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The effect of using smart e-learning app on the academic achievement of eighth-grade students

Saif Alneyadi [1], Yousef Wardat [2*], Qasim Alshannag [3], Ahmad Abu-Al-Aish [4]

[1] Department of Curriculum and Instruction, College of Education, Al Ain University, Al Ain 15551, UAE
[2] Higher Colleges of Technology, Al Ain, UAE
[3] Emirates College for Advanced Education, Abu Dhabi, UAE
[4] Department of Computer Science, Faculty of Computer Science and Information Technology, Jerash University, Jerash, JORDAN

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Abstract

The purpose of this study is to determine whether smart applications can help students in the United Arab Emirates (UAE) acquire higher levels of proficiency in scientific ideas. To do this, 120 eighth-graders (the last year of the second cycle) from schools in UAE city of Al Ain participated in a quasi-experimental study. These students were divided into two equal groups at random: a test group that studied with the aid of technology, and a control group that learned through the conventional classroom technique. A test on scientific concepts and intelligent applications based on the educational program served as study aids. The findings of the scientific-concept accomplishment test revealed statistically significant differences between the mean scores for the two groups, favoring the experimental group. As a result of the type of smart application used, particularly Alef platform in comparison to the Boclips and Connect platforms, the results also showed statistically significant differences between the mean scores for the experimental group students' achievement level regarding scientific concepts. The researcher advises incorporating smart applications into the educational process in light of these findings, particularly when instructing scientific topics.

Keywords: smart applications, educational platforms, Alef, Connect, Boclips, scientific concepts, eighth grade, United Arab Emirates

INTRODUCTION

Teachers work to modify students' behaviors in addition to reaching the objective educational and scientific goals of the educational process. It enables educators to arrange subject matter in an engaging manner that will pique and inspire students while considering their traits and underlying themes. In order to provide the technical and scientific frameworks required to advance awareness, education is crucial. Because of this, contemporary societies anticipate that educational institutions will meet the demands of contemporary knowledge and creativity, particularly while doing research (Alneyadi et al., 2023; Aloufi et al., 2021; Gningue et al., 2022; Majeed & Ziyadat, 2008).

Teachers' responsibilities now extend beyond only imparting knowledge to pupils. Teachers are in charge of teaching pupils how to learn and use information in their daily lives. It demands a change in the educational process to put more emphasis on scientific reasoning abilities that aid students in separating facts from reasoning, identifying causation, drawing conclusions, making predictions, and making judgments based on enough evidence. Also, critical thinking aids students in resolving issues in their day-to-day lives outside of the classroom (Ibrahim, 2004; Tashtoush et al., 2022a, 2022b; Wardat et al., 2022).

The transfer of information to both in-class and out-of-class activities is a key component of contemporary educational principles. According to Saadeh and Ibrahim (1997), education is an effort or strategy made to aid a person in acquiring or altering a certain knowledge

✉ saif.alneyadi@aau.ac.ae ✉ yousef_alwardat@yahoo.com **(*Correspondence)** ✉ qalshannag@gmail.com
✉ ahmad.abualaish@jpu.edu.jo

Contribution to the literature

- This research aims to examine the effectiveness of smart applications in raising achievement levels for scientific concepts among students in the United Arab Emirates (UAE).
- This research aims to provide quality education based on the latest international curricula in science and mathematics, make it available free of charge to millions of Arab students, and open new horizons of knowledge for them.
- This research aims to establish the foundations of self- and systematic learning without contradicting the role of traditional educational institutions.

base, skill, attitude, or idea. Al-Khalili et al. (1996) claimed that scientific conceptions might either be a process (i.e., a mental process by which a collection of traits, observations, or facts) or a result (a name, term, or symbol that is given to a group of common qualities or attributes) (Saadeh & Ibrahim, 1997). Due to the importance of scientific concepts, an urgent need to develop effective teaching methods and processes that motivate students and improve their performance (Zaytoun, 2004).

Research Problem

Finding better ways to teach technical issues during lectures and ensuring that students grasp them causes research problems. Also, there are numerous intelligent applications for learning that have been demonstrated in various mobile and electronic office equipment kinds. The current study looks at how using intelligent applications in the classroom might help students get ready for the real world.

Several studies(Al-Jeriwi, 2020; Al-Nasr, 2009; Demir et al., 2018) have identified weaknesses among students in understanding and mastering scientific concepts. One of the reasons is that abstract concepts found in science books require many modern means and techniques to clarify and decipher them.

The study adopted the observation method to understand how teachers transmitted information to students in the second science cycle (5^{th} to 8^{th} grade [10 to 13/14 years]). The researchers categorized the science teachers as either traditional (those teaching concepts using traditional methods that include theoretical explanations without sensory or technical means) or modern (using intelligent applications to increase achievement).

The teachers that used modern methods adopted one of the three teaching platforms like Alef, Boclips, and Connect platform. More than 250 schools in UAE use Alef platform. It provides educational content to support the school's curriculum with approximately 2,000 digital lessons, with several features that students can access conveniently. Ministry of Education launched Boclips platform to disseminate distinct educational films, making learning more attractive to students. It contains a library of high-quality educational videos that meet international learning standards. Boclips also provides teachers with the content, tools, and strategies to use video safely, efficiently, and effectively in the classroom. Finally, the connected platform has a teacher and student learning center that provides a range of assessments, tests, worksheets, books, labs, and videos. Connect ED platform has a teacher and student learning center that provides reviews, tests, worksheets, additional books, labs, and videos.

This research is delimited by time, place, human, and subject. First, the study was conducted during the second semester of 2020/2021 among primary private schools affiliated with UAE's Ministry of Education in the Al Ain region. The participants were eighth-grade teachers and students of the second cycle in the studied schools. The research topic is delimited regarding the effectiveness of smart applications (Alef, Connect, and Boclips) in raising scientific achievement among eighth-grade students. The results of this research are also delimited regarding the data collection tools and the indications of their validity and reliability. By examining these three learning platforms in elementary schools, this study seeks to answer the following research question:

1. **RQ1.** What are the scientific concepts required for students of the second cycle?
2. **RQ2.** How effective is Alef platform in raising the acquisition level of scientific concepts among eighth-grade students in UAE?
3. **RQ3.** How effective is Connect platform in raising the acquisition level of scientific concepts among eighth-grade students in UAE?
4. **RQ4.** How effective is Boclips platform in raising the acquisition level of scientific concepts among eighth-grade students in UAE?
5. **RQ5.** How practical are smart applications in raising the level of acquisition of scientific concepts among eighth-grade students in UAE?
6. **RQ6.** Is there a statistically significant relationship between the achievement test results for scientific concepts and the type of smart application used among eighth-grade students in UAE?

Research Objectives

The current study aims to accomplish two goals. Initially, it lists the scientific ideas that UAE students in the second cycle of eighth grade need to know. The impact of smart apps (Alef, Connect, and Boclips) on improving student performance is then examined.

Significance of the Research

This study makes two contributions to the body of literature by looking at how intelligent applications can be utilized to educate sciences. Secondly, it adds to the expanding body of studies looking at how well smart applications might improve students' understanding of scientific ideas. The project will add to and advance existing knowledge in this area, potentially having a positive influence on the educational sector. The results of this study will also be useful for researchers, educators, curriculum designers, smart technology creators, and students. The pupils will learn scientific ideas. This research establishes the groundwork for future studies that will use cutting-edge methodologies to create scientific concepts at various educational levels. The research will give curriculum creators and developers a list of scientific ideas they can incorporate into the second cycle of eighth-grade science courses. The processes and techniques in this list will help teachers instruct students on scientific topics.

LITERATURE REVIEW

Previous studies have examined the impact of smart applications on academic achievement. These studies have examined the impact of available digital platforms and specific innovative applications (e.g., Easy Class, Edmondo, Future Gate, Edraak, Google Classroom) on teaching mathematics (Alnaabi, 2021), biology (Al-Issawi & Al-Moussawi, 2020) science, social studies, and citizenship (Al-Shamrani & Al-Ariani, 2020), English (Aljaser, 2019), and chemistry (Chen & Liu, 2020). Smart technologies also encourage teachers to adopt effective teaching strategies such as the flipped classroom strategy (Ramadan, 2019), augmented reality technologies (Chen & Liu, 2020), WebQuest strategy (Harahsheh, 2019), and computerized thinking maps strategies (Shana, 2017). These applications are developed using the Android operating system (Eliyawati et al., 2020) . Technology improves students' cognitive skills, self-regulation abilities, and animation development (Demir et al., 2018), helping them to develop healthy habits (Alnaabi, 2021) for knowledge retention(Al-Jeriwi, 2020).

Specific smart applications have been shown to improve cognitive skills, self-regulation abilities, and the development of habits. Easy Class platform (Alnaabi, 2021), Edmondo education platform (Al-Issawi & Al-Moussawi, 2020), and Future Gate (Al-Shamrani & Al-Ariani, 2020) have been shown to predict cognitive improvement and reduced anxiety levels among students. Beirne (2020) found that students' (n=50) academic achievement and attitudes improved after using Edraak platform. Al-Zoro (2020) also found that using Edraak platform during mathematics classes improved engineering students' problem-solving skills. Using a sample of 66 students, Abu Suleiman (2019) found that teaching using the Edmodo educational platform increased achievement and motivation among female students from the third intermediate grade in al-Madinah al-Munawwarah. Mobile learning applications improved the academic achievement of university students in Turkey when developing animations (Demir et al., 2018). They also improved student performance (Al-Amour & Alimat, 2016) and the student's multiple intelligences (Zuaiter, 2015).

General learning platforms motivate students to learn specific subjects (e.g., English) and positively influence their performance, critical thinking, future thinking skills, and retention. Aljaser (2019) found that students exposed to an e-learning environment had better performance and attitudes toward learning English. Sherif (2019) found that using social learning networks to modify alternative biological concepts developed creative thinking skills among female students. Nora and Snyder's (2008) results showed statistically significant differences in scientific thinking, achievement level, and learning retention among students exposed to integrated e-learning. Alsalhi et al.'s (2019) study found that integrated e-learning improved students' academic achievement in science. Al-Jeriwi (2020) confirmed that using artificial intelligence technology in the e-learning environment positively impacted the development of future thinking skills and academic achievement in science. The study of Al-Nasr (2009) reveals that computerized educational material improved science operations skills among the students due to the teaching method in favor of the experimental group.

Teaching strategies proposed by learning platforms can also improve students' practical performance and critical thinking. Ramadan's study revealed the flipped classroom strategy's effectiveness in developing cognitive achievement and functional performance in students' computer skills (Ramadan, 2019). Al-Rubaian's (2017) results indicated that students in flipped classrooms showed more critical thinking skills and performance. Using augmented reality techniques among 10th graders in Jordan, Al-Nawaisah and Abu Jaber (2020) found that students acquired more knowledge in chemistry when using this teaching method. Harahsheh (2019) sought to investigate the impact of WebQuest strategy among sixth-graders in Jordan. The results revealed that the students' creativity improved when teachers used WebQuest strategy. However, Al-Abbas (2019) showed that teaching strategies (e.g., problem-centered learning) did not influence student social interaction. Using a sample of 49 eighth-graders in Jordan, their study showed that students exposed to problem-centered learning strategy acquired more scientific concepts, but their social interaction skills remained unchanged. Al-Salaq (2018) found that computerized learning strategies improved students reflective thinking. Bani Younis and Dawlat (2017) confirmed that the directed induction strategy improved learning and performance among third-graders regardless of gender. Shana's (2017) study revealed that the computerized thinking maps strategy developed student learning enjoyment. Abu Farha's (2015) study found that applying the STEM approach using the robot toolkit (EV3) improved ninth-graders performance in Jordan.

Other studies have focused on developing operating systems that are efficient and effective for digital education. Eliyawati et al. (2020) developed an Android application and demonstrated its effectiveness in explaining the various representations of acid-base chemistry. The results show that learning applications should be customized according to students' learning capabilities (e.g., artistic traits versus content and learning experience). They recommend that smart applications should link content with symbolism. Omar's (2016) study revealed that color cues in the background of digital images within e-books did not affect student cognition (impulsivity/deliberation).

Teacher perceptions and responses are critical in the effective implantation of smart applications. Ghavifekr and Rosdy's (2015) study analyzed teachers' perceptions of ICT integration to support teaching and learning. Using a sample of 101 teachers from 10 Kuala Lumpur, Malaysia secondary schools, the results indicated that ICT integration is highly effective for teachers and students(AlAli et al., 2023; Ghavifekr & Rosdy, 2015). Furthermore, preparing well-equipped teachers using ICT tools and facilities is critical to technology-based teaching and learning success. Further, the professional development training programs for teachers play a role in enhancing the quality of learning for students.

There is a scarcity of similar studies applying similar study tools for eighth-graders in UAE. The current research aims to reveal the effectiveness of intelligent applications in raising the acquisition level of scientific concepts in this context.

METHOD AND PROCEDURES

Research Methodology

The research used the descriptive approach to answer the research questions. In addition, a quasi-experimental approach was used to apply the research experience and reveal the effectiveness of smart applications in raising the achievement of scientific concepts in UAE.

Participants and Procedure

The research community consisted of 120 eighth-graders (the final year of the second cycle) from four schools in Al Ain, UAE. The study was carried out during the second semester of 2020/2021. The students were randomly assigned to two equal groups: an experimental group that studied the thermal energy unit using intelligent applications and a control group that studied the same unit using the standard teaching method.

Table 1. Distribution of research sample members according to teaching method and gender

Group	Teaching method	Gender		Total
		Male	Female	
Experimental	Smart applications	30	30	60
Control	Regular teaching method	30	30	60
Total		60	60	120

Table 1 shows the distribution of the sample members according to the research variables. The research followed a quasi-experimental design, as follows: EG: $O_1 \times O_2$ and CG: O_1-O_2, where EG stands for the experimental group, CG stands for the control group, × stands for teaching using smart applications, O_1 stands for the pre-scientific concepts' achievement test, and O_2 stands for the post-scientific concept's achievement test.

The instructional material (experimental processing material) was created by designing the unit (thermal energy) from the eighth-grade science book, which includes three topics (thermal energy, temperature, and heat; thermal energy transfers; and thermal energy use). This content was uploaded to educational platforms for teaching. The instructional material enabled teachers to present the unit's content (thermal energy) using different teaching strategies (individual, group, and peer learning). The researchers created sub-topics to suit the used smart applications and tablets. The instructional program used the educational platforms for the topics available in the setting unit, where the "thermal energy, temperature, and heat" topic was taught using Connect platform, the "thermal energy transfers" topic was taught using Alef platform, and the "thermal energy use" topic was taught using Boclips platform. The teachers developed educational activities, including electronic activities, homework, e-learning lessons, and an electronic test.

The three platforms were considered together because they share many essential characteristics of interactive, adaptive learning environments based on the principle of virtual classes. Furthermore, they are also open-source tools (i.e., available for modification by anyone) and specialize in deep learning. However, there are subtle differences, e.g., usage mechanisms, specific techniques, levels of accuracy, and objectivity in the results. This study will highlight the effectiveness of different teaching methods through smart applications by comparing the three platforms.

The researchers constructed a scenario for the educational videos that explain the content (i.e., the videos that the researcher prepared using the video merging and cutting program (V-Edit) and the audio recording program (Capture Recorder). They also constructed a teacher's manual using Word program (Microsoft Word 2010). Finally, they uploaded the instructional content through the educational platform and presented it to experts to verify its validity and reliability.

The implementation of the educational program took four weeks, with three lessons per week, each of 45 minutes, leading to a total of 12 class sessions. To maintain accuracy and objectivity in the research results, the researcher supervised the teaching process of the experimental and control groups.

Measures

Scientific concepts achievement test

Students were tested on the central and sub-skills of the thermal energy unit. The test items were subsequently developed guided by the general foundations used in developing tests. They answered 26 multiple-choice items, each with four choices, only one of which was correct. To develop the questions, the teachers determined the objective of the test, and the education material (the thermal energy unit included in the eighth-grade textbook, which UAE Ministry of Education sets) was selected. The clarity of the phrases, the level of the students, and the absence of more than one possible answer were considered.

The test was presented in its initial form to three experts specializing in curricula and methods of teaching science and pure science. To judge its validity for application in the field, the experts rated the questions based on the extent of their correctness (scientific and linguistic terms), the clarity of the test language, relevance, and suitability for an application. In light of the experts' opinions, two items were deleted, and the phrasing of some items was modified. Thus, the final test consisted of 24 items.

The test questions were verified using a preliminary sample other than the target study sample. From the pre-test, the time for the test was determined as 40 minutes, and it was calculated by finding the average between the sum of the first student's answer time (31 minutes) and the last student's answer time (49 minutes).

RESULTS

Analytical Strategy

We applied Pearson correlation (validity and reliability) and Kuder-Richardson KR20 (reliability) equation to the coefficient between all items (Odeh, 2010). To answer the research questions, the arithmetic means, and standard deviations were obtained, in addition to the t-test for two independent groups,

Table 2. Difficulty/discrimination coefficients of test items

Item	Difficulty coefficient	Discrimination coefficient
1	0.36	0.58
2	0.29	0.40
3	0.64	0.68
4	0.29	0.58
5	0.50	0.43
6	0.43	0.50
7	0.64	0.50
8	0.57	0.73
9	0.**73**	0.58
10	0.50	0.50
11	0.50	0.68
12	0.50	0.60
13	0.50	0.54
14	0.64	0.52
15	0.57	0.66
16	0.50	0.70
17	0.57	0.52
18	0.34	0.59
19	0.50	0.57
20	0.**73**	0.63
21	0.29	0.56
22	0.43	0.70
23	0.43	0.68
24	0.71	0.69

Pearson correlation coefficient and the Kuder-Richardson KR20 equation, to verify the validity and reliability indicators of the research tools.

To test the seven hypotheses, the arithmetic means and standard deviations of the scores of the two study groups were obtained for the scientific concept pre-test and post-test according to the group variable (teaching method).

Pre-Analysis

The coefficients (difficulty, discrimination, validity, and reliability) were obtained to verify the psychometric features of the test. The test was applied to a pilot sample of 20 male and female students of the eighth grade in the schools under study other than the target study sample, as detailed below.

As shown in **Table 2**, the difficulty coefficients for the test items ranged between 0.29-0.73, while the discrimination coefficients ranged between 0.34-0.73. These values are acceptable for the study (Odeh, 2010). The validity of correlation coefficients ranged between 0.31 and 0.72, and the reliability was 0.86. They were both statistically significant. The Kuder-Richardson (KR20) test revealed the reliability coefficient to be 0.89, which is indicative of the test's reliability.

Equivalence of Groups

To verify the equivalence of the two groups (experimental and control) in students' achievement of scientific concepts, the researcher applied the t-test to the results of the (preliminary) test of scientific concepts.

Table 3. Results of the t-test on the pre-application of the scientific concept test

Group	n	Arithmetic mean	Standard deviation	t-value	Significance
Experimental	60	11.80	2.91	1.74	0.098
Control	60	10.95	1.75		

Note. Statistically significant at the 0.05 level

Table 4. Arithmetic means & standard deviations of students' responses to scientific concept pre-/post-test according to group-1

Group	n	Pre-test		Post-test	
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation
Control	60	1.52	0.76	4.03	0.91
Experimental	60	1.46	0.84	6.51	0.78
Total	120	1.49	0.90	5.27	0.94

Note. Maximum mark=8

Table 5. Results of t-test of the independent data for the performance of the experimental & control groups on the scientific concepts post-test-1

Group	n	Arithmetic mean	Standard deviation	t-value	Significance
Experimental	60	4.03	0.91	16.03	0.000
Control	60	6.51	0.78		

Note. Statistically significant at the 0.05 level

Table 6. Arithmetic means & standard deviations of students' responses to scientific concept pre-/post-test according to group-2

Group	n	Pre-test		Post-test	
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation
Control	60	1.66	0.70	4.72	0.74
Experimental	60	1.53	0.68	5.97	0.92
Total	120	1.60	0.84	5.35	1.01

Note. Maximum mark=8

As shown in **Table 3**, there was no statistically significant difference at the α=0.05 level between the mean scores for the control and experimental groups in the scientific concept pre-test. The t-value was 1.74, which is not statistically significant. It indicates no statistically significant difference between the control and experimental groups in pre-applicating the scientific concepts test, indicating the two samples' homogeneity.

Test of the Research Questions

RQ1: What scientific concepts are required for students of the second cycle?

As a result, they revealed fifteen critical scientific concepts to eighth-grade students. These concepts include key concepts (thermal energy, temperature, and heat), thermal energy transfer concepts (radiation, conduction, heat conductor, heat insulation, specific heat, heat shrink, thermal expansion, convection, and load currents), use of thermal energy (heating device and thermostat).

RQ2: How effective is Alef platform in raising the level of acquisition of scientific concepts among eighth-grade students in UAE?

As shown in **Table 4**, there is a difference between the mean scores of the two groups of students for the scientific concept post-test, as the results indicate that the scores of the students for the control group on the post-test (M=4.03, SD=0.91) and experimental group (M=6.51, SD=0.78)

Table 5 shows a statistically significant difference between the mean scores for the control and experimental groups (α=0.05, t-value of 16.03). It indicates Alef platform's effectiveness in raising the acquisition level of scientific concepts among eighth-grade students.

RQ3: How effective is the connected platform in raising the acquisition level of scientific concepts among eighth-grade students in UAE?

As shown in **Table 6**, there is a difference between the students in the control group (M=4.72 and SD=0.74) and the experimental group students (M=5.97, SD=0.92, 1.25 degrees).

Table 7 shows that Connect platform's experimental group showed greater scientific conception than the control group (t-value of 8.20).

Table 7. Results of t-test of the independent data for the performance of the experimental & control groups on the scientific concepts post-test-2

Group	n	Arithmetic mean	Standard deviation	t-value	Significance
Experimental	60	4.27	0.74	8.20	0.000
Control	60	5.97	0.92		

Note. Statistically significant at the 0.05 level

Table 8. Arithmetic means & standard deviations of students' responses to scientific concept pre-/post-test according to group-3

Group	n	Pre-test		Post-test	
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation
Control	60	1.41	0.81	4.23	0.85
Experimental	60	1.36	0.75	6.02	0.90
Total	120	1.39	0.86	5.13	0.93

Note. Maximum mark=8

Table 9. Results of t-test of the independent data for the performance of the experimental & control groups on the scientific concepts post-test-3

Group	n	Arithmetic mean	Standard deviation	t-value	Significance
Experimental	60	4.23	0.85	11.19	0.000
Control	60	6.02	0.90		

Note. Statistically significant at the 0.05 level

Table 10. Arithmetic means & standard deviations of students' responses to scientific concept pre-/post-test according to group-4

Group	n	Pre-test		Post-test	
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation
Control	60	11.80	2.91	13.95	2.17
Experimental	60	10.95	1.75	18.50	2.83
Total	120	11.38	2.43	16.23	3.39

Note. Maximum mark=24

Table 11. Results of t-test of the independent data for the performance of the experimental & control groups on the scientific concepts post-test-4

Group	n	Arithmetic mean	Standard deviation	t-value	Significance
Experimental	60	13.95	2.17	13.91	0.000
Control	60	18.50	2.83		

Note. Statistically significant at the 0.05 level

RQ4: How effective is Boclips platform in raising the acquisition level of scientific concepts among eighth-grade students in UAE?

As shown in **Table 8**, there is a difference between the students in the control group (M=4.23, SD=0.85) and the experimental group (M=6.02, SD=0.90, 1.79 degrees).

As shown in **Table 9** that there is a statistically significant difference between the control and experimental groups (α=0.05, t-value=11.19).

RQ5: How effective are smart applications in raising the level of acquisition of scientific concepts among eighth-grade students in UAE?

As shown in **Table 10**, there is a difference between the students in the control group (M=13.95, SD=2.17) in the experimental group (M=18.50, SD=2.83, t=4.55 degrees).

Table 11 shows that the experimental groups responded to the "smart applications" in raising the level of acquisition of scientific concepts among eighth-grade students ($p<0.05$).

RQ6: Is there a statistically significant relationship between the achievement test results for scientific concepts and the type of smart application used among eighth-grade students in UAE?

As shown in **Table 12**, there are apparent differences between the experimental groups depending on the intelligent application. Alef platform (M=6.51, SD=0.91) was more effective at scientific conceptualization compared to Boclips platform (M=6.02, SD=0.89) and Connect platform (M=5.97, SD=0.94).

Table 13 shows statistically significant differences between the experimental and control group students ($p<0.05$).

Table 12. Arithmetic means & dimensional standard deviations of the performance of the experimental group students according to the smart applications variable, arranged in descending order according to the arithmetic means

Variable	Variable levels	Arithmetic mean	Standard deviation
Smart applications	Alef platform	6.51	0.91
	Boclips platform	6.02	0.89
	Connect platform	5.97	0.94
Total		18.50	2.83

Note. Each application mark=8 & Maximum score=24

Table 13. Results of the one-way analysis of variance test to detect the differences in the achievement level of scientific concepts among students according to the type of smart application

Variance source	Total of squares	Freedom scores	Mean scores	Calculated F value	Significance
Application type total error	7.818	2	3.909	7.474	0.000
	29.811	57	0.523		
	37.629	59			

Note. Statistically significant at the 0.05 level

Table 14. Results of the Scheffé test for the achievement level of scientific concepts among students according to the smart application type

Level	Arithmetic mean	Alef platform	Boclips platform	Connect platform
Scheffé test	6.51	6.51	6.02	5.97
Alef platform	6.02			
Boclips platform	5.97	0.49		
Connect platform		0.54	0.05	

Note. Statistically significant at the 0.05 level

Table 14 shows statistically significant differences between students' achievement level of scientific concepts due to the type of intelligent application and in favor of Alef platform compared to the two other platforms, Boclips, and Connect ($p<0.05$).

DISCUSSION

The results revealed that all the smart platforms (Alef, Connect, and Boclips) effectively raised the acquisition of scientific concepts among eighth-grade students). However, Alef platform was more effective compared to the rest.

The applications are practical because they contain a set of interactive educational simulations in learning in general, enabling students to develop a deeper understanding of scientific concepts and reach advanced knowledge levels. They link scientific theory with real life, which helps them understand and analyze chemical concepts, given that the students implement practical activities individually while taking sufficient time. In addition, these applications help simplify concepts, increasing immersion in different educational situations. While also considering individual differences in terms of students' needs, interests, desires, and tendencies.

Smart applications also enable students to learn concepts in a logical order, which contributes to building and assimilating knowledge soundly. Consequently, these intelligent applications have integrated worksheets, video presentations, and practical demonstrations of experiments to improve students' efficiency. Further, applications contribute significantly to finding alternative solutions to tasks that enable students to retain the knowledge for extended periods.

According to Shaw et al. (1997), organizing and documenting students' work increases the effectiveness of the strategy used for teaching. The use of smart applications has other benefits for the student. It promotes active learning for students, enhancing their self-confidence and creativity. The teachers also incorporate exercises and games related to scientific concepts. Smart applications are one of the boons of constructivist learning, which is based on active learning, self-learning, and meaningful learning. Abou Ali (2022) indicated that the learner organizes information in interconnected nodes and mental schemas, increasing retention.

Alef platform trumped the other platforms' effectiveness in learning scientific concepts. The platform is rich in educational videos and movies and uses artificial intelligence applications to support student learning. Alef platform is also a free application that can be downloaded and installed on smartphones. Students expressed satisfaction and enjoyment, noting the ease of use and access to the educational material. Compared to other platforms, the platforms allowing activities and assignments. All of this likely contributed to creating positive impressions among students concerning the tools of Alef platform. These results are supported by previous studies that advocate for educational platforms (e.g., Abu Suleiman, 2019) and artificial intelligence (e.g., Akpınar, 2020; Al-Jeriwi, 2020).

Connect platform includes videos that teach a wide range of languages , multiple skills, and interactive resources that appeal to young learners (e.g., (Al-Issawi & Al-Moussawi, 2020; Al-Shamrani & Al-Ariani, 2020). Boclips platform allows teachers to broadcast "safe" videos (Ramadan, 2019; Sherif, 2019), without exposing students to advertisements or inappropriate content). In addition, a teacher-friendly interface allows teachers to bring the real world into the classroom through an extensive library of high-quality educational videos and standards-based resources. Interactive video is a required method, especially in personal learning, as it considers the individual level of information and speed of presentation. All of this probably helped raise the bar for students' scientific concepts.

CONCLUSIONS

Based on the findings, the researcher makes several recommendations. Ministry of Education should adopt the use of smart applications in education. Arabic language curricula should include educational activities based on smart applications to teach scientific concepts. Teachers should be trained regarding strategies and mechanisms for employing smart applications in education. Finally, parents and teachers should encourage students to use smart applications, given their positive impact on raising the level of scientific concepts acquisition.

Future research can extend the findings in this study by conducting similar studies on social sciences and humanities (e.g., linguistics) at different academic levels. They can include modern strategies and computerized educational programs to acquire scientific concepts for students, especially in light of the tremendous technological progress.

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REFERENCES

Abou Ali, A. (2022). *Effectiveness of combined strategy instruction in improving listening comprehension and reducing anxiety in secondary classes* [Doctoral dissertation, Lebanese University].

Abu Farha, S. (2015). *The effect of applying the STEM approach using the EV3 robot kit on the acquisition of scientific concepts for the ninth-grade female students* [Unpublished master's thesis]. University of Jordan.

Abu Suleiman, S. (2019). The effectiveness of the Edmodo educational platform in the achievement and development of motivation among third-grade students in the middle school mathematics course. *Journal of Scientific Research in Education, 8*(20), 281-307.

Akpınar, E. (2021). The effect of online learning on tertiary level students mental health during the COVID-19 lockdown. *The European Journal of Social & Behavioural Sciences, 30*(1), 52-62. https://doi.org/10.15405/ejsbs.288

Al-Abbas, L. (2019). *The effect of a computerized educational program based on a problem-centered learning strategy on acquiring scientific concepts in the light of social interaction patterns among eighth grade female students* [Unpublished master's thesis]., Al Al-Bayt University.

AlAli, R., Wardat, Y., & Al-Qahtani, M. (2023). SWOM strategy and influence of its using on developing mathematical thinking skills and on metacognitive thinking among gifted tenth-grade students. *EURASIA Journal of Mathematics, Science and Technology Education, 19*(3), em2238. https://doi.org/10.29333/ejmste/12994

Al-Amour, Y., & Alimat, M. (2016). The effectiveness of the Google Classroom program on acquiring biological scientific concepts in the blood unit of tenth grade students in the Negev District in Palestine 48. *Journal of the Islamic University for Educational and Psychological Studies, 24*(4) 144-164. https://doi.org/10.12816/0035582

Al-Issawi, S., & Al-Moussawi, S. (2020). The effect of teaching according to the Edmodo educational platform on the achievement of fourth-grade middle school students in biology. *Journal of Arts, Literature, Humanities and Sociology, 55*, 215-232.

Aljaser, A. M. (2019). The effectiveness of e-learning environment in developing academic achievement and the attitude to learn English among primary students. *Turkish Online Journal of Distance Education, 20*(2), 176-194. https://doi.org/10.17718/tojde.557862

Al-Jeriwi, S. (2020). The effect of using artificial intelligence technology in the e-learning environment on developing future thinking skills and academic achievement in science for middle school students. *Tabuk University Journal of Humanities and Social Sciences, 9*, 261-289.

Al-Khalili, J. (2020). *The world according to physics*. Princeton University Press.

Alnaabi, F. M. (2021). *The effectiveness of using the Easy Class platform to raise the achievement level in* *mathematics for second-grade students in basic education in the Sultanate of Oman*. https://drmahmoudelfaramawy.blogspot.com/2021/01/Easy-Class.html

Al-Nasr, W. (2009). *The effect of a computerized educational material on acquiring scientific concepts and basic science processes for early childhood students in the United Arab Emirates* [Unpublished master's thesis]. University of Jordan.

Al-Nawaisah, S., & Abu Jaber, M. (2020). The effect of using augmented reality techniques in acquiring scientific concepts: An applied study on the chemistry curriculum for tenth grade students. *Andalusia Journal, 25*(2), 271-290.

Alneyadi, S., Abulibdeh, E., & Wardat, Y. (2023). The impact of digital environment vs. traditional method on literacy skills: Reading and writing of Emirati fourth graders. *Sustainability, 15*, 3418. https://doi.org/10.3390/su15043418

Aloufi, F., Ibrahim, A. L., Elsayed, A. M. A., Wardat, Y., & Ahmed, A. O. (2021). Virtual mathematics education during COVID-19: An exploratory study of teaching practices for teachers in simultaneous virtual classes. *International Journal of Learning, Teaching and Educational Research, 20*(12), 85-113. https://doi.org/10.26803/ijlter.20.12.6

Al-Rubaian, W. (2017). The effectiveness of the flipped classroom on the Easy Class platform for developing critical thinking skills in the science course among middle school students in Riyadh. *Specialized International Educational Journal, 6*(2), 188-201. https://doi.org/10.12816/0036077

Al-Salaq, H. (2018). *The effectiveness of a computerized educational program in science based on the McCarthy model in acquiring scientific concepts and developing reflective thinking skills among primary school students in Jordan* [Unpublished PhD thesis]. International Islamic Science University.

Alsalhi, N. R., Eltahir, M. E., & Al-Qatawneh, S. S. (2019). The effect of blended learning on the achievement of ninth grade students in science and their attitudes towards its use. *Heliyon, 5*(9), e02424. https://doi.org/10.1016/j.heliyon.2019.e02424

Al-Shamrani, A., & Al-Ariani, M. (2020). The effectiveness of using distance education platforms (Future Gate–United Education System) in developing cognitive achievement and reducing the level of test anxiety among middle school students in Jeddah. *The Arab Journal of Specific Education, 4*(15), 287-312.

Al-Zoro, F. (2020). *The effectiveness of the Edraak platform in developing the skills of solving engineering problems for mathematics among seventh grade students* [Unpublished master's thesis]. University of the Middle East.

Bani Younis, A., & Dawlat, A. (2017). The effect of employing a computerized educational software based on the directed induction strategy on the acquisition of scientific concepts for third grade students. *Journal of the Islamic University of Educational and Psychological Studies, 25*(4), 521-543. https://doi.org/10.12816/0043450

Beirne, E. (2020). *What a feeling! A multistage, multimethod investigation of emotions and their antecedents in an Irish Language MOOC* (Doctoral dissertation, Dublin City University).

Chen, S.-Y., & Liu, S.-Y. (2020). Using augmented reality to experiment with elements in a chemistry course. *Computers in Human Behavior, 111*, 106418. https://doi.org/10.1016/j.chb.2020.106418

Demir, K., Demir, K., & Akpinar, E. (2018). The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning. *Malaysian Online Journal of Educational Technology, 6*(2), 48-59. https://doi.org/10.17220/mojet.2018.02.004

Eliyawati, E., Agustin, R. R., Sya'bandari, Y., & Putri, R. A. H. (2020). Smartchem: An Android application for learning multiple representations of acid-base chemistry. *Journal of Science Learning, 3*(3), 196-204. https://doi.org/10.17509/jsl.v3i3.23280

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science, 1*(2), 175-191. https://doi.org/10.21890/ijres.23596

Gningue, S. M., Peach, R., Jarrah, A. M., & Wardat, Y. (2022). The relationship between teacher leadership and school climate: Findings from a teacher-leadership project. *Education Science, 12*, 749. https://doi.org/10.3390/educsci12110749

Harahsheh, K. (2019). The effect of the WebQuests strategy in teaching science in acquiring scientific concepts and developing creative thinking skills among primary school students in Jordan. *Educational Journal, 2*(130), 265-304.

Ibrahim, M. (2004). *Thinking from an educational perspective: Its definition, nature, skills, development, and patterns*. The World of the Book.

Majeed, S., & Ziyadat, M. (2008). *Quality and academic accreditation for public and university education institutions*. Safaa House for Publishing and Distribution.

Nora, A., & Snyder, B. P. (2008). Technology and higher education: The impact of e-learning approaches on student academic achievement, perceptions and persistence. *Journal of College Student Retention: Research, Theory & Practice, 10*(1), 3-19. https://doi.org/10.2190/CS.10.1.b

Odeh, A. (2010). *Measurement and evaluation in the teaching process*. Dar Al-Amal.

Omar, I. (2016). The difference of color hint with the background of the digital image within the e-book and its relationship to the cognitive style (impulsivity/deliberation) and the effect of both on the acquisition of scientific concepts for preparatory stage pupils. *Journal of the College of Education–Al-Azhar University, 170*(4), 77-125.

Ramadan, N. (2019). *The effectiveness of the flipped classroom strategy based on electronic educational platforms in developing some computer skills for preparatory stage Students* [Unpublished master's thesis]. Ain Shams University.

Saadeh, G., & Ibrahim, A. (1997). *School curriculum in the twenty-first century*. Al-Falah Bookshop.

Shana, E. (2017). *The effectiveness of using the computerized thinking maps strategy in acquiring scientific concepts and enjoying learning in science for fifth grade students* [Unpublished master's thesis]. University of Jordan.

Shaw, J., Chambless, M., Chessin, D., Price, V., & Beardain, G. (1997). Cooperative problem solving: Using K-W-D-L as an organizational technique. *Teaching Children Mathematics, 3*(9), 482-486. https://doi.org/10.5951/TCM.3.9.0482

Sherif, A. (2019). *The effect of educational platforms in modifying alternative biological concepts and developing creative thinking skills for ninth grade students in light of the level of self-efficacy* [Unpublished PhD thesis]. University of Jordan.

Tashtoush, M. A., Wardat, Y., Aloufi, F., & Taani, O. (2022a). The effect of a training program based on TIMSS to developing the levels of habits of mind and mathematical reasoning skills among pre-service mathematics teachers. *EURASIA Journal of Mathematics, Science and Technology Education, 18*(11), em2182. https://doi.org/10.29333/ejmste/12557

Tashtoush, M. A., Wardat, Y., Aloufi, F., & Taani, O. (2022b). The effectiveness of teaching method based on the components of concept-rich instruction approach in students achievement on linear algebra course and their attitudes towards mathematics. *Journal of Higher Education Theory and Practice, 22*(7). https://doi.org/10.33423/jhetp.v22i7.5269

Wardat, Y., Belbase, S., Tairab, H., Takriti, R. A., Efstratopoulou, M., & Dodeen, H. (2022). The influence of school factors on students' mathematics achievements in trends in international mathematics and science study (TIMSS) in Abu Dhabi Emirate Schools. *Education Science, 12*, 424. https://doi.org/10.3390/educsci12070424

Zuaiter, B. (2015). *The effectiveness of using software based on multiple intelligences in acquiring scientific concepts for fifth grade students* [Unpublished master's thesis]. University of Jordan.