

The Impact of Employing Artificial Intelligence Technologies on Ninth Grade Female Students' Achievement in Islamic Education, Visual Thinking Development, and Learning Motivation

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ABSTRACT

The present study aimed to investigate the impact of employing artificial intelligence (AI) technologies on the academic achievement of ninth grade female students in Islamic Education, as well as the development of their visual thinking skills and learning motivation. The study employed a quasi-experimental design, consisting of an experimental group and a control group. The experimental group included 30 students who were taught using AI technologies, while the control group, also consisting of 30 students, was taught using traditional methods. To achieve the objectives of the study, three tools were used: an achievement test comprising 30 questions, a visual thinking skills test consisting of 23 questions distributed across five skills and a learning motivation scale composed of 67 items measuring five factors (with validity confirmed by experts and reliability coefficients of 0.74, 0.70, and 0.86 respectively). The results revealed statistically significant differences at the 0.05 level between the mean scores of the experimental and control groups in the achievement test, visual thinking test, and learning motivation scale, all in favor of the experimental group. The findings were discussed in light of the theoretical framework and previous studies. The study concluded with a set of recommendations and suggestions.

Keywords: Technologies, Artificial Intelligence, Visual Thinking, Learning Motivation.

INTRODUCTION

Education is the foundation for the progress of nations and the development of societies. Through teaching, research, and community service, educational institutions build knowledge and foster innovation. With advances in technology, computers and their applications have become an integral part of modern education, providing new ways to engage learners and address individual differences (Al-Mousa, 2002).

The rapid growth of information technology and the spread of the Internet have led to the rise of artificial intelligence (AI)—a major branch of computer science concerned with designing systems that simulate human intelligence and reasoning (El-Sharkawy, 2011). AI enables computers to perform tasks that require understanding, problem-solving, and decision-making. In education, these technologies make learning more interactive, help students understand complex concepts, and reduce teachers' workload by automating tasks such as assessment and content delivery (Karsenti, 2019).

Globally, AI has become a key focus in education reform, with many countries integrating AI tools such as chatbots, virtual environments, and adaptive learning systems into classrooms (Abdelkader, Rashwan, & Abdelwahab, 2023; Ahmed, 2022; Al-Omari, 2022). These tools help create flexible, student-centered learning environments that enhance engagement and motivation (Al-Kandari, 2024).

The Sultanate of Oman has also prioritized AI integration as part of its national educational vision. The Education Council (2017) emphasized preparing learners to deal with modern technologies, while the National

Commission for Education, Culture, and Science (2020) called for building teachers' capacity to employ AI in classroom teaching. Accordingly, the Ministry of Education has begun introducing AI-based tools into school curricula, including Islamic Education.

Islamic Education holds a central place in Oman's curriculum as it aims to build students' moral and intellectual foundations. Efforts have been made to modernize its teaching methods and align them with current trends in education. However, traditional lecture-based approaches and rote memorization still dominate instruction, often limiting students' engagement, motivation, and ability to visualize abstract religious concepts. Integrating AI technologies into this subject can help overcome these limitations by making learning more interactive, visual, and relevant to students' real-life experiences.

LITERATURE REVIEW

AI in Education

Amid global trends toward the use of artificial intelligence (AI) technologies in education, there has been widespread interest among researchers in exploring their impact on the educational process. Several educational studies have confirmed the importance of employing these technologies to develop and improve education. Some studies in Oman (e.g., Al-Saeedi et al., 2023) found weak integration of AI concepts in curricula such as social studies.

A growing body of recent studies has highlighted the increasing interest in employing artificial intelligence (AI) technologies in education, with findings consistently affirming their effectiveness in enhancing thinking and learning skills. Several studies demonstrated the impact of AI-based applications and platforms on developing logical thinking (Swalameh & Al-Saeed, 2023), future thinking and science achievement (Al-Jarawi, 2020), as well as strengthening academic self-concept and habits of mind among low-achieving students (Darwish & Al-Laithi, 2020). Additionally, AI chatbots were found to improve cognitive aspects in science learning (Al-Omari, 2019).

Other studies pointed to the role of AI in developing educational skills and attitudes, showing its effectiveness in improving self-learning skills and fostering positive attitudes toward collaborative learning (Ahmed, 2022), as well as enhancing motivation to learn computer science (Swalameh & Al-Saeed, 2023). In contrast, some studies investigated the current reality of AI adoption in educational institutions, revealing that while faculty members' use of AI technologies was generally high, institutional orientations toward their integration ranged between moderate and positive, with differences associated with specialization and technological skills (Al-Qahtani & Al-Dayel, 2023; Al-Rubaie, 2022).

At the level of higher education, Fernández et al. (2022) emphasized that AI-based educational frameworks hold strong potential for improving the quality of education and personalizing learning according to students' needs. This underscores the necessity of investing in digital training programs to prepare professionals capable of keeping pace with technological advancements. Nevertheless, some studies reported that teachers' mastery of AI employment skills remains limited, with several obstacles hindering its effective implementation (Khaibari, 2020).

Gap in Islamic Education Research

It is noticeable that most previous studies addressing the employment of artificial intelligence technologies have been conducted in various fields and applied to different subjects such as computer science, chemistry, social studies, science, and Arabic language. Their topics varied and included measuring the extent of AI applications' availability within curricula, the reality of their employment, the level of knowledge about them, and attitudes toward them, as well as their impact on several variables such as the development of creative self, self-learning skills, academic achievement, logical thinking, motivation, habits of mind, academic self-concept, and attitudes toward AI. Other studies examined the actual use of these technologies by teachers, such as the studies by Al-Qahtani and Al-Dayel (2023), Ahmed (2022), Al-Rubaieyah (2022), and Al-Khaibri

(2020). However, to the researcher's knowledge, no studies, to the researcher's knowledge, have addressed the employment of these technologies in the subject of Islamic education and their effect on teaching this subject. Hence, through this study, the researcher seeks to explore the impact of employing artificial intelligence technologies on the academic achievement of ninth-grade female students in Islamic education, as well as on the development of their visual thinking and learning motivation.

Study Problem

Despite rapid advancements in educational technology, certain subjects, such as Islamic Education, continue to face challenges that limit learning effectiveness. Traditional teaching methods, primarily relying on lecture-based instruction and rote memorization, often hinder students' comprehension of abstract religious concepts and historical events, while also reducing engagement and motivation. This limitation is particularly evident in students underdeveloped visual thinking skills, including interpreting events, analyzing the components of worship, and connecting them to real-world contexts.

These instructional shortcomings have been associated with lower academic achievement and a lack of deep understanding. While the Ministry of Education in Oman promotes the integration of artificial intelligence (AI) technologies in teaching to enhance learning outcomes, their application in Islamic Education remains limited.

Consequently, there is a clear research gap regarding the impact of AI techniques on students' academic performance, visual thinking development, and learning motivation in Islamic Education. Addressing this gap is essential to explore how AI can support more interactive, student-centered, and effective learning experiences.

Study Objectives

This study aims to achieve the following objectives:

- To investigate the effect of using AI techniques on the academic achievement of ninth-grade female students in Islamic Education.
- To explore the effect of using AI techniques on the development of visual thinking skills among ninth-grade female students in Islamic Education.
- To examine the effect of using AI techniques on the learning motivation of ninth-grade female students in Islamic Education.

Research Questions

- What is the effect of using artificial intelligence (AI) techniques in teaching Islamic Education on the academic achievement of ninth-grade female students?
- What is the effect of using AI techniques in teaching Islamic Education on the development of visual thinking skills among ninth-grade female students?
- What is the effect of using AI techniques in teaching Islamic Education on the learning motivation of ninth-grade female students?

RESEARCH METHODOLOGY

This study employed a quasi-experimental design in which the study sample was divided into two groups: experimental and control. The experimental group was taught using artificial intelligence techniques, while the control group was taught using traditional teaching methods. Table 1 illustrates the quasi-experimental design of the study. A pretest–posttest control-group quasi-experimental design was employed, with the same measures administered to both groups before and after the intervention.

Table 1. Study Design

Pre-test	Study Groups	Type of Treatment	Post-test
Academic Achievement Test, Visual Thinking Test, Learning Motivation Scale	Experimental	Teaching using Artificial Intelligence techniques	Academic Achievement Test, Visual Thinking Test, Learning Motivation Scale
Academic Achievement Test, Visual Thinking Test, Learning Motivation Scale	Control	Teaching using traditional methods	Academic Achievement Test, Visual Thinking Test, Learning Motivation Scale

Study Population and Sample

The study population consisted of all ninth-grade female students enrolled in public schools affiliated with the General Directorate of Education in South Al Batinah Governorate for the academic year 2024/2025, totaling 3,814 students (Statistics and Indicators Department, Ministry of Education, 2024).

The study sample comprised 60 ninth-grade female students from Al-Rumais Basic Education School. The sample was divided into two groups: an experimental group of 30 students and a control group of 30 students. This school was selected for the following reasons: cooperation of the school administration and teachers with the researcher, provision of necessary facilities for conducting the study, and the availability of the Al-Rumais Smart Classroom, equipped with devices and technologies required for the study. There are no distinguishing characteristics of the students at this school compared to other public schools. The experimental and control groups were randomly selected.

Study Materials

A teacher's guide was prepared to assist in teaching the units "Hajj Practices," "Introduction to the Prophetic Sunnah," and "Our Ethics" from the ninth-grade textbook using AI technologies. The guide included daily lesson plans for teaching the units using AI techniques, as well as an enrichment and assessment activity booklet. Upon completion, the guide was presented to several specialists in Islamic Education curricula at the General Directorate of Curricula, Ministry of Education, and to a group of educational supervisors overseeing Islamic Education. They provided their scientific and pedagogical feedback on the content of the guide, including the accuracy of the educational material, clarity of lesson plans, appropriateness of activities for the topics, and consideration of individual differences among students. Necessary modifications were made based on their feedback. In addition, the study used the applications: ChatGPT, Augmented Reality (AR), Tarteel, and Multimedia Applications (Kahoot and Wordwall). The intervention lasted 4 weeks, with 4 lessons per week of 35 minutes each. ChatGPT, AR, Tarteel, Kahoot, and Wordwall were used for guided explanation, visual simulation, practice, and assessment, with the teacher facilitating and monitoring the activities.

Study Instruments

The study relied on three instruments:

Achievement Test

The researcher developed an achievement test covering the cognitive levels of knowledge, comprehension, application, analysis, synthesis, and evaluation, using a multiple-choice format. The test aimed to measure the

knowledge structures acquired by the students during the study period. It covered the content of the units “Hajj Practices,” “Introduction to the Prophetic Sunnah,” and “Our Ethics” from the ninth-grade textbook. This type of test was chosen because it is highly objective, ensuring consistent scoring across different evaluators. Additionally, it covers a wide range of unit topics, measures various learning outcomes at multiple levels, and does not require a long time to answer (Ibbett & Wheldon, 2016).

Steps for Constructing the Achievement Test

Content Analysis: Analyze the content of the units “Hajj Practices,” “Introduction to the Prophetic Sunnah,” and “Our Ethics” to identify the concepts and issues addressed in each unit.

Analysis of Unit Objectives: Examine the cognitive levels targeted by the unit objectives.

Preparing the guidelines for Writing Test Items:

- Items should be appropriate for the students’ level.
- Each question should have only one correct answer.
- Questions should not allow multiple interpretations or meanings.
- Each question should measure only one cognitive level.
- Questions must be clear, specific, and free from ambiguity.
- Questions should be scientifically and linguistically accurate.
- The position of the correct answer should be randomized.
- Avoid providing hints that could help students identify the correct answer.

Preparation of a Test Specification Table: A test specification table was prepared to determine the relative weight of each lesson in the units according to the number of periods allocated for each lesson. Table 2 illustrates the percentage distribution in the achievement test specification table.

Table 2. Specification Table of the Achievement Test for the Units “Hajj Practices,” “Introduction to the Prophetic Sunnah,” and “Our Ethics” from the Ninth-Grade Textbook for the Academic Year 2023/2024

Question Levels	# of Questions	Percentages
Recall	7	23%
Comprehension	7	23%
Application	6	20%
Higher-Order Thinking Skills		
Synthesis	1	3%
Analysis	4	14%
Evaluation	5	17%
Total	30	100%

The questions were distributed according to the cognitive objectives. Table 3 illustrates the distribution of questions across the different levels of the cognitive domain.

Table 3. Distribution of Test Questions According to Cognitive Levels

Cognitive Level	Questions
Recall	8, 12, 15, 19, 20, 21, 25
Comprehension	2, 4, 6, 16, 18, 24, 29
Application	1, 3, 9, 11, 13, 30
Analysis	5, 7, 26, 28
Synthesis	22
Evaluation	10, 14, 17, 23, 27

The test was initially drafted in its preliminary form consisting of 30 questions.

Preparing the Answer Key

An answer key was prepared for the achievement test to ensure scoring accuracy, assigning one point for each correct answer and zero for incorrect responses. Establishing the Test Validity. The achievement test was reviewed by a panel of specialists in Islamic Education curricula from the Directorate General of Curricula at the Ministry of Education, alongside a group of educational supervisors overseeing Islamic Education, and nine Islamic Education teachers from schools in South Al Batinah Governorate. Their feedback focused on:

- The overall appropriateness of the test items for students' level.
- Alignment of items with the specified cognitive levels.
- Accuracy and clarity of language.
- Suggestions for improvements or additions.

Based on the reviewers' feedback, some modifications were made to the test, including rephrasing certain items, adjusting the cognitive level of some questions, and modifying some linguistic expressions. The final version consisted of 30 questions, with each correct answer awarded one point, giving a maximum score of 30 points.

Establishing Test Reliability

To verify reliability, clarity of instructions, and determine the required time, the test was administered to a pilot sample of 37 ninth-grade students outside the study sample. The test was scored using the prepared answer key, and Cronbach's Alpha was calculated to determine internal consistency, resulting in a reliability coefficient of 0.74, which is acceptable educationally.

Calculating Difficulty and Discrimination Indices

- **Difficulty Index:** Each item's difficulty was calculated as the proportion of students who answered correctly to the total number of students, following Al-Khayyat (2010). An item with a difficulty index of 0.50 is considered optimal, while items below 0.30 or above 0.90 may need revision. In this study, difficulty indices ranged from 0.51 to 0.84, and all items were retained.
- **Discrimination Index:** This measures how well an item distinguishes between students with different levels of the measured attribute (Al-Khayyat, 2010). An item is considered discriminative if its index falls between 0.20 and 0.80. In this study, discrimination indices ranged from 0.161 to 0.466, which are acceptable for the achievement test.

Determining Test Administration Time

The appropriate time for the test was estimated by applying it to the pilot sample, recording the time taken by the first and last student to complete the test, and calculating the average. The average time was approximately 35 minutes, thus one class period was considered suitable for completing the test.

Visual Thinking Test

The visual thinking test was prepared following these steps:

- **Defining the Test Objective:** The objective was to measure the effect of using AI techniques on developing visual thinking skills among ninth-grade students in Islamic Education.
- **Identifying Skills Measured:** The test measured skills aligned with the content of the targeted units, including shape recognition, shape analysis, understanding relationships, interpreting ambiguity, and inferring meaning.
- **Formulating Test Items:** The test consisted of 23 multiple-choice questions. Table 4 presents the distribution of questions according to the five skills measured.

Table 4. Distribution of Visual Thinking Test Questions Across the Five Skills

Skill	Questions	Number	Percentage
Shape Recognition	1, 3, 4, 17, 18	5	22%
Shape Analysis	2, 7, 8, 13, 16, 21	6	27%
Understanding Relationships	5, 6, 15, 20	4	17%
Interpreting Ambiguity	9, 10, 12, 23	4	17%
Inferring Meaning	11, 14, 19, 22	4	17%
Total	1–23	23	100%

Validity of the Visual Thinking Skills Test:

To ensure the content validity of the test, its initial version was reviewed by a group of Islamic Education curriculum specialists at the General Directorate of Curricula, Ministry of Education, as well as by a group of educational supervisors overseeing Islamic Education, in addition to a group of Islamic Education teachers from schools in South Al Batinah Governorate. Based on the reviewers' feedback, several modifications were made, including rewording some items, replacing unclear images and diagrams, and revising questions that did not effectively measure the intended skills. The finalized test consisted of 23 questions, with 1 point assigned for each correct answer, making the total possible score 23 points.

Reliability of the Test: To verify the reliability of the test, the clarity of its instructions, and the time required to complete it, the test was administered to a pilot sample of 37 ninth-grade students not included in the study sample. Scoring followed the prepared answer key, and the internal consistency reliability was calculated using Cronbach's Alpha, yielding a reliability coefficient of 0.70, which is considered acceptable for educational purposes.

Equivalence of the Study Groups

To ensure the equivalence of the study groups in terms of academic achievement, visual thinking skills, and learning motivation, the pre-tests were administered to the students of both the experimental and control

groups. An independent samples t-test was used to determine the significance of differences between the two groups. The results are presented in Table 5.

Table 5. Independent Samples t-test Results for the Equivalence of the Control and Experimental Groups in the Pre-test of Academic Achievement, Visual Thinking, and Learning Motivation

Instrument	Control Group (n=30)		Experimental Group (n=30)		Df	t-value	Significance
	Mean	SD	Mean*	SD*			
Pre-test Academic Achievement	5,97	1,73	5,37	2,02	58	1,233	0,222
Visual Thinking Scale	4.60	3.284	6.23	3.501	58	1.897	0.063
Self-Learning Skills Scale	3,89	0.41	3,90	0,48	58	0,052	0,959

Total score for Academic Achievement Test = 30

Total score for Visual Thinking Scale = 22

Total score for Learning Motivation Scale = 5

It is clear from Table 5 that the t-values for the differences between the means of the experimental and control groups in the pre-test of academic achievement, visual thinking, and learning motivation are not statistically significant. This indicates that the two groups are equivalent across all instruments. Prior achievement was controlled through pretest equivalence between the experimental and control groups. Prior technological experience was not formally measured and is acknowledged as a limitation.

Procedures

The researchers followed the following procedures in the study:

- Preparing the Academic Achievement Test, Visual Thinking Scale, and Learning Motivation Scale, and presenting them to a panel of experts to verify their validity, followed by testing their reliability using a pilot sample.
- Developing a teacher's guide for instructing the designated units using AI technologies, including the instructional steps, behavioral objectives, and lesson plans. The guide was reviewed by specialized experts to assess its suitability for application.
- Selecting the sample from ninth-grade students at Al-Rumais Basic Education School, consisting of two classes: one representing the experimental group and the other the control group.
- Obtaining official approval from the Technical Office for Studies and Development at the Ministry of Education to implement the study.
- Administering the pre-test of study instruments (Academic Achievement Test, Visual Thinking Scale, and Learning Motivation Scale) to both the experimental and control groups to assess their equivalence.
- Teaching the experimental group using AI techniques, while the control group was taught using conventional teaching methods.
- Administering the post-test of study instruments: Academic Achievement Test, Visual Thinking Scale, and Learning Motivation Scale.

- Collecting the data and analyzing it statistically.
- Presenting and interpreting the study results.
- Providing recommendations and suggestions.

RESULTS AND DISCUSSION

Research Question 1 “What is the effect of using artificial intelligence (AI) techniques in teaching Islamic Education on the achievement of ninth-grade female students?”

Null Hypothesis 1: There is no statistically significant difference at the level of ($\alpha = 0.05$) between the mean scores of ninth-grade female students in the Islamic Education achievement test attributable to the teaching method (AI techniques vs. conventional teaching) in the post-test.

To answer this question, an independent-samples t-test was conducted to determine the significance of differences between the experimental and control groups on the achievement test, as shown in Table (6).

Table (6). Results of the t-test for the significance of differences between the mean scores of the experimental and control groups in the achievement test

Group	N	*Mean	SD	df	t	**Sig
Experimental	30	27.57	2.45	58	3.328	0.001
Control	30	22.66	4.15			

* Maximum score = 30 ** Significance level = 0.05

Table (6) indicates that there is a statistically significant difference between the mean scores of the two groups. To determine the effectiveness of the independent variable (AI techniques) on the achievement test, the effect size was calculated using eta squared (η^2) based on Cohen’s formula (Cohen, 1988, p. 281):

$$\frac{t^2}{t^2 + df} = \eta^2$$

According to Cohen’s classification:

- $\eta^2 = 0.01$ indicates a small effect size.
- $\eta^2 = 0.06$ indicates a medium effect size.
- $\eta^2 = 0.14$ indicates a large effect size.

The obtained eta squared value was (0.16). According to Cohen’s classification of effect size, this represents a large effect, indicating the effectiveness of AI techniques in enhancing achievement in Islamic Education. Therefore, the null hypothesis was rejected, as a significant difference at $\alpha = 0.05$ was found between the experimental and control groups.

This result is consistent with previous studies that confirmed the effectiveness of AI techniques in improving academic achievement, such as Al-Jarawi (2020) and Al-Omari (2019), which highlighted the positive impact of AI applications on students’ learning outcomes.

The superior performance of the experimental group over the control group in the current study’s achievement test may be attributed to several factors, including:

Presentation of content: The units in the textbook were presented through AI techniques, which provided engaging multimedia elements and modern technologies that increased the quality of learning outcomes and simplified the learning process. The incorporation of interactive features, excitement, and variety significantly enhanced students' attention and motivation to learn, facilitating the effective and efficient delivery of content. This finding aligns with Al-Ashiri (2011), who emphasized that integrating technology into the learning process positively influences students' comprehension, as it allows observation, enjoyment, reinforcement, and feedback, making learners more active and engaged, which ultimately improves their understanding and retention. **Diverse AI-based activities:** The experimental group engaged in varied activities designed with AI tools that catered to different cognitive levels and learning styles. These activities included constructive and diverse feedback, which helped students correct their errors, reduce misconceptions, and make progress. Goodwin (2008) similarly reported that providing students with feedback during learning improves knowledge acquisition, performance, and learning speed.

Use of multimedia in content delivery: The instructional materials supported by AI included images, sounds, texts, and animations, which stimulated students' senses and cognition. According to cognitive theory, knowledge acquired through sensory channels is clearer, easier to process, and more deeply retained in memory (Ismail, 2009).

Interactive and visualized learning: AI tools delivered information in interactive and visual forms, enabling students to acquire, understand, and analyze knowledge effectively. This approach enhanced their ability to differentiate between concepts, apply them practically, and engage in self-paced learning. For instance, by using the 3D Hajj simulation program, students were able to understand the rituals of Hajj and Umrah, identify the locations where they are performed, and experience the spiritual aspects of these acts of worship.

Bridging abstract concepts: AI technologies made abstract and symbolic concepts more tangible, helping students better perceive events, relationships, and situations, and apply knowledge to new contexts. For example, in the "Hajj Practices" and "Introduction to Sunnah" units, many abstract concepts were clarified through AI-enhanced experiences, allowing students to connect new information with prior knowledge for application in different scenarios. **Creating an engaging learning environment:** The use of AI in activities transformed the learning environment, increasing students' participation and motivation. AI applications offered colorful and varied visuals that captured attention, fostered enthusiasm, and encouraged active engagement. Moreover, the provision of immediate and accurate feedback following each activity helped students identify their strengths and weaknesses regarding content understanding and skill acquisition.

Research Question 2: "What is the effect of using AI techniques on developing visual thinking among ninth-grade female students in Islamic Education?"

Null Hypothesis 2: There is no statistically significant difference at the level of ($\alpha = 0.05$) between the mean scores of ninth-grade female students in the visual thinking skills test in Islamic Education attributable to the teaching method (AI techniques vs. conventional teaching) in the post-test.

To verify the related null hypothesis, means and standard deviations of both study groups' performances were calculated, in addition to conducting an independent samples t-test to examine the statistical significance of the differences in the post-test of visual thinking, as presented in Table (7).

Table (7). Means, Standard Deviations, and t-test values for the Experimental and Control Groups in the Post Visual Thinking Test

Skill	Max Score	Group	Mean	SD	df	t-value	Sig.	η^2
Shape recognition	5	Experimental	4.20	0.714	60	3.886	0.000	0.20

		Control	3.20	1.215				
Shape analysis	6	Experimental	4.57	0.935	60	2.129	0.039	0.07
		Control	3.73	1.929				
Relationship perception	4	Experimental	3.60	0.621	60	3.106	0.003	0.13
		Control	2.97	0.928				
Ambiguity interpretation	4	Experimental	3.37	0.809	60	2.474	0.016	0.09
		Control	2.67	1.322				
Meaning inference	4	Experimental	2.67	0.844	60	2.179	0.033	0.07
		Control	2.13	1.042				
Total score	23	Experimental	18.40	1.905	60	4.343	0.000	0.23
		Control	14.70	4.260				

Significant at ($\alpha = 0.05$)

The results in Table (7) indicate statistically significant differences at the level of (0.05) between the mean scores of the experimental and control groups in the post visual thinking test, in favor of the experimental group. The mean score of the experimental group was (18.40, SD = 1.905), compared to (14.70, SD = 4.260) for the control group. Significant differences were also found in all five sub-skills (shape recognition, shape analysis, relationship perception, ambiguity interpretation, and meaning inference). These findings confirm the effectiveness of AI applications in developing visual thinking skills among students. Accordingly, the second null hypothesis was rejected because significant differences were observed at $\alpha = 0.05$ in all visual-thinking measures.

The effect size values (η^2) further demonstrate this effectiveness. According to Cohen (1988), AI techniques produced a large effect on overall visual thinking ($\eta^2 = 0.23$) and shape recognition ($\eta^2 = 0.20$), while the effect was moderate in shape analysis (0.07), relationship perception (0.13), ambiguity interpretation (0.09), and meaning inference (0.07).

The superior performance of the experimental group can be attributed to several factors:

- Shape recognition: AI techniques presented visual stimuli such as images, diagrams, maps, and videos, which enhanced attention and visual engagement. This aligns with the findings of Abu Jalbah (2017), Al-Harthiya (2015), Zانقور (2014), and Al-Astal (2014).

- Shape analysis: Students were required to analyze details of visual inputs and answer guiding questions, enhancing their ability to extract meanings and concepts. Similar results were reported by Abu Jalbah (2017), Al-Astal (2014), and Al-Harhiya (2015).
- Relationship perception: This higher-order skill was fostered by engaging students in identifying connections among visual elements, theoretical knowledge, and outcomes, especially in lessons related to Hajj rituals. These results are consistent with Abu Jalbah (2017), Al-Busaidiya (2017), and Al-Astal (2014).
- Ambiguity interpretation: AI-based activities stimulated curiosity by including tasks that required students to identify and resolve ambiguities, linking them to real-life experiences. This finding agrees with Abu Jalbah (2017), Al-Jabri (2017), and Zانقور (2014).
- Meaning inference: As a composite skill, inference was enhanced by systematic exposure to visuals and activities that encouraged deep reflection, analysis, and synthesis of new concepts. This is supported by Abu Jalbah (2017), Al-Jabri (2017), and Zانقور (2014).
- Overall, the findings strongly support the conclusion that AI applications significantly contributed to the development of visual thinking skills among students in the experimental group.

Research Question 3: “What is the effect of using AI techniques in teaching Islamic Education on developing learning motivation among ninth-grade female students?”

Null Hypothesis 3: There is no statistically significant difference at the level of ($\alpha = 0.05$) between the mean scores of ninth-grade female students in the learning motivation scale in Islamic Education attributable to the teaching method (AI techniques vs. conventional teaching) in the post-test.

To answer this question, an independent samples t-test was conducted to examine the statistical significance of the differences between the mean scores of the experimental and control groups on the post-test of the learning motivation scale. The results are presented in Table (8).

Table (8). Means, Standard Deviations, and t-test values for the Experimental and Control Groups in the Post Learning Motivation Scale

Group	N	Mean	SD	df	t-value	Sig.
Experimental	30	4.04	0.363	58	2.06	0.04
Control	30	3.88	0.205			

Scale range = 5, significant at ($\alpha \leq 0.05$)

As shown in Table (8), the calculated t-value (2.06) was statistically significant at the ($\alpha \leq 0.05$) level, indicating that there was a significant difference between the mean scores of the experimental and control groups in favor of the experimental group. The mean score of the experimental group was (4.04), compared to (3.88) for the control group. Accordingly, the null hypothesis was rejected, and the alternative hypothesis was accepted, which stated that there are statistically significant differences in learning motivation between the two groups in favor of the experimental group taught using AI techniques.

To determine the effect size, eta squared (η^2) was calculated using Cohen’s (1988) formula. The obtained value was (0.06), which indicates a medium effect size. This result confirms the effectiveness of AI applications in enhancing students’ learning motivation. Thus, the third null hypothesis was rejected, with the experimental group scoring significantly higher than the control group at $\alpha = 0.05$.

The superior motivation levels among the experimental group may be attributed to several factors. AI techniques created a psychologically and socially safe classroom environment that was also physically attractive. The variety of classroom activities, tasks, and post-lesson quizzes, accompanied by immediate

feedback, enhanced students' enjoyment of the learning process and increased their motivation. Furthermore, AI provided interactive and innovative methods of presenting content through visuals, graphics, and auditory effects, maintaining continuous engagement and stimulating curiosity. Opportunities for cooperative learning, discussion, and questioning also contributed to higher levels of enthusiasm and motivation. Additionally, the novelty of AI-based learning environments sparked students' interest and curiosity to explore and engage with these new learning methods.

These findings are consistent with previous studies, such as Sawalma and Al-Saeed (2023), which also demonstrated the positive role of AI applications in fostering students' motivation to learn. Students' experiences and perceptions of AI-supported learning were not systematically collected; future studies should include interviews or reflective questionnaires to capture learners' perspectives. Educational use of AI requires teacher supervision, protection of students' personal data, verification of AI-generated content, and attention to cultural and religious appropriateness.

RECOMMENDATIONS

In light of the findings of this study, the researcher proposes the following recommendations:

- Promoting the integration of AI technologies in education, given their role in achieving learning objectives and adding excitement and enjoyment to the delivery of educational content.
- Equipping classrooms with computers and internet access, alongside providing continuous technical support to ensure the effective utilization of AI applications.
- Organizing training courses and workshops for Islamic Education teachers and supervisors to enhance their competencies in applying AI techniques during lessons, as these have proven effective in improving students' achievement, critical thinking, and self-learning.
- Encouraging school administrations to adopt incentive and reward systems, both material and moral, in order to foster competition among teachers—including Islamic Education teachers—towards integrating AI applications into classroom instruction.
- Adopting national initiatives by the Ministry of Education, such as competitions for teachers and students in programming and AI applications, supported by community partnerships. Such initiatives can highlight and sustain pioneering projects by either incorporating them into curricula or linking them with labor market needs.

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