

# The Effectiveness of Using Augmented Reality in Teaching Geography Curriculum on the Achievement and Attitudes of Omani 10th Grade Students

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## Abstract

This study aimed to investigate the effectiveness of using a mobile Augmented Reality (AR) application in the geography unit for tenth grade students on their achievements and attitude. The unit is part of the Omani's social studies curriculum and entitled, "Environmental Problems and Hazards". To meet this purpose, a quasi-experimental study design was conducted. The instruments designed, validated and used to collect data were pre-post achievement tests and attitudinal scale. The participants were 64 male students, divided into two experimental and control groups. The field application period took four weeks in which the control group studied the unit using the normal teaching method, while the mobile AR application and the HP Reveal groups were supported with a website that supports their features. Findings show that there was a statistically significant difference between the pre and post-field applications in terms of students' achievement and attitudes. Nevertheless, there was no impact observed when the control and experimental groups' achievement were compared. The researcher suggested conducting further investigations to examine the value of integrating AR in the educational system considering various factors and variables.

**Keywords:** Augmented Reality; Students' Achievement; Attitude, Social Studies Curriculum; Geography; HP Reveal.

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## 1. Introduction

The role of technology is important in our lives, particularly in the field of education. The integration of Information and Communication Technologies (ICT) in teaching and learning shows positive effects and has become a new trend in the field of education (Georgieva, 2006). In addition, earlier research studies showed that supporting education with technologies to deliver instructions helps teachers to carry out innovative teaching approaches (Alkhattabi, 2017) and helps learners to improve their curiosity and understanding. In addition, it help them to “increase their learning capacities and personal development” (Gómez-Ejerique & López-Cantos, 2019, p.1).

Using technology is not exclusive to a specific area, as students can use different ICT tools, applications, and services at any time and place. Therefore, integrating ICT in the educational process increases students’ motivation toward learning and makes them responsible for their learning (Safar, Al-Jafar, & Al-Yousefi, 2017). Since individual students vary on their characteristics and interests, using ICT in teaching and learning has to be managed according to their needs and levels. Moreover, researches showed that, students at the elementary level prefer to use concrete rather than abstract thinking; therefore, utilizing technology tools that help to provide content with real experience can influence their critical thinking skills and pace of learning (Al-Asheeri, 2017). New technology such as virtual and/or augmented reality can simulate real-life situations and enrich the educational environment with interactive content. Romero Forteza & Carrió Pastor (2014) find that virtual learning environments must be adaptable for implementation with various teaching approaches.

Augmented Reality (AR) technologies are specifically characterized by their ability to depict reality by transferring abstract elements to dynamic ones. Primarily, this technology brings direct and in-direct real-world environments through digital devices, with which students can interact and manipulate the presented content (Chang, Wu, & Hsu, 2013). Many students in schools have difficulties in understanding or imagining the studied concepts, phenomena, and/or processes spatially. The traditional way to solve this problem is by providing two-dimensional (2D) images or video clips that can show how the processes or phenomena occur (Shelton & Hedley, 2002), but AR technology can now easily show the depth of these phenomena (Chang, Wu, & Hsu, 2013).



## 2. Significance of the study

The importance of this study lies on measuring the effectiveness of a technological trend in educational technology, which is AR technology. Based on the best of our knowledge, this study is considered first work in the field of using AR in geography teaching in Oman according to researcher findings. The results of this study may help the curriculum designers/planners to apply new strategies through the use of such emerging technologies. Furthermore, it may increase the Omani teachers' awareness of integrating new technologies such as AR in their teaching methods. It is also envisaged that the study may open doors to integrate new learning styles to enrich geography lessons with technology-enriched environments. Through this field experience, the researchers believe that the findings could offer solutions to the difficulties faced by geography (and social studies) teachers in terms of site visits, natural phenomena observations or lack of finance.

## 3. Statement of the problem

Currently, removing boundaries of time and location is an important factor that supports lifelong learning. With the advancement of new mobile technologies, teachers had become able to integrate AR as an innovative teaching method (Al-Azawi and Shakkah, 2018). In addition, using AR to augment abstract topics on the printed books, by using multimedia and three-dimensional objects can enhance students' learning experience. As a result, students can move through the curriculum topics with a deep understanding of what they are learning. With the advent of modern technologies, geography teachers are now able to bring the real world to their students and eliminate the traditional barriers of learning. Introducing interactive technologies, such as AR, can make the learning process more exciting and elongate the information retention (Alhumaidan, Lo, & Selby, 2018).

Oman is one of the rare countries that have rich geographical diversity (Al Maashri, Al-Asadi, Tageldin, Al-Lawati, & Al Shidhani, 2015). Therefore, the Ministry of Education in Oman has integrated a geography curriculum that explains Oman's diversity from different perspectives. Furthermore, findings by (Al-Maamari, Al-Nofli, & Al-Gharibi, 2014) showed that both teachers and students were interested in the variation of the topics presented in the geography units. In addition, the topics that attract students' interest most were weather/climate, natural disasters (earthquakes, volcanoes, and cyclones) and environmental issues such as deforestation, soil erosion, and the greenhouse effect. However, teachers face problems to accurately represent spatial phenomena or

topics (such as desertification) by using the traditional methods of 2D multimedia (Shelton & Hedley, 2002). Omani geography teachers are no exception. Sometimes they want their students to discover a specific location, but it is remote from their school's position and unreachable in a short time. Recent research calls for the implementation of new technologies, particularly AR, in the Omani educational system to overcome these and other logistical obstacles that may impede learners from experiencing the depth of the natural phenomena (Basha, Abbas, Yusufi, & Rajbunisa, 2019; Al Musawi, Ambusaidi, Al-Balushi, Al-Sinani, & Al-Balushi, 2017; Almusawi, Resheidi, Jadeedi, Alsaadi, & Riyami, 2016; Al Maashri, et al, 2015). From this perspective, this research aims to study the effectiveness of using augmented reality in teaching the geography unit of social studies curriculum on the achievements and attitudes of 10th-grade students.

## 4. Methodology

### 4.1. Research Design

This research emphasizes the use of quasi-experimental design and focuses on a specific variable namely, the attitudes. Therefore, to achieve the objectives of the study and to get reliable data on the impact of AR on students' learning, this study used a quasi-experimental research design to measure two main variables, which are achievement and attitudes. The study sought to answer two questions, the first question was answered using an achievement test and the data collected using this instrument helped to identify the systematic change in students' learning and understanding. The second question utilized the attitudinal scale to analyze students' tendency to adopt this technology in their future learning and life. All the data by these two instruments were collected and analyzed quantitatively.

### 4.2. Population and Sample

The target population is 10th-grade students in Al Shiekh Nasser bin Rashid School in Al-Mawaleh region in the Muscat governate in Oman. The targeted sample of this research is 64 students. According to meta-analysis investigation, most of the previous studies in the field of AR conducted the investigation among samples not exceeding 100 (Akçayır & Akçayır, 2017; Garzón & Acevedo, 2019).



There were seven sections of 10 grade in the school, and two sections were selected based on the research need. Random selection of the sample and mixing students was not allowed due to school and the Ministry of Education (MOE) policies. The first section was contained 31 students and they will be under the control group and the other section includes 33 students and they will be under an experimental group; Table 1 illustrates sample distribution.

**Table 1** Sample distribution among the groups

Group	Students Number	Treatment	Measurement Tool
Experimental	33	Learning with AR	Achievement test and Attitudinal scale
Control	31	Traditional class	Achievement test

### 4.3. Procedures

With a limited time of implementation, the study was established in one of the government schools in Muscat. Implementing AR in students' teaching and learning was unique, which caused full acceptance from the school administration and the cooperative teachers. The experiment did not require a change in the classroom setting, but it was based on using mobile devices. The following points summarize the procedures followed by the researcher until finishing the research. The aim of this step is to show for beginner researchers a minimum required step for making research within the school context.

- Reading the Horizon Reports of schools and Higher education to get more insight into the new promises technologies in the field of education.
- After deciding which technology to use, reviewing previous works conducted in that field was necessary to start from the researchers to stop and learn from their recommendations.
- Selecting the study population and sample; school, students, and content.
- Since the study was conducted in a government school, the formal procedure was required, which included a no objection letter released from SQU to MOE and the selected school.

- Looking for logistic support, in terms of providing smart devices to conduct the experiment. Different request letters were sent to SQU and MOE for that purpose.
- Selecting the appropriated AR application based on what resources were available, the used model was SECTIONS model.
- Developing evaluation tools (Achievement test and attitudinal scale) and revising them from different experts from SQU and MOE.
- Preparing the learning materials that include different types of multimedia using the Internet and producing them.
- Preparing the AR application from creating accounts, integrating multimedia, and creating Auras.
- Selecting students randomly, and conducting a pre-test for both groups and a pre attitudinal scale for the experimental group.
- Training teachers on using the new instructional materials, and deciding the suitable learning strategies that fit with the experiment and the MOE learning goals.
- Start the experiment over four weeks in the second semester of the academic year 2018/2019.
- Assessing students after they finished the experiment through the post-test for two groups and the attitudinal scale for the experimental group.
- Analyze the collected data by adding the data in SPSS and according to the results, a summary of the result with the experts from SQU and MOE.

## 5. Findings

The findings showed that there was an increase in students' learning (achievement) before and after the process of treatment was established. Furthermore, students' motivation and interaction increase as observed by the instructor. However, there were no significant differences between the control and the experimental group after using AR in terms of their learning, despite the attitude of the experimental group increasing.

## 6. Recommendations

According to the experiment and its findings in term of using AR in teaching geography unit, there are several recommendations provided by the researcher for the purpose of increasing reader insight about the findings and providing suggestions for future research in that field of using AR in education in general, and in the Omani context in specific.

- Since the findings in terms of testing students' achievement after using AR did not match with what came in most of the previous literature, further research is required to be conducted in this area controlling some factors such as:
  - A. Ensuring that each student has his own mobile device in the process of implementation.
  - B. Assigning different teachers for teaching both the control and experimental group.
  - C. Applying the experiment in parallel with both groups.
  - D. The prepared achievement test marks should be written in students' records to ensure students' realism in selecting answers and their credibility.
  - E. Developing a method that ensures students' access to the materials used in their homes to enable them to review what they learned in class.
  - F. Ensure that there is enough time to teach all the content, or the AR may become a distracting tool.
  - G. Focusing on innovative learning strategies and new classroom settings in which students are able to interact easily.
- There is a need to investigate the effect of using AR in teaching geography content, but with using different assessment tools to traditional achievement tests to show the effect. This suggestion rises because students who used AR focused on interaction with content and understanding it through different aspects in which the normal test might not be measuring the effect of.
- This research investigated the effect of mobile-based AR on teaching geography. Oman is one of the countries that is geographically diverse. Another type of AR, which is location-based, could be implemented in students' teaching in the form of field trips to specific sites. Therefore, there is a need to investigate the effect of location-based AR in teaching geography on different

factors such as students' achievement, motivation, attitude, and interaction and comparing the findings with mobile based methods.

- Since this research investigated 64 male students from one school in four weeks, there is a need for a wider investigation that includes both genders from different governances to generalize the findings for the decision makers to take the necessary measures.

## 6. Conclusion

Most of the technologies used are accessible, but they are not self-explanatory. Teachers should find creative strategies to combine the implemented technology and their instructional strategies in a way that learning occurs in an easy and fast manner. In addition, virtual technology depends on designing the interactive content, therefore giving much attention to the instructional design process, as well as the application's user interface design playing a key role in making changes. Moreover, technical problems that appear during the use of AR applications should be anticipated to let students concentrate on their learning without any distractions.

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