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The Correlation between the Use of Augmented Reality in Islamic Education and Academic Achievement among Secondary School Students in Abu Dhabi

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Abstract. This study aims to investigate the existence of a relationship between the practice of augmented reality and academic achievement. The descriptive survey method was used on a sample of 310 students, 165 of whom were females and 145 of whom were males. A questionnaire was conducted to find out the extent of augmented reality practice in education using five dimensions, namely: the use of augmented reality by Islamic education teachers, readiness to use augmented reality, benefitting from augmented reality, use of augmented reality to aid learning, and the ability to deal with difficulties with using augmented reality. The arithmetic mean was used to calculate the level of the practice of augmented reality, and the results of the second semester of the academic year (2022/2023) were used to measure academic achievement. The Pearson correlation coefficient was used to calculate the correlation between augmented reality practice and academic achievement. A weak positive relationship was found between augmented reality and academic achievement, with a statistical significance at α<0.05. There are statistically significant differences between grades in favour of the eleventh grade and between genders in favour of female students in practising augmented reality at α<0.05.

Keywords: academic achievement; augmented reality; educational technologies; Islamic education; secondary education

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1. Introduction

Augmented reality, also known as AR, is a technology that is changing teaching and learning. Unlike virtual reality, which immerses users in a fully virtual environment, augmented reality overlays digital elements onto the physical world in real time, including text, images, videos, and 3D models (Azuma, 1997; Duh & Li, 2013), This enables students to interact with information and represent them dynamically, thus potentially providing students with a meaningful education (Catenazzi & Sommaruga, 2013).

Augmented reality and virtual reality are often falsely used interchangeably. Augmented reality is an extension of virtual reality. Al-Sharhan (2003) mentions that the augmented reality environment is very close to actual reality, as the virtual elements make up a small part of the augmented reality experience. On the other hand, Milgram and Kishino (1994) note that virtual reality is an environment in which the user or viewer is completely immersed in a completely artificial world, and this world may or may not resemble the environment of the real world. For instance, some VR environments may not be limited by the laws of gravity, time, or properties of matter. In the same study, Milgram does not consider a dichotomy between augmented reality and virtual reality. He views it as a continuum between which forms of mixed reality fall. He called this continuum the continuum of reality and virtuality, represented by the diagram in Figure 1.

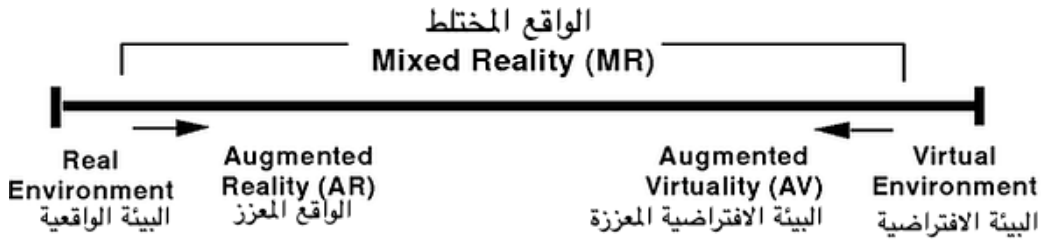

Figure 1: Milgram and Kishino's reality-virtuality continuum

Many educators and teachers have resorted to using augmented reality technology in education to solve the problem of the weakness of traditional education, especially the problems related to its monotony and its focus on memorisation rather than helping them learn and comprehend the material (Al-Khalifa, 2010). Using AR in class could increase discussion about the topic being taught in class and help develop students' sensory perceptions, as students see explanations and images, especially three-dimensional images, and control these effects (Fauzi, 2019). This could potentially attract students' attention to what is being taught (Qeshta, 2018).

The educational value of augmented reality programmes is closely related to how they are designed, implemented, and integrated into formal education environments (Ibanez et. Al., 2020; Yuen, 2011). A way in which augmented reality improves education is by providing new ways of navigating the environment that cannot be obtained in a completely realistic or virtual

environment, as it can create hybrid educational environments that increase integration and bring together real and virtual objects (Akcayır & Akcayır, 2017). To make the most of augmented reality, it is best to think of it as a concept rather than a specific type of technology. Involving teachers in the process of developing educational applications that employ this concept will benefit these programmes (Chen et al., 2013; Radu, 2012).

Wise (1973), Issawi (1974) and Abu Zeina (1998) define academic achievement as the knowledge and skills that students acquire from specific educational experiences, which are measured by teachers or prescribed tests. Issawi (1974) gives the following definition of academic achievement: It is the amount of knowledge and skills that an individual carries, resulting from previous experiences and training. Also, the word "achievement" is often used to refer to academic achievement or learning, as scholars prefer to use this word in the context of education; in the professional context, it is preferable to use the word "sufficiency." Hawes and Hawes (1982) note that academic achievement is successful performance in distinct fields and subjects; this is the result of continuous effort and skill that are accompanied by interest, and this achievement is summarised in the form of marks, grades, or descriptive notes.

Shehata and Al-Najjar (2003) mention more than one definition of academic achievement. Among these definitions is that academic achievement is the amount of information, knowledge and skills that a student obtains. These are expressed in grades after a test is prepared that measures these specific levels, and is characterised by its validity, stability and objectivity. Procedurally, it is defined as the amount of information acquired by the student because of studying the topics of specific study units and is measured through an achievement test prepared by the educator.

Several factors affect academic achievement in students. Stronge (2010) mentions the school environment, the curriculum, and the efficiency of the school's teaching and administrative staff as leading factors. Davis (1984) emphasises the effect of family situations, stating that the lower the socioeconomic status of the students, the lower their scores are before first grade. Academic achievement is closely related to how well students integrate into life after graduation. Students who perform better academically tend to have higher incomes and better health overall than their peers (Walberg, 2010).

There have been many studies that investigated the use of augmented reality in education, indicated its positive impact on academic achievement, information acquisition, and motivation, and recommended its use in the educational process. For example, the study of Wahba (2019) addresses the impact of using augmented reality in teaching computer science on the academic achievement of students who suffer from some learning difficulties. The study of Al-Balushi et al. (2022) dealt with the same topic in the science subject for fourth-grade students. In the field of Islamic education, the study conducted by Al-Saqriya and Al-Salmi (2020) investigated the effect of using augmented reality on the acquisition of jurisprudential concepts for tenth-grade female students. Al-Mashharawi (2022)

also studied the impact of using augmented reality on both academic achievement and motivation in technology education in the Gaza Strip.

1.1 Problem Statement

The use of traditional methods in class lessons and reliance on recitation and repetition by the teacher render the educational content of those lessons far removed from real life and its problems (Loughlin, 2025). This method makes students dependent solely on memorisation and reduces the importance of comprehension, research skills, and critical thinking (Al-Suwaidi, 2024). One of the defects of education through traditional means and methods lies in the inability of students to employ all their senses and comprehend what is explained during the lessons, especially if it relies on visual concepts and motor instructions, as visualisation skills are not addressed and dealt with by teachers and students during lessons (Al-Mashharawi, 2020).

Academic achievement in classes that rely on these methods is generally low, as all these factors lead to poor concentration, stress and psychological pressure. Thus, students' performance weakens during the year, shown through tests, whether in questions that require memorisation, direct answers, and retrieval of information or in tasks that require employing higher-order thinking skills (Qeshta, 2018). The weak achievement in Islamic education, in particular, is due to the tools and methods used in instruction, despite the huge number of rapid developments that have occurred in the educational process (Alkhaleej, 2014).

Many studies have shown that AR technologies have great educational benefits, such as encouraging creativity, alleviating anxiety, increasing participation, and many others (Wedyan et al., 2022). Despite these benefits, this technology has not gained the spread it deserves (De Lima et al., 2022), especially among Islamic education teachers. This is noticed in the decrease in students' academic achievements in learning and applied performance due to Islamic education teachers' use of traditional methods and means of teaching. Therefore, the recommendations of the study by Mustafa (2023) and Al-Saqriya and Al-Salmi (2020) encouraged the practice of applying augmented reality, linking the curriculum and the real environment, as it is not sufficiently applied among Islamic education teachers.

1.2 Research Questions

RQ1: Are there statistically significant differences in the level of practice of augmented reality among Islamic education teachers from secondary school students' perceptions in schools in the Emirate of Abu Dhabi due to the variables of gender and grade?

RQ2: Is there a statistically significant correlation at the significance level ($\alpha \geq 0.05$) between the practice of augmented reality among Islamic education teachers and the level of academic achievement of secondary school students in schools in the Emirate of Abu Dhabi?

2. Literature Review

Omurtak and Zeybek (2022) also conducted a study entitled "The impact of augmented reality applications in biology lessons on academic achievement and motivation." The study included a sample of 38 students in the ninth grade in Turkey who were divided into two groups: experimental and control. The experimental approach was followed, and a pre- and post-test was conducted with the students. A descriptive survey method was used, where a questionnaire was administered to the students to measure their motivation. The study found that there were statistically significant differences between the two groups in academic achievement in favour of the experimental group. Regarding motivation, there was no statistically significant relationship in general, but this relationship was found in the "exam anxiety" dimension, and it was a negative relationship.

Abu Thantin (2022) also conducted a study entitled "The impact of teaching science with augmented reality technology in developing motivation for learning and academic achievement among second-grade students in a middle school in Afif Governorate," where the first semester grades of the 118 students were looked at, after which they were divided into two groups: a control group and an experimental group.

A scale of motivation to learn questionnaire was administered to the experimental group in addition to an experimental test conducted with both groups. Significant differences were found in the pre- and post-measurement of motivation between the two groups in favour of the experimental group. Also, significant differences were found in post-achievement tests for both groups in favour of the experimental group.

Al-Najdi (2022) conducted a study aimed at investigating the effectiveness of using augmented reality in enhancing student performance through the use of quick response (QR) codes in textbooks in the Saudi education system. The experimental approach was followed, where a pre- and post-test was conducted with students who were divided into two groups, experimental and control.

The experimental group conducted a self-evaluation through the Saudi National Education Portal, and the researcher found that there were statistically significant differences between the control group and the experimental group in academic achievement in favour of the experimental group. Also, 91% of the students in the experimental group were able to evaluate themselves. After the experiment, students indicated that they began using this technology in other subjects and used augmented reality in general in preparing for lessons.

Mustafa (2022) conducted a study entitled "The effect of using two types of augmented reality (static and mobile) on the academic achievement of basic stage students in Islamic education." The researcher used the quasi-experimental approach by dividing 50 female students into two experimental groups. One of them used the fixed pattern and the other used the moving pattern. Also, the researcher prepared pre- and post-tests to measure academic achievement. The

results showed that there were differences between the achievement of female students in the two groups in favour of the group that used the moving style.

3. Methodology

We adopted a quantitative correlational research method for this study, specifically the survey method with a questionnaire as the research instrument. This study investigated the correlation between the use of augmented reality in Islamic education and academic achievement. Therefore, our choice of research instrument was justified as the questionnaire allowed data to be collected to describe the research population (Fauzi et al., 2019).

The sample for this study consisted of 310 Abu Dhabi secondary school students, including both male and female students, ranging from grades 10 through 12. Participants were selected using a sample of convenience as it was cost-effective and easy to implement (Jager et al., 2017). We used the grades of the 2nd semester in 2022/2023 to measure academic achievement. We used Google Forms to draft and administer the questionnaire for data collection to save costs, time, and energy. Google Forms is a widely used tool for collecting instant data (Creswell, 2012).

The questionnaire contained six parts (See Appendix 1). The first part included demographic questions about the gender of the participant (male/female), grade level (10–12), and Islamic education scores out of 100 in the 2nd semester. For parts 2 through 5, the items were adapted from the questionnaires of previous studies, mainly Alshehri (2019) and Abdallah (2022). Cronbach's alpha was used to test the reliability of the items in the questionnaire. The alpha values obtained exceeded 0.85, indicating high reliability and thus sustainability for usage.

We collected data on the use of augmented reality by Islamic education teachers (9 items), willingness to use augmented reality in learning (6 items), benefitting from using augmented reality in learning (10 items), use of augmented reality to aid learning (9 items), and ability to deal with challenges related to using augmented reality in learning (9 items).

We selected questions from the studies of Alshehri (2019) and Abdallah (2022) and added other questions ourselves that aligned with the aim of this study and would elicit the necessary data to answer the research question. For part 1, the questionnaire used a scale of 0 to 100 to measure the score. For parts 2–5, the questionnaire used a Likert scale to analyse the collected data. The 5 options for the Likert scale were 1 – strongly disagree, 2 − disagree, 3 – neutral, 4 – agree, and 5 – strongly agree. Table 1 shows the distribution of the questions.

Table 1: Distribution of questions in the questionnaire

Section	Number of Questions
Use of augmented reality by Islamic education teachers	9
Readiness to use augmented reality in learning	6
Benefitting from using augmented reality in learning	10
Use of augmented reality to aid learning	9
Ability to deal with challenges related to using augmented reality in learning	9

The data obtained were analysed through descriptive statistics using a summary of the overall data, which can provide information directly and efficiently (Pallant, 2020). We also used the Pearson correlation coefficient to determine the presence of a correlation between the two variables. Table 2 shows how the mean score was interpreted for data analysis (Ahmad, 1993).

Table 2: Interpretation of Mean

Mean Score	Interpretation	Level
1.00-2.33	Low/Negative	Weak
2.34-3.66	Average/Neutral	Medium
3.67-5.00	High/Positive	Good

Furthermore, to determine the differences in the students' use of augmented reality in Islamic education based on their grade level, data were analysed using one-way analysis of variance (ANOVA). To determine the differences based on gender, data were analysed using the student t-test.

4. Findings

The first part of the questionnaire was used to collect the demographic descriptions and the scores for each of the sample's 310 respondents. The results were organised using frequencies and percentages (Table 3).

Table 3: Demographics of respondents

Variable	Categories	Frequency	Percentage (%)
Gender	Male	145	46.77
	Female	165	53.23
	Total	310	100
Grade level	10	104	33.55
	11	106	34.19
	12	100	32.26
	Total	310	100
Score	60-70	38	12.26
	71-80	76	21.61
	81-90	108	34.84
	91-100	97	31.29
	Total	310	100

Table 3 shows that the percentage of male and female participants was close, with female respondents (53.23%) accounting for a slightly larger percentage than their male counterparts (46.77%). Concerning grade levels, 106 respondents (34.19%) were in grade 11, followed by 104 respondents (34.19%) in grade 10, and 100 in grade 12 (%). Moreover, the scores of the participants were as follows: 34.84% of the participants obtained scores ranging between 81 and 90, closely followed by 97 participants (31.29%) with scores above 91. Participants with scores between 71 and 80 constituted 21.61% of the sample, and the category of scores between 60 and 70 accounted for the smallest number of participants (12.26%).

Table 4 shows the results of the t-test used to determine whether there were differences in the use of augmented reality in Islamic education depending on gender. There were statistically significant differences at 0.05 as the calculated t-value reached -2.32. The differences were in favour of the female respondents in the study sample, whose average was 3.615 compared to 3.328 for their male counterparts.

Table 4: t-test results

Variable	Gender	Number	Average	Standard deviation	Degrees of freedom	t-test value	Significance level
The overall use of augmented reality in Islamic education	Male	145	3.328	0.40	308	-2.32*	0.02
	Female	165	3.615	0.40			

A one-way ANOVA was used to determine whether there was a statistically significant difference regarding respondents' use of augmented reality in Islamic education based on their grade level (Table 5).

Table 5: ANOVA results

Variables	Grade	Number	Mean	Standard deviation	Value F	Statistical significance
The general level of the practice of augmented reality	10	104	3.301	0.47	*3.23	0.04
	11	106	3.466	0.42		
	12	100	3.602	0.29		

The results in Table 5 display the presence of statistically significant differences between the overall score for practising augmented reality technology in learning the Islamic education subject among secondary school students in schools in the Emirate of Abu Dhabi, depending on the academic grade variable, where the calculated (f) value reached 3.23. It is a statistically significant value at the significance level of 0.05. This result is in favour of grade 12 students, whose

average was 3.602, compared to grades 10 and 11, whose averages were 3.301 and 3.466, respectively.

The Pearson correlation coefficient was used to test the correlation between the use of augmented reality with each section of the questionnaire and academic achievement (Table 6). All the values calculated were statistically significant at a standard error of 0.05.

Table 6: Pearson results

Sections	**Achievement level**
	Correlation coefficient
Use of augmented reality by Islamic education teachers	0.31*
Readiness to use augmented reality in learning	0.39*
Benefitting from using augmented reality in learning	0.35*
Use of augmented reality to aid learning	0.22*
Ability to deal with challenges related to using augmented reality while learning	0.21*
Overall use of augmented reality in Islamic education	0.21*

The results from Table 6 indicate that there was a weak positive correlation between the overall level of practising augmented reality technology in learning Islamic educational subjects and academic achievement. Furthermore, a weak positive correlation was found between Islamic education teachers' use of augmented reality technology and the students' level of achievement.

In addition, there was a positive, yet weak correlation between readiness to use augmented reality technology in learning and academic achievement. There was a positive correlation between benefitting from augmented reality technology in learning and academic achievement. Moreover, there was a weak positive correlation between the focus on employing augmented reality technology in learning and academic achievement. Finally, a weak positive correlation was found between the ability to deal with the difficulties of using augmented reality technology in learning and academic achievement.

5. Discussion

There were statistically significant differences in the use of augmented reality based on the grade level, as the results were calculated to be in favour of the grade 11 participants. We speculate that this is due to grade 10 being a transitional stage from junior to senior secondary education. Therefore, trying such technology may distract them from learning instead of helping them focus. As for the grade 12 students, since they were in the last years of their studies and, as such, had many tests and exams to take, they might not have had time to try new technologies; they would much rather stick to methods which have already worked for them. These findings are consistent with the findings of Al-Aboudi et al. (2021), as age

influenced the use of augmented reality. In that study, younger participants were unfamiliar with augmented reality and less able to use it.

There were also statistically significant differences in the use of augmented reality based on gender. The results were in favour of female respondents. We attribute this to the fact that schools in the Emirate of Abu Dhabi and the UAE in general are interested in raising the quality of girls' education and their level of learning, as the percentage of girls in UAE secondary schools reached about 77% (Dubai Women's Establishment, 2025). The study of Al-Aboudi et al. (2023) did not find any statistically significant differences attributable to the gender variable.

A positive correlation was found between the overall use of augmented reality in Islamic education and academic achievement, with statistical significance at 0.05. This finding is consistent with that of studies carried out by Omurtak and Zeybek (2022), Yildrim and Kapucu (2021), Alnajdi (2022), Astuti et al. (2019), and Demircioglu et al. (2022). All these studies show that students who use augmented reality in learning outperform their peers who do not.

Tosti et al. (2014) explain that augmented reality provides an interactive environment in which students can practice skills whenever and however they desire, which could explain the positive findings in the studies. While positive, the correlation we found was weak, with a correlation coefficient of 0.21. It is speculated that this is because Islamic education does not have as many tangible or hands-on experiences or learning activities as other subjects, such as sciences (Al-Saqriya & Al-Salmi, 2020). Further research could be done on the degree of AR adoption in Abu Dhabi to give context for this study.

Out of the questionnaire sections, readiness to use augmented reality in learning had the biggest correlation coefficient with academic achievement at 0.39. This positive correlation was statistically significant at 0.05. We believe that this is because students who are willing to try new strategies or tools to assist their learning end up achieving better grades. This is consistent with the findings of Fauzi et al. (2019), as the researchers found that students' readiness to use augmented reality in learning led to a 68% increase in their academic achievement. However, this correlation was still weak, and we predict that this is because of the lack of opportunities.

The questionnaire section with the lowest correlation coefficient was the ability to deal with challenges related to using augmented reality in learning, which displayed a weak positive correlation value of 0.21. The findings of Oriarte and Portello (2023) show that students who can use AR independently perform better than those who only use it in class with external assistance. The correlation, in our case, was positive yet weak. As such, we believe this is because Islamic education does not test students for their technological abilities.

6. Conclusion

The use of augmented reality in Islamic education has shown a weak positive correlation with academic achievement that is statistically significant at 0.05. This

is perhaps due to the nature of Islamic education as a subject, as it does not have as many tangible experiences as sciences and similar subjects. Other factors may affect the result, such as the strategies used when using augmented reality and whether they are effective or not. We also believe that the way augmented reality applications and tools are used seems to focus more on entertainment than supporting learning objectives.

More studies that use different research methods need to be conducted to measure the relationship between augmented reality and academic achievement in students. Experimental studies, such as those of Al-Saqriya and Al-Salmi (2020) and Mustafa (2023), show that students who support their learning with augmented reality performed better in tests than their peers who did not use augmented reality. In addition, these studies show that the grades of those students significantly improved when using augmented reality as compared to those who did not use it.

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Appendix 1

Questionnaire Instructions:
Dear student

We provide you with this questionnaire that measures the relationship between the use of augmented reality in Islamic education and academic achievement among secondary school students in Abu Dhabi. Please answer as carefully and meticulously as possible. **Please read the following instructions:**

- This instrument contains 43 items.
- Please do not leave an item unanswered.

Section 1: Demographic information of the sample
Gender**:**
- Male
- Female

Grade level**:**
- 10
- 11
- 12

Score in Islamic education exam last semester _____.

No.	Item	Frequency				
		1	2	3	4	5
Section 2: The use of augmented reality by Islamic education teachers						
1	My teacher shows me the newest educational technologies					
2	My teacher introduced me to augmented reality					
3	My teacher tells me about the educational uses of augmented reality					
4	My islamic teacher has previous knowledge about augmented reality					
5	My islamic teacher is experienced with computer technologies					
6	My teacher informs me about augmented reality as an educational technology					
7	My teacher enables me to use augmented reality in class or outside class					
8	My teacher uses augmented reality to facilitate lessons					
9	My teacher tells me that augmented reality is a safe way to reenact processes					
Section 3: Readiness to use augmented reality						
1	I find it hard to use augmented reality applications due to language barriers					
2	I do not have enough skills to use augmented reality					
3	I find it hard to use augmented reality applications					

4	I am not convinced augmented reality is effective in education					
5	There are no technical staff available to help when needed					
6	I find it hard to keep up with new augmented reality applications and technologies					
7	The amount of material prevents teachers from using augmented reality					
8	I do not find augmented reality efficient					
9	I do not find augmented reality effective					
Section 4: Benefitting from augmented reality						
1	Augmented reality gives me good information about the educational experience					
2	Augmented reality provides accurate and clear information					
3	Augmented reality is effective in providing digital stimulus to the real environment					
4	Augmented reality simplifies and clarifies the lesson					
5	Information and data reach me effectively using augmented reality					
6	Augmented reality facilitates student-teacher interactions					
7	Augmented reality combines teacher's instruction with digital information					
8	Augmented reality is dynamic					
9	Augmented reality is fun to use in education					
10	Augmented reality provides a safe environment to practice my skills					
Section 5: Use of augmented reality to aid education						
1	I have the desire to use augmented reality					
2	I use augmented reality when instructed by the teacher					
3	I use search engines to find information about augmented reality					
4	I use technology well					
5	I am good at using smart devices					
6	I can troubleshoot smart devices					
Section 6: The ability to deal with difficulties of using augmented reality in education						
1	Augmented reality attracts and maintains my attention					
2	Augmented reality is ineffective in teaching					
3	Using augmented reality in education is a waste of time					
4	I feel tired when using augmented reality					
5	I feel anxious when using augmented reality					
6	I prefer augmented reality to other methods					

7	I enjoy using augmented reality in education					
8	I find it hard to learn using augmented reality					
9	I am averse towards educational technologies					