reduce reliance on human experts.

The concept of AI as part of modern education has been the subject of many studies focused on the components, features, and effects of AI in facilitating the processes of teaching and learning as well as developing educational strategies. In this context, Farani (2020) performed a study to identify the factors influencing teachers’ decisions as to whether to choose AI in education based on the (UTAUT). For this purpose, the study adopted the descriptive method. Thus, the theory’s scale was performed among a sample comprising 446 teachers in the governorate of Yanbu. Teachers were found to be highly accepting in relation to the use of AI in education. The study reflected that there are significant differences between the sample’s responses concerning the intention to use AI in education as a function of gender, with women showing greater scores. Moreover, differences were found to be significant as a function of age, years of experience, and specialization. Because teachers expressed positive viewpoints regarding the use of technology, the study recommended expanding the use of AI applications in education. The same researcher conducted another study that emphasized that modern educational approaches have attached much importance to learners and their abilities as well as the ways of enhancing those abilities. The study also emphasized the necessity to consider individual differences between students and to provide sufficient educational opportunities for learners. These opportunities should suit the abilities, intelligence, and approach to learning in each student. The paper aimed to provide a scenario for using AI in discovering learners’ multiple intelligence and to create computer systems that are more sufficient, more precise, and faster in determining learners’ multiple intelligence levels, and improving and benefiting from them.

In this context, Mahmoud (2020) carried out a study to identify the AI applications that can be used to improve education during the COVID-19 outbreak. The study employed the descriptive method by surveying and analyzing the relevant studies, books, and periodicals. For this purpose, a questionnaire with open questions was developed to investigate the chief problems and challenges in education, and AI’s role in confronting them. The study also found that to confront some of those challenges and problems, it is possible to employ a number of AI applications in education such as (to name a few) smart education systems, smart content, VR, AR, Layer, Aurasma, and Augmented 4. A number of recommendations were given according to the study results; most importantly, that educational institutions should rely on some AI applications and the culture of technology should be disseminated in educational institutions and society.

Existing research on AI has also ventured to examine its effectiveness in teaching science subjects. In this respect, Abdul Latif (2020) did a study with the intent to identify the effects of an AI-based education system in improving the deep understanding of nuclear interactions and the capacity for self-study in secondary school students. To this end, the research team developed an AI-based system to teach nuclear chemistry in the first secondary class. The categories of study tools, the understanding of nuclear interactions test and capacity for self-study scale were developed. To investigate the effectiveness of the teaching system, 65 students were selected from the first secondary class. The sample was divided into two groups: the first (experimental) group studied nuclear chemistry based on AI and the second (control)

studied the same material in a traditional manner. The tools were applied before and after the study. The results revealed obvious differences between the arithmetic means of students in the experimental group and the control group, with the experimental group returning higher scores. Furthermore, there were obvious differences in the scores of the experimental group before and after applying the study tools, with post-tests showing higher scores. This demonstrates the effectiveness of the AI-based teaching system in improving the deep understanding of nuclear interactions and the capacity of self-study in secondary school students.

In the context of AI and its applications in education, new concepts have emerged. The most important concept in this regard is “augmented reality,” which has received the attention of scholars like Mohammad (2019) who carried out a study to show the effects of applying augmented reality on 5th grade students’ achievement in the subject of science in Kuwait. To perform this study, a random, systematic sample was selected over two academic courses at Mislon Elementary School for girls, located in the Capital of Education. Having adopted the semi-experimental method, the study selected one of the two courses randomly. Then, the sample group was divided into two groups, the first being experimental in which the augmented reality method was applied and the second being the control group in which the typical method was applied. The two groups were taught the first chapter of the human body unit. For the experimental group, the HP Reveal Aurasma program was used, which is based on augmented reality technology. Findings showed that the amount of information acquired and maintained by students in the experimental group was greater than that acquired and maintained by the control group. It was also shown that the effects of augmented reality on students’ achievement in the experimental group and their retrieval of information were high. Based on these findings, the study made valuable recommendations including the establishment of educational projects based on the augmented reality technology and designing sciences curricula for the elementary level that are compatible with this technology.

The discussion on AI and its use in education must focus on the applications that effectively help facilitate and improve the teaching–learning process. In this respect, Yen et al. (2013) investigated the learning and motivation effect of teaching learners through various educational designs based on simulation, including 2D animations, 3D animation, and augmented reality (AR). The topic was the forms of the Moon. The sample group comprised 104 university students from the north of Taiwan. The sample was divided into three groups with each using one of the three experimental designs. Findings showed that the 3D and AR groups had better concentration and more motivation toward learning. All groups were found to have similar efficacy in learning.

Characteristics of Using AI

AI is characterized by the following features (Matai, 2012: 3–4):

- **Representation of knowledge:** AI programs, as opposed to statistical programs, use a certain form for describing knowledge. This form contains facts, relations between these facts, and regulations that relate these relations, etc. Meanwhile, knowledge base provides the largest amount of information whereby to find a solution for the problem at hand.
- **Experimental design:** An important feature in AI is that its programs find solutions for problems that have no clear general solution. This means programs do not employ sequential steps for finding the correct solution but instead find a certain way that seems to be appropriate. Still, this feature may change should it become clear that the first alternative does not lead to the answer fast. That is, the program focuses on the effective solutions.

Objectives of AI

Mahmoud (2020: 188) argued that AI tries to identify the nature of human intelligence with the intent to design computer programs capable of simulating smart human behavior. This means these programs are able to solve a certain problem or make a decision in a certain circumstance. In other words, these programs seek the most suitable manner for solving a problem or making a decision. Then they work accordingly by performing a number of different logical processes already entered to the computer.

The main objective is to instill human knowledge into the computer as per the rules of knowledge. Then the computer, through programming tools, can search in these rules and make comparisons and analysis. This is done to draw conclusions and infer the best answers and ways for solving various problems. This process is similar to what is done by human beings when trying to solve new problems encountered on a daily basis, where they rely on their expertise and past experiences. Humans also search for new ways according to their expectations and skills in inference (Abd An-Nour, 2005).

Afifi (2014) purported that AI has numerous applications in various fields such as expert systems, speech recognition, letter recognition, natural language processing, speech production, games, robots, model and shape recognition, observation, decision support systems, learning, and teaching.

Paramount AI Programs in Education

No longer is AI an extra benefit in the field of education. Rather, it has become one of the principles of educational enhancement in developed countries and one of the most important methods for developing scholastic curricula. The following are the most significant AI applications in this respect (Naser: 2010):

- **Digital systems specific to school:** This refers to data networks to establish large-scale neural networks capable of specifying and addressing the weaknesses of each student. These networks, moreover, contribute to data management and problem solving over the fastest time possible. Of paramount importance is Classera Corporation.
- **Establishment of algorithms in educational tools:** These algorithms will reform educational curricula and make them suitable for the interests of students. This is done in order to reduce the time required to tailor the educational material.
- **Improvement of students' communication skills with systems similar to humans:** This will be the greatest motivation for students, as it will allow them to immediately communicate with humans in all language and social sectors. This will, in turn, help reinforce communication as well as social skills.

Different Kinds of AI

Abd An-Nur (2005) pointed out numerous categorizations of AI:

1. **Expert systems:** As computer programs, these systems contain a reliable information system. The chief objective of these systems is to help humans in the thinking process. Expert systems are also used to make decisions so as to achieve the user's objectives.
2. **Neural networks:** These function similarly to the human neural system. Casual computers provide us with numerous projects through rapid responses.
3. **Genetic algorithms:** These are sets of instructions similar to biological processes, where they serve to solve a certain problem. These algorithms, furthermore, are ways to help solve specific problems and are used in sports applications so as to achieve the best solutions for a problem. They are also used in various sciences and technologies whose solutions can be regarded as having many facilities that work faster than humans.
4. **Intelligent agents:** These form an expert system that works within systems relying on a computer in order to make the computer work smarter. For example, a computer may warn users when a necessary task arises. There are also various applications that help the user create folders such as E-Mail and Microsoft.

Naser (2010), moreover, stated that AI can be categorized into the following headings:

1. **Artificial narrow intelligence:** This is among the simplest forms of AI. It reacts to an action in a certain circumstance and has certain functional characteristics, such as the Deep Blue robot that conquered world chess champion, Garry Kasparov.
2. **Strong AI:** This type is able to make decisions requiring large data capture and analysis, e.g., self-driving cars.
3. **Superintelligence:** These are models under development. Superintelligence has two forms. The first understands human thinking and is able to have limited social interaction. The second

form, however, is able to predict others' feelings. Thus, as a highly intelligent generation of intelligence, it can be used to confront electronic attacks and also in wars and medicine.

Another prediction was that investment in the field of AI will increase by 2030. AI has also been used in global-scale wars. Yet it can be reprogrammed and used also for the hacker's benefit, which in turn would inflict grave damage. AI can also be used to understand more deeply about social and political affairs of a certain country, and can be employed to predict natural disasters. However, in a way it cannot distinguish between civilians and military forces. Meanwhile, army forces should be able to neutralize an electronic attack caused by AI, which could be difficult. Finally, this technology is recent and can help overcome some of the global challenges (Holmes, 2019).

Features of AI

Othman and Jamil (2012: 225) attributed the following features to AI:

1. Uses ways similar to those used by humans in solving problems
2. Deals with hypotheses simultaneously and with high precision and speed
3. Works properly and constantly, without fluctuation
4. Its construction requires much information about a certain area
5. Analyzes symbolic, non-digital data through analytical processes and logical comparison
6. Aims to conform to human behavior and thought
7. Arouses new ideas that lead to innovation
8. Instills human expertise
9. Provides more than one version from the system, thereby taking the place of experts
10. Does not experience fatigue and frustration
11. Reduces reliance on human experts.

Research Methodology

This study relies on the descriptive approach, which investigates, describes, and analyzes the application of AI in the 8th grade science curriculum of in the Sultanate of Oman and its effectiveness in developing educational strategies and teaching-learning processes. Its qualitative nature allows for a detailed explanation of the problem being studied. The researcher randomly selected a sample of 60 participants (see Table 5). Data were collected through an e-questionnaire. Then, SPSS was used to perform statistical operations on the data and the findings related to each hypothesis are separately presented and discussed here.

Research Population and Sample

The population of the present research sample comprised all workers dealing with 8th grade students of public schools of the Sultanate of Oman. Because it is difficult to include all the study population in the research, a simple random sampling method was employed where an e-questionnaire was used. The sample group comprised 60 individuals who responded to the questionnaire's items.

Instrument

A questionnaire was developed as a tool for the field study. The questionnaire, including its axes and statements, was developed after reviewing the theoretical literature. The questionnaire comprised three axes: teaching, teacher, and educational strategies. Moreover, it included 27 statements based on a Likert five-point scale (Strongly agree: 5; agree: 4; neutral: 3; disagree: 2; strongly disagree: 1).

Instrument Validity

This research took into account both construct validity and self-validity.

a. Construct validity

Having distributed the questionnaire to a pilot sample consisting of 10 participants from the population (but not from the sample group), the questionnaire's construct validity and internal consistency were confirmed.

This was done through calculating the correlation coefficients between each statement and the score of the axis that comprises the statement. Results were as follows:

First Axis: Teaching

TABLE 1
CORRELATION COEFFICIENTS BETWEEN THE SCORE OF EACH STATEMENT AND THE TOTAL SCORE OF THE FIRST AXIS

No.	Statement	Correlation Coefficient
1	Artificial intelligence gives a more accurate definition of education than traditional teaching.	**0.736
2	The educational content can be programmed using AI applications.	**0.615
3	AI enhances the concept of digital education.	
4	AI works on improving the educational curricula presented to learners.	**0.742
5	AI presents solutions to different educational problems.	**0.739
6	AI enhances skill processes of the educational curriculum.	**0.815
7	AI enhances cognitive processes of the educational curriculum.	**0.739
8	AI increases the skills incorporated in the educational curriculum.	**0.762
9	All methods and equipment necessary to ensure efficacy and effectiveness in using AI applications are available.	**0.762

**statistically significant ($\alpha = 0.01$)

Second Axis: Teacher

TABLE 2
CORRELATION COEFFICIENTS BETWEEN THE SCORE OF EACH STATEMENT AND THE TOTAL SCORE OF THE SECOND AXIS

No.	Statement	Correlation Coefficient
1	AI applications are suitable to the teacher and their educational expertise.	**0.753
2	AI applications suit students' educational expertise.	**0.728
3	AI applications increase students' learning ability.	**0.733
4	AI applications increase students' skill level.	**0.782
5	AI applications increase students' cognitive level.	**0.746
6	Through AI applications, students' skill aspects can be analyzed.	**0.692
7	Through AI applications, students' cognitive aspects can be analyzed.	**0.763
8	Through AI applications, students' emotional aspects can be analyzed.	**0.742
9	AI applications take into account individual differences among students.	**0.693

**statistically significant ($\alpha = 0.01$)

Third Axis: Educational Strategies

TABLE 3
CORRELATION COEFFICIENTS BETWEEN THE SCORE OF EACH STATEMENT AND THE TOTAL SCORE OF THE THIRD AXIS

No.	Statement	Correlation Coefficient
1	AI applications are suitable to the educational strategies used.	**0.731
2	Through AI applications, the educational strategies can be related to the expertise of teacher and learner.	**0.682
3	AI applications increase the efficacy and effectiveness of learning strategies.	**0.744
4	Through AI applications, the best teaching methods that suit the learner's ability and expertise can be selected.	**0.751
5	AI applications increase the teacher's ability to achieve the objectives of educational strategies.	**0.831
6	AI applications work on improving the teacher's ability to select the appropriate strategy that suits learners' individual differences.	**0.829
7	AI applications help improve the spirit of cooperation between learners.	**0.736
8	AI applications help improve the sense of responsibility in learners.	**0.795
9	AI applications work on achieving all the educational objectives effectively and efficiently.	**0.742

**statistically significant ($\alpha = 0.01$)

b. Self-validity

The validity of the questionnaire was calculated through the self-validity coefficient, which was shown to be 0.968. This coefficient is high; thus the questionnaire can be applied to the research sample group.

Instrument Reliability

Reliability of the questionnaire was calculated using Cronbach's alpha coefficients for internal reliability.

TABLE 4
RELIABILITY OF THE QUESTIONNAIRE USING CRONBACH'S ALPHA FOR INTERNAL RELIABILITY

Axis	Number of Statements	Cronbach's Alpha Value
Teaching	9	0.917
Teacher	9	0.943
Educational strategies	9	0.909
Whole questionnaire	27	0.925

Source: Research data

As shown in Table 4, the Cronbach's alpha coefficient for all study axes was found to be greater than 0.60. Therefore, the study instrument is of high reliability and appropriate for the research purposes.

Analysis of the Questionnaire
First: Demographic Information

TABLE 5
DEMOGRAPHIC INFORMATION OF THE SAMPLE GROUP

Dimension	Variable	No.	Percentage (%)
Gender	Male	49	81.7
	Female	11	18.3
Age	Below 30	1	1.7
	30-40	32	53.3
	40-50	23	38.3
	50-60	4	6.7
Academic qualification	Bachelor	37	61.7
	Master	21	35.0
	Doctorate	2	3.3
Job position	School admin	2	3.3
	Administer assistant	2	3.3
	Supervisor	18	30.0
	First-class teacher	13	21.7
Work experience	Below 5 years	2	3.3
	5 to less than 10 years	3	5.0
	10 less than 15 years	20	33.3
	15 to less than 20 years	15	25.0
	20 years or more	20	33.3

Source: Research data

Second: Axes of the Questionnaire

TABLE 6
FREQUENCIES, PERCENTAGES, ARITHMETIC MEANS, STANDARD DEVIATIONS, AND RELATIVE WEIGHTS OF THE STATEMENTS

Agreement Statement	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Mean	SD	Relative Weight	Rank
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%				
Educational aspect														
AI is more appropriate for education than traditional education.	17	28.3	31.0	51.7	8.0	13.3	3.0	5.0	1.0	1.7	4.000	0.883	0.800	8
The educational can be developed using AI applications.	20	33.3	35.0	58.3	0.0	0.0	4.0	6.7	1.0	1.7	4.150	0.715	0.830	5
AI improves digital education.	24	40.0	33.0	55.0	3.0	5.0	0.0	0.0	0.0	0.0	4.350	0.577	0.870	2
AI improves the educational curricula presented to learners.	27	45.0	26.0	43.3	7.0	11.7	0.0	0.0	0.0	0.0	4.333	0.681	0.867	3
AI presents solutions to various educational problems.	21	35.0	21.0	35.0	16.0	26.7	16.0	26.7	1.0	1.7	4.500	0.921	0.900	1

AI improves the skills of the educational curriculum.	18	30.0	31.0	51.7	8.0	13.3	1.0	1.7	2.0	3.3	4.033	0.852	0.807	7
AI improves the cognitive aspect of the educational curriculum.	16	26.7	36.0	60.0	5.0	8.3	2.0	3.3	1.0	1.7	4.067	0.8	0.813	6
AI helps improve the skills contained in the curriculum.	25	41.7	25.0	41.7	6.0	10.0	3.0	5.0	1.0	1.7	4.167	0.924	0.833	4
All the method and equipment ensuring efficacy and effectiveness of AI applications are provided.	5	8.3	17.0	28.3	17.0	28.3	18.0	30.0	3.0	5.0	3.050	1.064	0.610	9

		Teacher												
AI applications suit teachers' educational expertise and abilities.		8.3	25.0	41.7	15.0	25.0	14.0	23.3	1.0	1.7	3.317	0.983	0.663	7
5	7	11.7	16.0	26.7	20.0	33.3	14.0	23.3	3.0	5.0	3.167	1.076	0.633	9
	14	23.3	34.0	56.7	9.0	15.0	2.0	3.3	1.0	1.7	3.967	0.823	0.793	2
	16	26.7	28.0	46.7	8.0	13.3	6.0	10.0	2.0	3.3	3.833	1.044	0.767	4
	16	26.7	28.0	46.7	13.0	21.7	2.0	3.3	1.0	1.7	3.933	0.88	0.787	3
	12	20.0	31.0	51.7	11.0	18.3	5.0	8.3	1.0	1.7	3.8	0.917	0.760	5
	14	23.3	36.0	60.0	8.0	13.3	1.01	1.7	1.0	1.7	4.017	0.77	0.803	1

abilities of students.																			
AI applications allow for analyzing the emotional aspect of students.	7	11.7	21.0	35.0	19	31.7	8.0	13.3	5.0	8.3	3.283	1.106	0.657						8
AI applications take into consideration the individual differences between students.	6	10.0	29.0	48.3	16.0	26.7	0.6	10.0	3.0	5.0	3.483	0.983	0.697						6

Educational strategies																			
AI applications suit the educational strategies used.	7	11.7	22.0	36.7	18.0	30.0	13.0	21.7	0.0	0.0	3.383	0.958	0.677						6
AI applications can link the educational strategies with the teacher and student's expertise.	11	18.3	38.0	63.3	9.0	15.0	1.0	1.7	1.0	1.7	3.950	0.746	0.790						3
AI applications contribute to	13	21.7	43.0	56.7	11.0	18.3	1.0	1.7	1.0	1.7	3.95	0.79	0.790						3

increasing the efficacy and effectiveness of educational strategies.	14	23.3	35.0	58.3	7.0	11.7	3.0	5.0	1.0	1.7	3.967	0.843	0.793	2
AI applications allow for choosing the best teaching methods that suit the learner's ability and expertise.	18	30.0	29.0	48.3	12.0	20.0	1.0	1.7	0.0	0.0	4.067	0.756	0.813	1
AI applications improve the teacher's ability to choose the appropriate strategy that suits the individual	14	23.3	32.0	53.3	11.0	18.3	3.0	5.0	0.0	0.0	3.950	0.79	0.790	3

12	20.0	32.0	53.3	7.0	11.7	8.0	13.3	1.0	1.7	3.767	0.981	0.753	4
8	13.3	28.0	46.7	17.0	28.3	6.0	10.0	1.0	1.7	3.6	0.906	0.720	5
8	13.3	18.0	30.0	23.0	38.3	10.0	16.7	1.0	1.7	3.367	0.974	0.673	7

Source: Sample data

Having sorted out the statements of the educational axis (Table 1) in terms of the relative weights as viewed by the study sample, it became clear that the statement “AI presents solutions to different educational problems” was the most important statement with a relative weight of 0.9. This is while the statement “All methods and equipment necessary to ensure efficacy and effectiveness in using AI applications are available” was found to be the least important statement with a relative weight of 0.610. It was shown also that both the performance and effectiveness of using AI in education, as viewed by the study sample, have improved, where the value of overall average of the axis was noticed to be 4.072.

After sorting out the statements related to the teacher axis (Table 6) in terms of importance (greater relative weight) as viewed by the study sample, it became clear that the statement “Through AI applications, students’ cognitive aspects can be analyzed” was the most important with a relative weight of 0.803. On the other hand, the statement “AI applications suit the educational experience of the student” came in last position with a relative weight of 0.633. The overall score of this axis was shown to be moderate (3.644).

Lastly, having sorted out the statements related to the educational strategies (Table 6), it became clear that statement “AI applications help increase the teacher’s ability to achieve the purposes of educational strategies” was the most important one with a relative weight of 0.813. On the other hand, the statement “AI applications help improve all the objectives of the educational process with efficacy and effectiveness” came in last position with a relative weight of 0.673. The overall score on this axis was found to be moderate (3.778).

Testing Research Hypotheses

H1: There are no obvious significant differences ($\alpha = 0.05$) in the degree to which experts agree on applying AI to the 8th grade science curriculum in the Sultanate of Oman as a function of gender.

Findings revealed that there are no obvious differences between the participants’ responses on this dimension as a function of gender. See Table 7.

**TABLE 7
DIFFERENCES IN AGREEMENT AS A FUNCTION OF GENDER**

Aspect	Variable	Mean	F	Sig.
Gender	Male	3.978	2.049	0.356
	Female	3.954		

Source: SPSS analysis of the sample data

This finding obviously shows that both male and female participants express positive attitudes toward the use of AI in the 8th grade science curriculum in the Sultanate of Oman. This point is different from that presented in Farani (2020) that found statistically significant differences between the sample’s responses regarding the intention to use AI in education as a function of gender, with women showing greater scores.

H2: There are no obvious significant differences ($\alpha = 0.05$) in the degree to which experts agree on applying AI in the 8th grade science curriculum in the Sultanate of Oman as a function of career.

Findings showed that there are obvious differences on this dimension as a function of career, with teachers getting higher scores. This shows teachers have more significant agreement on applying AI on this group of students (Table 8).

TABLE 8

Aspect	Variable	Mean	F	Sig.
Career	School admin	4.163	**11.326	0.000
	Administer assistant	4.097		
	Supervisor	4.123		
	First-class teacher	4.235		
	Teacher	4.429		

Source: SPSS22 data analysis of the sample group

The findings of this study reflect that the use of AI in the 8th grade science curriculum in the Sultanate of Oman is effective in developing educational strategies and facilitating teaching–learning processes. In this respect, this study agrees with a number of previous studies like Mahmoud (2020), Farani (2020), Abdul Latif (2020), Mohammad (2019), and Yen et al. (2013) regarding the effectiveness of AI in the field of education.

CONCLUSIONS

This study has examined the features of AI and its effectiveness in developing educational strategies and facilitating teaching–learning processes if it is used in the 8th grade science curriculum in the Sultanate of Oman. The participants expressed their strong agreement that AI helps increase teaching and learning performance. Moreover, they expressed that AI would help teachers develop their performance to a moderate level. Importantly, the results also revealed the participants’ view of AI as effective in developing educational strategies. No statistically significant differences at the significance level of 0.05 were found in the degree to which participants agree on applying AI in the 8th grade science curriculum in the Sultanate of Oman as a function of career. Differences favored teachers, thus showing that teachers agree the most on applying this educational technology to 8th grade students in the Sultanate of Oman.

RECOMMENDATIONS

- It is recommended to provide training courses and programs for educational staff to help them use AI applications and, thus, increase their abilities in this area.
- It is recommended to provide technical, technological, and financial capacities that will increase the effectiveness of applying AI in education across all educational curricula in the Sultanate of Oman.
- It is recommended to raise the staff’s awareness of the importance of coping with the modern technological developments in order to improve the level of education and achieve the objectives thereof with high efficacy and effectiveness.

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