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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

A QUALITATIVE CASE STUDY IN AUGMENTED REALITY  
APPLICATIONS IN EDUCATION: DIMENSIONS  
OF STRATEGIC IMPLEMENTATION

A Dissertation Submitted in Partial Fulfillment  
of the Requirements for the Degree of  
Doctor of Philosophy

Abrar S. Almoosa

College of Education and Behavior Sciences  
Department of Educational Technology

May 2018

This Dissertation by: Abrar S. Almoosa

Entitled: *A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation*

has been approved as meeting the requirement for the Degree of Doctor of Philosophy in College of Education and Behavioral Sciences in School of Educational Technology

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## ABSTRACT

Almoosa, Abrar S. *A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation*. Published Doctoral of Philosophy dissertation, University of Northern Colorado, 2018.

The main purpose behind technology integration is to improve the teaching and learning process. Augmented reality (AR) is a new instructional tool in the educational field. Current literature showed AR integration is successful in the United States. However, it does not exist for Kuwait. Despite the time and money invested to integrate different instructional tools, teachers in Kuwait have been unaware of the existence of the AR application and its potential use in the classroom. There is a need to help teacher educators in Kuwait use AR applications and maximize the benefits of this technology for students' best interests.

This study explored the use of AR among teacher educators in the United States who currently used this technology in their classrooms. It also explored the opinions of Kuwait veteran teachers regarding AR technology integration, designed a process for strategic implementation aimed at teachers in Kuwait, and acted as a guide to follow for AR integration in education in Kuwait. The target population consisted of teacher educators from United States who have integrated AR applications in their teaching and veteran public elementary school teachers from Kuwait. This study employed a qualitative case study design. A number of interviews and focus group discussions were conducted to collect data. Major themes were developed for both samples. U.S.

participants shared their educational experiences with AR integration. Although teacher-participants from Kuwait were initially overwhelmed with AR, this study found they would be willing to implement AR if supported by the government. The findings of the study provided a clear view of how to integrate AR technology as an educational tool to vary and improve instructional tools in Kuwait classrooms to meet young learners' needs and interests. The recommendations for strategic implementation were specifically tailored for public schools in Kuwait. A suggestion for further research was to have a second phase of the study that would examine teacher-participants' experiences with AR integration. Finally, implications of this research study supported every educator who had never considered nor integrated AR as an instructional tool, specifically teachers in Kuwait.

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## TABLE OF CONTENTS

CHAPTER I. INTRODUCTION.....	1
The Study.....	5
Teaching with Digital Media in the United States.....	5
Teaching with Digital Media in Kuwait.....	6
Problem.....	6
Purpose of This Study.....	7
Research Questions.....	9
Definition of Terms.....	9
Summary.....	11
CHAPTER II. REVIEW OF LITERATURE.....	13
A Description of Augmented Reality.....	13
History of Augmented Reality.....	19
Augmented Reality Use, Application Use, and Application of Augmented Reality in General.....	24
The Role of the Educator.....	28
The Role of the Student.....	28
Perception of Augmented Reality.....	31
Advantages of Augmented Reality.....	31
Barriers Facing Implementation of Augmented Reality.....	33
Integration and Transference of Augmented Reality into Educational Systems.....	34
Summary.....	36
CHAPTER III. METHODOLOGY.....	38
Theoretical Framework: Social Constructionism Epistemology.....	38
Researcher Stance/My Story.....	40
Ethical Considerations.....	41
Methodological Framework.....	42
Methodology.....	44
Trustworthiness.....	51
Data Analysis.....	53
Summary.....	55

CHAPTER IV. FINDINGS .....	57
Interviews.....	58
Identified Themes .....	59
Summary.....	74
CHAPTER V. CONCLUSION.....	76
Introduction.....	76
Findings Related to the Research Questions.....	77
Discussion.....	83
Implications of the Study.....	87
Limitations .....	91
Recommendations for Future Research .....	93
Conclusion .....	94
REFERENCES .....	99
APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVAL.....	108
APPENDIX B. EMAIL INVITATION TO PARTICIPATE IN THE STUDY.....	110
APPENDIX C. PARTICIPANT VOLUNTEER FORM.....	112
APPENDIX D. CONSENT FORM: INTERVIEW.....	114
APPENDIX E. CONSENT FORM: FOCUS GROUP.....	117
APPENDIX F. INTERVIEW QUESTIONS .....	120
APPENDIX G. FOCUS GROUP QUESTIONS .....	123
APPENDIX H. REMINDER TO ATTEND INTERVIEW .....	126
APPENDIX I. REMINDER TO ATTEND FOCUS GROUP SESSIONS .....	128

## LIST OF TABLES

1.	Six Phases of Thematic Analysis .....	54
2.	Visual Model for Data Collection and Analysis .....	55
3.	Overview of Research Questions and Themes .....	58

## LIST OF FIGURES

1.	Screen capture showing the use of augmented reality in a PDF document .....	18
2.	The Sensorama developed by Heilig .....	30
3.	The Sword of Damocles developed by Sutherland.....	21
4.	Videoplace developed by Kreger.....	22
5.	Epistemology, methodology, and methods used in this study .....	39

## CHAPTER I

### INTRODUCTION

In 1922, Thomas Edison stated, “I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks” (Cuban, 1986, p. 9). Education is moving from the information age to the conceptual age (Langlie, 2008). The goal is to apply strategies and tools that prepare learners to be meaning makers who are ready for the real world. “As we shift to a new age of conceptual learning, a determination must be made of what a learning environment that includes these characteristics should look like” (Warren, Lee, & Najmi, 2014, p. 92). It is important to apply the best and latest learning strategies and tools to support learning and engage students. The goal is to provide an enriched experience that gives students access to information and materials not readily available elsewhere (Balkun, 2011). The use of audio and video has a long history in education (University of Guelph, 2006); however, the more the world invents new technologies and innovations, the more we observe their appearance in the classrooms. Integration of digital media in education is one of the most recent innovations; the beauty of it is it can include learners from all ages and needs.

Digital media come in different forms: images, audios, videos, animations, simulations, blogs, games, wikis, mobile devices, augmented reality, virtual reality, e-books, and 3-D pop-up books. Various types of media have been around for years. The

term of *digital media* has been defined by many scholars. Alty, Al-Sharrah, and Beacham (2006) simplified the term digital media to *media combination*. They explained that the goal of digital media is to represent information on a device. Their definition of digital media included devices ranging from video to animation, sounds, music, gesture, and speed (Alty et al., 2006). In addition, Buckingham (2007) stated that digital media are based on the internet, mobile phones, computer games, and interactive television. Furthermore, Balkun (2011) described digital media as an instructional toolbox that includes the Internet, e-book, video games, wikis, blogs, mobile devices, augmented reality, and virtual reality. Specifically, the word *digital* (2015) means “displaying a readout in numerical digits rather than by a pointer or hands on a dial: a digital speedometer; relating to, or using data in the form of numerical digits: a digital image” (p. 1). The second word of the term (*media* [2015]; usually used with a plural verb) is defined as “the means of communication, as radio and television, newspapers, and magazines, that reach or influence people widely” (p. 1). However, in general use, digital media are “audio, video and images that exist in a computer-readable format, and can reside on a local device (CD, DVD, hard drive), or remote location (website)” (University of Guelph, 2006, p. 1). Specifically, Hobbs (2011) defined digital media as follows:

The full range of cognitive, emotional and social competencies that includes the use of texts, tools and technologies; the skills of critical thinking and analysis; the practice of message composition and creativity; the ability to engage in reflection and ethical thinking; as well as active participation through teamwork and collaboration. (p. 17)

The scope of this research was mainly focused on one form of digital media: augmented reality (AR). Augmented reality “consists of merging live images with virtual layers of information” (Vogt & Shingles, 2013, p. 47). These layers of information

consist of three-dimensional (3-D) models that include content, images, sounds, and videos. “The principle of AR, in which virtual content is added on top of a real environment, is not to be confused with Virtual Reality, where the environment is mostly or totally virtual” (Vogt & Shingles, 2013). In addition, AR has been defined as “a real-time direct or indirect view of a physical real- world environment that has been enhanced/augmented by adding virtual computer-generated information to it” (Carmigniani et al., 2011, p. 342). The two types of AR differ in the way the virtual layer is associated with a given environment. The two different types of augmented reality applications are location-based AR and image-based AR. Vogt and Shingles (2013) described the differences between the two forms of AR:

Location-based AR applications rely on the spatial position and orientation of the device to select and display location-relevant information. For image-based AR, applications use image recognition algorithms to trigger the display of relevant content over a recognized physical pattern. (p. 47)

The existence of AR in the educational setting includes different disciplines such as science, engineering, magnetic fields, electrical engineering laboratory for distance education, astrophysics, and many more (Borrero & Márquez, 2012; Sin & Badioze Zaman, as cited in Vogt & Shingles, 2013). Augmented reality applications are embedded into mobile devices and tablets to provide interactive experiences to the user. These applications turn print materials into more interactive experiences for learners in order to encourage, engage, and motivate them. “With augmented reality, students can manipulate virtual objects or representations of real objects that would otherwise be impossible to hold as well as learn a task or skill” (Kipper & Rampolla, 2013, p. 19). The majority of AR applications have the ability to engage the learner in the experience. One such application is known as Aurasma (Hewlett-Packard Development Company, 2016)

where learners are able to create their augmented reality experiences by attaching a trigger image or video or downloading the various already made examples in the application and connecting them to a certain trigger. For instance, students can work in groups for a specific topic, i.e., history, by creating an interactive presentation as historical figures come to life. Another example of the use of AR application in classrooms is creating book reviews. Students can place small stickers in the corner of the pages to create AR reviews. It is a way to reflect on the reading in an interactive way as students can create a short video, animation, embedded website, and/or link to further explain their view. The process transfers plain text to interactive materials to enhance the students' reality. In the United States, AR applications are at a comfortable level of technology integration where they are used fairly often by teachers and students. Some U.S. schools incorporate AR applications in project-based activities. Students can learn with mobile and tablet devices by using AR applications. Augmented reality applications are able to engage learners by bringing a new dimension to learning.

Vogt and Shingles (2013) stated, "AR is an emerging concept, but it is now transitioning to a more firmly established technology" (p. 57). Furthermore, educators need to adopt new technological trends in their instruction. Journet (2007) stated in her reflection:

I am striving to reconsider how I define my core responsibilities as a teacher. Consequently, I have begun to compose in multiple modes, including sound, still, and moving images. I am becoming more adept with a wider range of media and software. And I now include multimodal assignments in my classes. (p. 108)

Specifically, educators need to compose and integrate digital media in their instruction. Digital media are becoming increasingly popular every day in educational settings. These tools are rapidly being used in different areas. Applying digital media in



the educational setting provides learners with a positive learning environment. These media have changed the standards and the traditional practices in education. This impact creates a challenge for all academic levels in general.

### **The Study**

The main aspect of this study was to explore implementation of AR applications in education in the United States to develop a strategic implementation for an educational setting in the State of Kuwait. As a qualitative case study, I used a number of interviews with teacher educators from the United States and focus groups with teachers from the State of Kuwait.

### **Teaching with Digital Media in the United States**

Recently, the main focus for much research and the academic community in the United States has been about establishing foundational knowledge about digital media integration in the educational setting. Digital media have been highly supported in many schools, universities, and research centers in the United States. In addition, applying these types of tools no longer requires a large financial investment as in previous decades. With the presence of mobile devices such as cell phones and tablets in use by students, it is easy to incorporate different applications and media. Mobile devices and tablets are fundamentally changing the way students of all ages collaborate, communicate, participate, and ultimately learn (Lacey, Gunter, & Reeves, 2014). Digital media take different forms in the educational setting. Recent studies have shown the use of digital media supports and develops students' skills such as communications, collaborative, engagement, motivation and many more. In fact, students remain engaged

in challenging activities with the use of technology (Alexander, 2014; Gayles & Hu, 2009).

### **Teaching with Digital Media in Kuwait**

Educators in Kuwait are aware of the important role of digital media and their impact on students' outcomes. However, education in Kuwait in general is taking small steps toward digital media integration. Teachers have just started to integrate basic technology tools in the classrooms. In addition, the literature lacks evidence of the use of digital media in educational settings in Kuwait.

### **Problem**

The main purpose of every learning and teaching process is to create meaningful learning experiences that can be used in real-life situations. Educators in the field provide the students with a number of learning activities; however, are these activities engaging, motivating, and able to support students in creating knowledge? Are these activities able to meet the needs of all students? Augmented reality technology combines technology with print and physical objects to build interactive learning experiences that address students' desires and familiarity in engaging in a multimodal environment. How could AR support educational goals as an activity in the classroom? What might that look like in international settings? With AR technology integration, it is not about changing the curriculum. This technology is able to enhance and accommodate existing curricula. It is a tool that affords learners ways to engage with content through new technology applications. Educators need to teach students on their terms by integrating technology that can exceed their expectations in order to motivate and engage them in a way that meets their needs and interests. This study introduced a new tool in the

educational setting in the State of Kuwait. Augmented reality technology can be revolutionary as it has the ability to create a real-life experience in terms of instructional teaching tools in classrooms.

Specifically, this study explored examples of AR applications in the United States in order to introduce this technology as a new instructional tool in the field of education in the State of Kuwait. In my experience as an educator in Kuwait, no parallel research has been conducted on this specific topic.

### **Purpose of This Study**

This study deeply focused on one aspect of the digital media--augmented reality (AR). The purpose of this qualitative case study was to understand the importance and feasibility of integrating AR in the educational setting in the State of Kuwait.

Augmented reality has gained much attention in recent years (Wu, Lee, Chang, & Liang, 2013). In fact, AR might help student learning as it can offer new learning opportunities by creating new challenges. The coexistence of virtual objects and real environments allows learners to visualize complex spatial relationships and abstract concepts (Wu et al., 2013). A number of studies focused on the positive outcomes of AR integration in education within the United States (Bower, Howe, McCredie, Robinson & Grover, 2014). However, integration of AR applications in the State of Kuwait still remains at the sparse level with little or no guidance. Teachers in Kuwait are likely unaware of the potential advantages AR might bring to the classroom as an instructional tool. This study explored U.S. teachers' perceptions along with the examples of published research of AR integration, particularly what teacher educators from United States have done to achieve successful integration.

By examining this importance to education, this study could help educators in the State of Kuwait develop general dimensions in integrating these types of technology across curricular instruction to improve teacher productivity and increase student engagement. I present an overview of the use of AR technology in the United States in order to provide recommendations for the educational setting in the State of Kuwait. The goal of the findings of this study was to enrich the field of education in Kuwait as well as the field of instructional technology in terms of integrating practical and interactive tools such as AR technology. The findings provide insights for educators, instructional designers, administrators, and educational organizations who are supporting technology integration in education. The study contributed to AR integration as this technology has the ability to take learning from a matter of students simply reviewing basic information to becoming engaged in a learning experience that helps them develop their abilities to absorb visual information. Specifically, the goal of this research study was to

1. Investigate the conceptual meaning of AR in the U.S. classroom.
2. Review the use of AR applications in education within the United States.
3. Provide a number of suggestions and recommendations for successful integration of AR applications based on U.S. implementation, particularly for public schools in the State of Kuwait.

From this point in the research, digital media are hereafter defined as AR applications (otherwise known as AR apps). Semi-structured interviews were conducted with teacher educators in the United States. Focus group interviews were conducted to explore the perceptions of veteran teachers from public elementary schools in Kuwait regarding AR integration. Examples from published AR integration research were

included in this study in reaching conclusions. Artifacts were collected such as curriculum and lesson plans. Finally, this study was designed to provide a number of recommendations for AR use in the educational setting and create a solid knowledge foundation for the use of AR application in Kuwait.

### **Research Questions**

The following research questions were addressed to provide insight critical for successful integration of digital media in general and particularly AR applications in the State of Kuwait:

- Q1     How and why have teacher educators in the United States used AR applications as an instructional tool in education settings?
- Q2     What are the perceptions of veteran Kuwaiti teachers in public elementary schools regarding the transference of AR practices in the United States to educational settings in Kuwait?
- Q3     What are Kuwaiti teachers' current perceptions about their ability to implement AR applications in their classroom?

### **Definition of Terms**

**App.** “A self-contained program or piece of software designed to fulfill a particular purpose; an application, especially as downloaded by a user to a mobile device” (Oxford Dictionary, 2014, Definition 1).

**Artifact.** An object that has meaning about the culture of its creators and users. It's a product of human workmanship or handicraft.

**Augmented reality.** “Merging live images with virtual layers of information” (Vogt & Shingles, 2013, p. 47).

**Bias.** Any influence that distorts the results of a research study. Bias might derive either from a conscious or unconscious tendency on the behalf of the researcher to

collect data or interpret them in such a way as to produce erroneous conclusions that favor his/her own beliefs or commitments.

**Digital media.**

Full range of cognitive, emotional, and social competencies that includes the use of texts, tools, and technologies; the skills of critical thinking and analysis; the practice of message composition and creativity; the ability to engage in reflection and ethical thinking; as well as active participation through teamwork and collaboration. (Hobbs, 2011, p. 17)

**Focus group.**

A series of audio-recorded group discussions held with differently composed groups of individuals and facilitated by a researcher, where the aim is to provide data (via the capture of intra-group interaction) on group beliefs and group norms in respect of a particular topic or set of issues. (Bloor & Wood, 2006, p. 88)

**Knowledge.** “Knowledge is the result of the transaction between social knowledge and personal knowledge” (Kolb, 1984, p. 36).

**Learning.** “The process whereby knowledge is created through the transformation of experience” (Kolb, 1984, p. 38).

**Nonprobability sampling.** A method whereby the researcher selects the sample based on certain needs rather than random selection.

**Pseudonym.** A principle of protection of participants’ identities and organizations by providing them with a fictitious name (Bloor & Wood, 2006)

**Semi-structured interview.** A structured interview with a set of questions.

**Social media.** Web-based services and applications that allow individuals to connect and share thoughts, photos, and content with other individuals.

**Trustworthiness.** The integrity of the research is called into question and the researcher is tasked to marshal enough evidence to provide an account that is confirmable,

credible, transferable, and dependable. The quality of an investigation is that which is noteworthy to audiences.

### **Summary**

The main purpose of this research was to explore the use of digital media with a focus on AR applications and how this could be successfully integrated into education in Kuwait. Basically, dimensions of strategic implementation were provided based on the final findings. Digital media are a rapidly evolving area of knowledge that might have significant impacts on students' learning outcomes. In particular, AR technology is the new future in the educational field. These tools are already developing and taking place in the educational setting. There is a need to integrate these types of tools in the curriculum. There are a number of successful integration examples across schools and colleges in the United States. However, educational and academic communities in Kuwait are reacting slowly compared with the United States as various schools and universities in the United States have already applied different types of digital media in their classrooms and there are a number of successful experiences in terms of AR technology.

Past studies have determined some specific positive outcomes in terms of the use of digital media in classroom such as how students are fully engaged in the learning process with digital media; it is a strategy to meet the students' diverse needs and backgrounds. Also, today's students are tech-savvy; integrating digital media in classroom will increase their learning capacity. Therefore, what teachers need is to create effective links to students' prior knowledge, the nature of digital media, and the content.

In this research study, integration of digital media was explored, particularly regarding the use of AR applications.

In Chapter II, I discuss aspects of digital media including the environment, development of AR, implementations of AR, effectiveness of the implementation, and historical background highlights of the most relevant learning theory. In Chapter III, I describe the methodology in terms of participants, types of methods I used, research procedures, and plan of analysis. Chapters IV and V discuss the findings according to the research theoretical framework of the research and present final conclusions of the dissertation.



## **CHAPTER II**

### **REVIEW OF LITERATURE**

#### **A Description of Augmented Reality**

Educational technology tools are changing the teaching and learning process in the classroom. The educational setting is developing quickly as it becomes more capable of adopting high technology tools and integrating them as instructional tools. Some of these adaptations might take place in the near term, some in mid-term, and others in long term. Augmented reality (AR) is a smart technological tool that has been considered to be a mid-term technology in terms of education (Spector & Denton, 2016). Today, however, the use of AR is promising for education in the near future. Therefore, teachers need to learn and adopt this technology soon to receive the most out of this integration in their classroom.

Augmented reality technology is embedded into mobile devices and tablets to provide interactive experiences to the user (Lee, 2012). This technology enables print materials to be more interactive for learners in order to encourage, engage, and motivate them. Augmented reality applications can include any type of text such as books, papers, manuals, magazines, newspapers, flyers, and posters; even Adobe Portable Document Format (PDF) documents and digital photos can be enhanced by AR. The main idea is to turn text into more interactive material by blending physical and digital worlds.

Augmented reality can be defined diversely based on its use and the field in which it is used. “Augmented Reality (AR) is an emerging concept, but it is now transitioning to a more firmly established technology” (Vogt & Shingles, 2013, p. 57). According to Wu et al. (cited in Milgram, Takemura, Utsumi, & Kishino, 1994), this approach emphasizes the technology aspect, defining AR as “a form of virtual reality where the participant’s head-mounted display is transparent, allowing a clear view of the real world” (p. 283). On the other hand, AR can be defined as “augmenting natural feedback to the operator with simulated cues” based on a broader approach. (Milgram et al., 1994, p. 283). Others have defined AR based on certain characteristics viewed beyond technology only. For instance, Vogt and Shingles (2013) stated that “augmented reality consists of merging live images with virtual layers of information” (p. 47). The authors explained that the layers of information consist of 3D models that include content, images, sounds, and videos: “The principle of AR, in which virtual content is added on top of a real environment, is not to be confused with Virtual Reality, where the environment is mostly or totally virtual” (p. 47). Moreover, the authors discussed two types of AR that differ in the way the virtual layer is associated with a given environment. The two different types of augmented reality applications include location-based AR and image-based AR. Location-based AR applications rely on the spatial position and orientation of the device to select and display location-relevant information. Image-based AR uses image recognition algorithms to trigger the display of relevant content over a recognized physical pattern (Vogt & Shingles, 2013).

The nature of AR is to provide a new environment for learners that enables them to interact with the world. “Augmented reality is one technology that dramatically shifts

the location and timing of learning” (Lee, 2012, p. 403). Tagged images, objects, and physical locations can come to life with interactive digital content such as video, animations, and 3D scenes. Bringing a virtual and real world to learners can enhance learning. Teachers and students can create and share their own AR. It is recognized that AR can help students learn as it creates new challenging opportunities (Koutromanos, Sofos, & Avraamidou, 2015). The opportunities these applications can offer are limitless.

Today’s learners are used to having smart technology at their fingertips. Integrating these technologies in the classroom will engage learners in the teaching and learning process. Augmented reality applications are able to offer a challenging, engaging, and entertaining learning environment. There are large numbers of AR applications and most of them are free and capable of being used on different types of hardware. They only require an Internet connection and a built-in camera to be able to use the surrounding settings for more interaction. The most popular AR applications on the market are Wikitude, Argon, Spacecraft 3D (NASA), 3D Compass, Google Sky Map, FETCH! Lunch Rush, ZooBurst, Aurasma, Pete the car: School Jam, AR Liver Viewer, Science AR, AR Liver, Anatomy 4D, Fig, Augmented Reality Freedom Stories, Instamotion AR, Life of a Monarch Butterfly, and many more.

Augmented reality has gained much attention in recent years (Wu et al., 2013). Augmented reality technology is a form of virtual reality where learners have a clear view of the real world. Yet, it is not a virtual reality as it uses virtual images in a live, real-world environment. “Augmented reality bridges the gap between the real and the virtual in a seamless way” (Lee, 2012, p. 13). It can be integrated in instruction and take

different forms to serve multiple purposes. For instance, an example of augmented reality in terms of instruction can be seen in PBS Kids (Cyberchase, 2015). PBS Kids created an AR application for tablets only called Cyberchase Shape Quest. The application is a math-based game focused on geometry, spatial reasoning, and problem solving. The main idea of the application is to challenge students to use geometry. There is a game board that can be printed; students need to point the tablet's camera at the game board to see the materials and the characters pop up to combine the real world with the digital content. The touch screen along with AR technology provide a fully interactive visual experience for students. Students will view the shapes differently as they are able to touch and view all the sides and practice the geometry vocabulary at the same time.

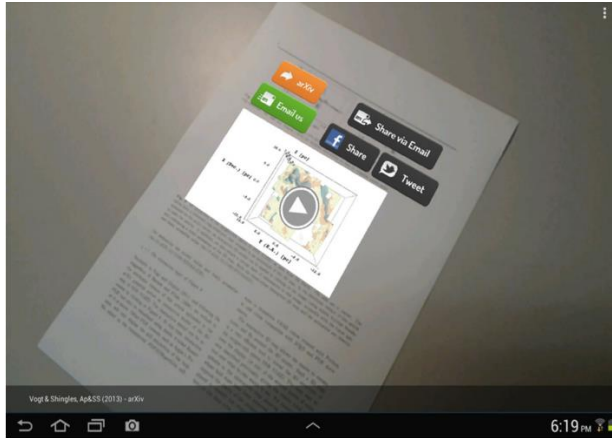
Vogt and Shingles (2013) identified two specific forms of AR: augmented posters, and augmented articles. Integrating AR in forms such as posters and articles or any plain text helps in the comprehension of the complexities in formation of data sets. These alternative visualization methods consist of interactive 3D models, videos, or animations to improve communication and better understand the results. Additionally, PDF documents are now able to contain animated 3D models for both soft and hard copies of documents (Vogt & Shingles, 2013). In other words, AR is an all-in-one instruction as readers can directly experiment with AR for themselves. Simply put, AR turns plain text into more interactive text.

Technology plays a very important role in AR. These applications can be integrated in formal and informal settings as they allow learners to interact with physical materials and objects by creating location awareness. A lightly augmented reality refers to a situation in which users utilize a large amount of information and physical materials

from the real world and have access to relatively little virtual information. On the other hand, a heavily augmented reality contains frequently accessible virtual information (Wu et al., 2013).

Augmented reality applications have different unique features. Some play videos with sounds, others provide further information by going to active URLs, and some have animation. Other AR applications are upgraded with additional buttons that allow the user to send an email or share the information on social media such as Facebook or Twitter. In addition, the content is easily used for sharing results between learning groups or delivering certain information to specific communities. Therefore, AR applications can strongly impact the quality and efficiency of the communication (Vogt & Shingles, 2013).

On the other hand, the way AR is linked to social media attracts more attention to the AR. In fact, Vogt and Shingles (2013) stated, “[AR offers] the capability to directly and rapidly link and share scientific data and publications on social media...[Social media] may be a powerful expansion driver for AR” (p. 56). Figure 1 displays a screen capture of how AR looks when learners use it when looking at a hard copy of a PDF document.



*Figure 1.* Screen capture showing the use of augmented reality in a PDF document.

These applications are considered a next-generation interface, affording a different way of interaction with information (Santos et al., 2014). The features of AR applications are unique and different than other technology tools. Augmented reality applications are more than images, animation, or videos. They are all-in-one applications. In addition, new possibilities for teaching and learning provided by AR have been recognized by a number of educational researchers (Wu et al., 2013). Applying AR in the classroom takes the teaching and learning process into a new different level. Learners will be able to learn about many different topics and closely examine different environments from classroom. Bronack (as cited in Wu et al., 2013) remarked that when bridging virtual and real worlds, AR creates an enhanced and augmented reality (Klopfer & Squire, as cited in Wu et al., 2013). Bower et al. (2014) also demonstrated that students appreciated how AR technology enabled them to undertake activities they would not otherwise be able to perform.

## **History of Augmented Reality**

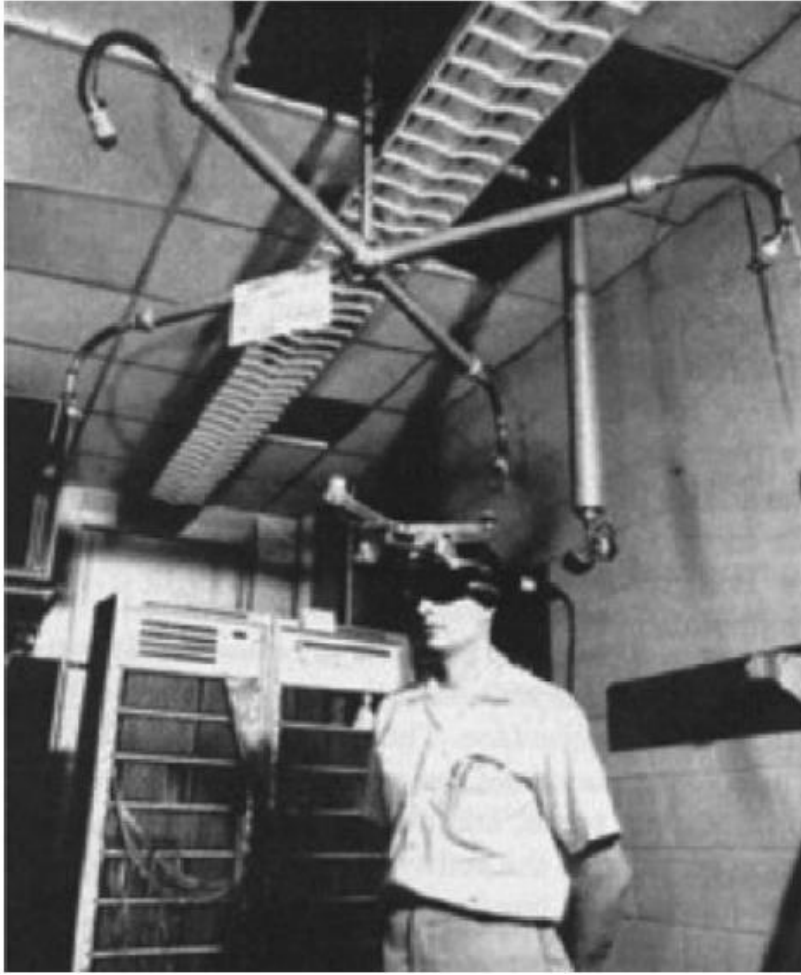
Augmented reality is considered to be one of several digital media tools because of its interactive environment. Digital media come in different forms: images, audios, videos, animations, simulations, blogs, games, wikis, mobile devices, augmented reality, virtual reality, e-books, and 3D pop-up books. In general, digital media have been around for years in different forms and related to different fields. With new technologies and innovation, it is easy to create, copy, store, download, and stream digital media. The transition to digital media is increasing in the United States (Wing & Duea, 2003).

Significant historical events and efforts contributed to the creation of AR technology but they were naive trials due to limited technology at that time. “The history of augmented reality goes back to the 1960s and the first system was used for both augmented reality and virtual reality” (Lee, 2012, p. 403). In 1962, cinematographer Morton Heilig designed a multi-sensory technology that included visuals, sounds, vibrations, and smells called Sensorama (see Figure 2; Kipper & Rampolla, 2013). In 1968, Ivan Sutherland created a system called The Sword of Damocles (see Figure 3), representing the first augmented and virtual reality in history (Kipper & Rampolla, 2013). Later in 1975, Myron Kreger was the first to invent a system that allowed users to interact with virtual objects and called it Videoplace (see Figure 4; Kipper & Rampolla, 2013).



*Figure 2.* The Sensorama developed by Heilig (Kipper & Rampolla, 2013).





*Figure 3.* The Sword of Damocles developed by Sutherland (Kipper & Rampolla, 2013).



*Figure 4.* Videoplace developed by Kreger (Kipper & Rampolla, 2013).

During the 1990s, the term *augmented reality* was coined by Tom Caudell and David Mizell (Kipper & Rampolla, 2013; Lee, 2012). The word came out as an effort of their work at Boeing’s Computer Services’ Adaptive Neural System Research and Development project. In 1996, Jun Rekimoto developed an AR prototype still in use today—the NaviCam (Kipper & Rampolla, 2013). The prototype enhanced the idea of the 2D matrix maker. The main idea was to combine real and virtual environments together as the computer identified physical places or objects to represent digital materials. A year later in 1997, the research leader in augmented reality, Ronald Azuma, identified the main characteristics of AR technology (Kipper & Rampolla, 2013): combination of real and virtual environments, interactive in real time, and based on 3D.

In 1999, the first AR company known as Total Immersion was founded (Kipper & Rampolla, 2013). The company designed a number of products. Then in 2000, Bruce Thomas created an augmented reality version of a popular game (Kipper & Rampolla,

2013). In 2001, Reitmayr and Schmalstieg created the first mobile AR system (Kipper & Rampolla, 2013). Later on, Mathias created the first system for tracking 3D on mobile devices in 2004 with a video see-through (Kipper & Rampolla, 2013). Two years later in 2006, Nokia started a mobile augmented reality application (MARA) project (Kipper & Rampolla, 2013). Basically, the application used cameras to capture a trigger to display a number of graphics and text in the user's real time.

From those beginnings, AR technology has become even more recognized in recent years. In 2008, an application called Wikitude World Browser was created by Mobilizy based on GPS and compass data (Kipper & Rampolla, 2013). It enabled the user to browse Wikipedia information in real-time by using a smartphone camera. Similar to Wikitude World, SPRXmobile launched Layar in 2009 (Kipper & Rampolla, 2013). In 2012, big industries and well-known brands such as Nissan, Toyota, BMW, and Mini integrated AR technology to advertise their products and provide their customers the experience of full 3D viewing of their cars (Kipper & Rampolla, 2013). Top-rated movies such as *Iron Man*, *Transformers*, *Star Wars* and *Star Trek* took advantage of AR to advertise their movies. Lego stores use AR to show shoppers an animated version of their Lego toys. Augmented reality is also found in U.S. Post Offices to help users check package sizes. Disney World integrated AR to make the Disney experience more magical for their guests by bringing events to life and providing virtual experiences in the park (Kipper & Rampolla, 2013). Also, Disney World uses AR technology in their products; for instance, using certain mobile applications will turn children's coloring books into animated 3D models that can sing or tell a story. Disney

Imagineers even created a magic mirror in their stores for little princesses to advertise their costumes (Total Orlando Blog, 2013).

Today, AR continues to advance and take place in different fields. The advantage of AR is not limited to entertainment features. It can simplify the most complex tasks, i.e., assembly and maintenance instructions. Through AR technology, users are able to view objects they are assembling using a 3D view. In 2014, Google invested \$542 million at Magic Leap Inc., an AR firm, as Google had high expectations of AR technology (Olivarez-Giles, 2016). Magic Leap Inc. was founded in 2010 with investments by different large-scale companies such as Google, Chinese Internet Giant Alibaba Group Holding Ltd., Morgan Stanley, Fidelity Management and Research Co., and Time Warner Inc.'s Warner Bros. (Olivarez-Giles, 2016). The company is working on developing the augmented reality technology in a way that transforms the world. Lately, Magic Leap Inc. is in the process of creating a device that could come in handy at school or in the office. The company did not explain the prototype of the new device and did not provide any details (Olivarez-Giles, 2016). However, they explained their device was unique in how it had the ability to project light into a wearer's eyes. "The user sees the world through the glass, while the virtual elements are projected from a light source at the edge of the glass and then reflected into the user's eyes by the beam-splitting nano-ridges." (Olivarez-Giles, 2016, para. 6).

### **Augmented Reality Use, Application Use, and Application of Augmented Reality in General**

Augmented reality technology is a developing tool in a field of promising technologies. Research showed AR is a growing technology that is popular in each field it serves. "It continues to develop over the decades and works its way into the modern

technological landscape of today” (Kipper & Rampolla, 2013, p. 14). Augmented reality technology can be used in advertising, navigation, sightseeing, entertainment, games, and education. According to Lee (2012), “Augmented reality has been put to use by number of major companies for visualization, training, and other purposes” (Lee, 2012, p. 403). As mentioned previously, many big companies have integrated AR to advertise their products and provide their customers with the best services.

### **Navigation**

Augmented reality is useful for navigation as it provides interesting information. For instance, Yelp and NRU applications mainly help users find places to eat, drink, and shop with real-time visual directions to the places (Kipper & Rampolla, 2013).

Sightseeing AR technology has the ability to enhance the user’s sightseeing experience and explore unique details of a place, event, or character by displaying interesting digital information and animations in real-time. For instance, New York’s Museum of Modern Art hosted an exhibit in 2010 (Kipper & Rampolla, 2013). The museum applied AR technology so visitors were able to view hidden exhibitions by using a certain AR application for iPhones or Android phones. A couple of specifically designed AR applications are currently on the market for tourism.

### **Entertainment and Games**

The entertainment industry generates billions of dollars each year (Kipper & Rampolla, 2013). Producers along with entertainers are working to provide a better experience for audiences and go beyond their expectations. With the continued growth of new technology, the definition of entertainment for audiences is being challenged. Augmented reality applications have tremendous potential to provide a unique

entertainment experience that allows users to interact with entertainment elements. Currently, AR-enabled games are now available for both mobile devices and desktop computers.

### **Education**

Technology is changing education, especially with the presence of mobile and tablet devices that access the Internet. The use of different types of technology in the educational setting could simplify complex information, motivate learners, and engage them in the learning process. For example, learners interact with the digital smart board more than the traditional chalkboard. Augmented reality technology is able to create a very interactive learning environment that is appealing to learners as they take control of their own learning and interact with digital objects in a real environment.

### **Application as an Instructional Tool**

Augmented reality is an advanced instructional tool to be used in the classroom. A number of researchers have connected the use of AR technology with student motivation. According to Lee (2012), AR has the ability to strengthen students' motivation and enhance their educational realism-based practices. Balkun (2011) emphasized the idea that "students not only must have access to digital media but also learn how to use technology thoughtfully, creatively, and cooperatively" (p. 16).

### **Application in Educational Settings**

It is important to apply the best and latest learning strategies and tools to support learning and engage students. "The goal is to provide an enriched experience that gave students access to information and materials not readily available elsewhere" (Balkun, 2011, p. 15). The use of audio and video has a long history in education (University of

Guelph, 2006); AR carries this further by allowing interaction with audio and video. Integration of AR can include learners from all ages. According to those whose research is in the field of AR and education, it is important for every teacher to read and think critically about the value of integrating AR in their curriculum. One of the goals of this research was to see if this was true. It was imperative to understand how AR could be connected to the primary goals and objectives of the content. These connections must be related and able to enhance meaning-making. The connections might look like a puzzle in terms of integrating AR into the curriculum but once the puzzle has been solved, the outcomes are quite impressive.

### **Application of Augmented Reality in United States Education**

Sony (2014) supported the use of digital media and especially AR in higher education. Leaders in the Sony company affirmed a shared commitment and investment with schools and would help facilitate the development of production, research, and curriculum with new Sony products (Sony, 2014). The company launched a digital media academy program across the United States from schools such as American University in Washington, D. C. in the East to the School of Cinematic Arts in Los Angeles (Sony, 2014). Sony's program is intended for students in higher education. The goal is to expose students to the latest Sony technologies and equipment, building on mutually beneficial goals. This program would ensure education stays ahead of the curve and evolves with an ever-changing landscape of technologies. The collaboration between Sony and academic institutions would foster and fuel solution approaches and facilitate new expressive applications of digital media technologies (Sony, 2014).

Overall, “Digital technology holds great promise as an aid to education” (Johnson & Christie, 2009, p. 288). Integrating AR in education is a huge move in the educational setting as these tools can meet the student’s needs and develop many skills. Johnson and Christie (2009) explained, “Developmentally appropriate software with open-ended content can encourage play, cooperation, and creative problem-solving” (p. 288).

### **The Role of the Educator**

According to Sansone (2014), it is important to train and prepare teachers to understand this technology. “The meaningful and effective use of technology in education depends upon developing a skill that goes well beyond training in how to operate the hardware or software” (Buckingham, 2007, p. 112). Teaching and learning with AR can be exciting and rewarding for both teacher and learners (Journet, 2007). Moreover, Journet (2007) believed there is a strong connection between learning and doing. For example, video gaming and virtual reality can enhance student engagement (Balkun, 2011). The environment associated with some of the digital media requires decision-making that provides ways for instructors to encourage students to rethink (Balkun, 2011). As for Journet’s experiences, she has discussed incorporating visual arguments, humanities computing, digital poetics, hypertext, interactive narrative, and graphic fiction into her English classes.

### **The Role of the Student**

Much of the research in this area tends to assume today’s learners are more than familiar and ready for digital learning. “Many of our students are born into a digital age surrounded by multimedia images, sound, and video” (Delello, McWhorter, & Camp, 2015, p. 209) Today’s learners are surrounded with technologies and they use different



types of devices and applications more than four hours per day (Johnson & Christie, 2009). Use of these technologies has a significant impact on learners as educators challenge them and encourage them to be more creative. “Digital media can reinvigorate teaching and scholarship” (Journet, 2007, p. 108). In contrast, a few studies have suggested the majority of learners lack the technology background they need and often fail to achieve what the technology promises (Buckingham, 2007; Livingstone & Bober, 2004). Buckingham (2007) argued that what students are lacking is to be supported and guided. In fact, students come to the classroom with rich multimedia experiences and much of the introduced strategies in the classroom seem to be too limited and restrictive for them.

In real life, individuals learn to use technology through trial and error in informal learning processes. According to Driscoll (2005), learners might carefully search and learn the right method to determine what their mistake had been. Usually the learning process occurs through exploration, experimentation, play, and collaboration with others whether in face-to-face or in virtual forms. All of these essential elements need to be considered by the teacher. As stated, “Teachers will need to employ an inquiry-based pedagogy enabling students to actively construct meaningful knowledge through hands-on activities” (Delello et al., 2015, p. 214). This type of technology provides an interactive environment to learners, thus serving educational purposes. Augmented reality applications have the ability to simplify complex information and data for learners. For example, learning about science is different with AR. Learners can examine the planets, moon, stars, and the entire galaxy in 3-D with AR.

Other studies supported the use of digital media to promote literacy (Balkun, 2011). Media literacy helps learners evaluate, analyze, and reflect. Moreover, learners develop a number of skills such as problem-solving and communication. Balkun described that working with digital media encouraged learners to go beyond the textbooks and the classroom itself. They have the opportunity to relate knowledge and method to each other. A new insight into the process of acquiring knowledge occurs. “This ability to think about their own learning in critical ways suggests that new forms of knowledge acquisition are taking place” (Balkun, 2011, p. 16).

Additionally, Buckingham (2007) explained that best practice for the use of digital media in the field of education is the combination of creative production and critical reflection. Moreover, this practice builds on students’ existing experiences. For instance, Santos et al. (2014) conducted a study aimed to measure the impact of technology integration to outcomes in higher education. The study found AR could positively affect students’ learning experiences. The authors combined the advantages of using AR with experiential learning and multimedia learning theories and found integration of digital media in higher education could be successful. The more students did, the more they learned.

Augmented reality has the ability to attract and inspire learners as they explore the presented materials from different perspectives that cannot be viewed in real life in a certain location or time. Learners are able to create and exert control over the tool. In fact, AR might help student learning as it can offer new learning opportunities by creating new challenges (Wu et al., 2013). The coexistence of virtual objects and real

environments allows learners to visualize complex spatial relationships and abstract concepts (Wu et al., 2013).

### **Perception of Augmented Reality**

With the presence of smartphones, students of all ages are showing up in classrooms with powerful computing devices in their pockets without any systematic effort on the part of educators. While it is true students often carry these devices to talk and text, they are actually powerful computers that can be used for all types of processes. What used to be only phones are now complex computing devices with added computing capabilities. Teachers need to take advantage of the availability of students' mobile devices in the classroom and encourage them to connect them to the curriculum more critically. Students use these devices frequently throughout the day. These devices are sources for texts, news, communication, cameras, podcasts, and social networks like Twitter, Facebook, Instagram, Snapchat and many others. Vogt and Shingles (2013) posited, "The rapid growth in the popularity of smartphones and tablets over recent years has provided a large base of potential users of Augmented Reality technology, and virtual layers of information can now be attached to a wide variety of physical objects" (p. 47). The question is whether or not these smartphones and tablets have been utilized by the teacher in the learning process.

### **Advantages of Augmented Reality**

A number of strengths and weaknesses are associated with composing and integrating media in the classroom such as intellectual property, copyright, class attendance, production support, software and hardware issues, accessibility, complexity, and learning styles. In addition, "there is no doubt that learning to use digital media

effectively requires a commitment of both time and resources” (Balkun, 2011, p. 21). Some studies have demonstrated that a large commitment is not the case anymore (Journet, 2007; Vogt & Shingles, 2013) since the use of these applications is mostly through smartphones and tablets and most teachers along with learners are very familiar with these devices. Particularly, mobile devices have increased the number of AR tools and applications. Added to that, AR tools and applications do not require specific knowledge or expertise to be implemented. “Complexity of AR is being taken away from the end user product, and is gradually less likely to slow down or stop the expansion of AR” (Vogt & Shingles, 2013, p. 56). Consequently, the complexity associated with digital media applications and tools in the field of education is not the biggest limitation and will not affect possible expansions of AR into many educational settings.

An overview of research literature showed that learners benefit from learning if it meets with students’ need to expand and grow their knowledge. Sansone (2014) stated, “Students have the opportunity to become an active part of their learning” (p. 73). Accessibility in terms of Internet connections or access to computers needs to be considered. However, since most digital media applications and tools are integrated in mobile devices associated with wireless internet and WiFi features, an expensive overlay of wired connections is not necessary.

One of the advantages of AR technology is “students generally know more about the mobile applications and are certainly more immersed in sound and in the visual, and are more fluent in new electronic genres” (Journet, 2007, p. 116). Teachers can benefit from students’ backgrounds and try to merge the use of AR with the academic context. Scholz (as cited in (Balkun, 2011) supported the use of technology as he stated, [It] “can

help learners to become more active participants in public life and, moreover, radical pedagogy and civic engagement” (p. 18).

Teachers cannot create certain experiments in the classroom, bring places such as the Galaxy to the classroom, or show students how human bodies look internally. In contrast, augmented reality applications and tools provide an alternative solution in creating unique learning experiences for learners. The evolution of AR offers exciting and engaging opportunities to enhance educational purposes and facilitate learning.

### **Barriers Facing Implementation of Augmented Reality**

In spite of the superior outcomes of AR technology in the educational setting, integration of AR is still limited and quite challenging because of its integration with traditional learning methods along with resistance to change and adopting new technologies (Lee, 2012). Implementing AR technology is a quite complex task and requires technical knowledge and dedicated efforts. The type of application might cause an issue; for example, learners might face technical problems when using new applications with complicated features they have not used before. Teachers need to beware of their choices of application type and level when introducing an application. Balkun (2011) expressed that some teachers and students felt discomfort when it came to the use of technology in the classroom. In fact, “each new form of digital media requires an investment of time and training” (Balkun, 2011, p. 15).

More limitations have been raised in the field of education and research regarding digital media. To some extent, these concerns have focused on content, pedagogy, and students’ learning styles. Educators’ concerns focused on current curriculum frameworks and methods of study. Do they need professional development to integrate digital media

such as AR or do they require a different conceptual or theoretical approach? As for pedagogy, “how can media educators capitalize on the self-evident potential of digital technology, particularly for students’ creative production, and what difficulties do they need to face in doing so?” (Buckingham, 2007, p. 113). Finally, more questions were raised in terms of students’ learning styles and appropriate digital media associated with them.

As for learners with disabilities, accessing media might cause an issue for them. Providing accommodations are essential such as adding captions for learners with hearing impairment or providing equivalent information in a different format for the blind. Considering learning styles is very important for successful integration. Long-term stability or availability is one of the biggest concerns of digital media as there is no guarantee companies providing these applications or tools will be in the market in the future. Educators never know how long these applications will exist--whether it be in 2, 5, or 20 years. Nothing is guaranteed and this might affect the future development of content or the curriculum. Finally, educators might face issues with leadership and some policy-makers who still do not realize the benefits of integrating digital media in the classrooms. Furthermore, some teachers remain resistant (Buckingham, 2007).

### **Integration and Transference of Augmented Reality into Educational Systems**

According to the literature, AR integration studies were quite limited in terms of AR use in the classroom as this technology is quite new in the educational setting. Accordingly, the literature lacked transference experiences in terms of AR integration between different educational systems. However, the majority of the studies reported the use of AR applications in education was a positive learning process (Delello et al., 2015;

Billinghamurst, Kato, & Poupyrev, 2001; Farias & Dantas, 2011; Kaufmann & Papp, 2006; Kerawalla, Luckin, Seljeflot & Woolard, 2006; Oh & Woo, as cited in Küçük, Yilmaz, Baydas, & Göktas, 2014).

A study by Küçük et al. (2014) was conducted in Erzurum, Turkey with seven different secondary schools to determine students' attitudes toward the use of AR applications in the classroom. Specifically, 167 secondary school students from both genders in the fifth grade utilized an AR applications book in their learning. The AR book covered one of the units in the curriculum. The unit was developed by instructional designers and teachers. The AR book included multimedia materials such as 2D/3D objects, animations, videos, and sounds. Students were able to interact with the content of the lesson using computer, web camera, and printed lesson materials. When pictures were placed in printed materials or marker cards were prepared to be shown to a web camera, those pictures came alive as 3D objects, animations, and videos in the book. The results of the study indicated students' attitudes toward the use of AR applications positively affected the learning process as students found they were easy and useful.

Additionally, Delello et al. (2015) examined the results of a multi-case study regarding the use of the AR application Aurasma. The main purpose of this research was to explore students' attitudes to gain insight and understanding of how AR could be incorporated into teaching to improve classroom learning. The research was conducted in higher education classrooms with 145 students from three disciplines: education, human resource development, and marketing. In the first case, the participants' assignments were based on a science methods course in the College of Education. They were asked to use the Aurasma application to create an aura centered upon elementary

scientific content. Then each student integrated the aura into an inquiry-based lesson plan and taught the lesson in their field-based classroom. In the second case, the participants were undergraduate students within the College of Business. The assignment was to create a business-training plan for new employees by producing a short (one to two minute) video using the Aurasma application. The last case was conducted in a graduate marketing online course. Students were asked to create an AR promotional initiative for a business or non-profit organization that would enhance their marketing efforts. Their work included photographs, website links, and videos. The results of the studies showed the majority of the students were pleased with their overall experiences with Aurasma. Students felt the AR application enhanced their course learning experience and indicated they would use the application in the future. Overall, students found that working with the AR application in the given assignments was relevant to their future careers outside of the classroom.

On the other hand, Sansone (2014) conducted a study to evaluate the value of AR in the classroom and found negative results. The study's results showed no statistically significant difference in participants' perceptions regarding the use of AR before and after viewing a video presenting AR technology. The results of Sansone's study were based on the perceptions of 61 pre-service and in-service educators. However, the participants did not experience the use of AR applications. Instead, they viewed a 10-minute online video presentation about AR and its use in classroom.

### **Summary**

Augmented reality started as an entertainment tool. However, today's classroom environment along with new learners has changed the type of instructional tools that can



be used in education. Overall, the future of AR in education is bright. The structure of these types of applications provides unique learning environments that can meet the needs of different learning styles. They are dominating as instructional tools in the educational setting. A review of the literature provided evidence that supported the use of AR in classrooms. While it might be true that AR will never replace the real-world environment, the experiences students can gain, or the knowledge they will develop, today's learners are more open to new technologies with new, enhanced opportunities provided by new devices and fast Internet speeds. There is a need to consider AR in education. There are successful integrations of AR technology in the United States. Yet, AR technology has not been introduced in Kuwaiti classrooms. This study encourages teachers and administrators in the Kuwait education sector to consider AR applications as an instructional tool, thus giving them the chance to plan and develop an effective integration of AR into their teaching practices within the existing curriculum. In the next chapter, I explain the methodology I used to investigate the use of AR in educational settings in the United States for the purpose of attempting to transfer information to educational settings in Kuwait.

## CHAPTER III

### METHODOLOGY

The following research questions guided this study:

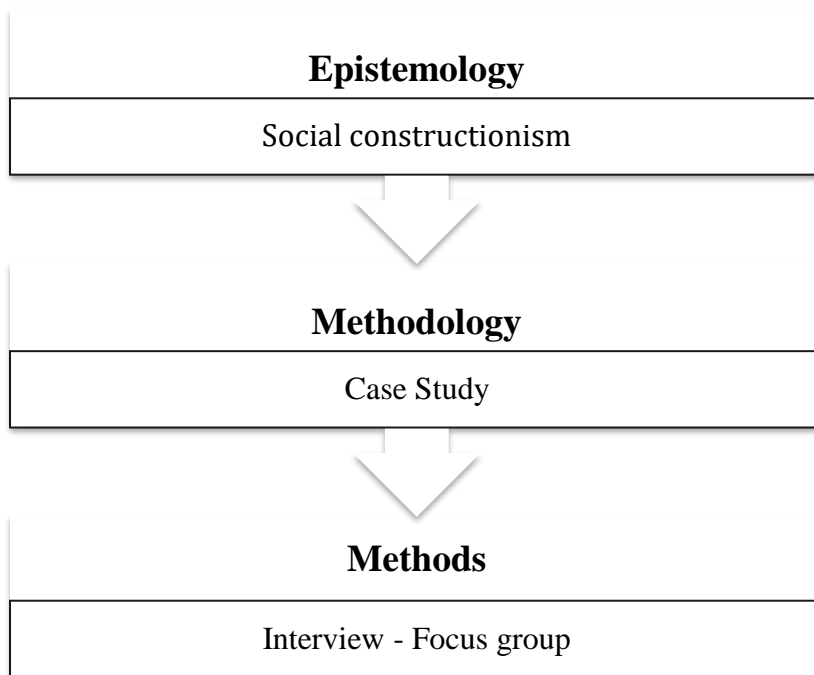
- Q1 How and why have teacher educators in the United States used AR applications as an instructional tool in education settings?
- Q2 What are the perceptions of veteran Kuwaiti teachers in public elementary schools regarding the transference of AR practices in the United States to educational settings in Kuwait?
- Q3 What are the Kuwaiti teachers' current perceptions about their ability to implement AR applications in their classroom?

In this research, I used a case study as a qualitative method based on a constructionist approach to discover answers to the study's research questions. In the following sections, I detail the study epistemology, my researcher stance, ethical considerations, methodological framework and methodology, and, finally, the analysis and coding of the data.

#### **Theoretical Framework: Social Constructionism Epistemology**

Basically, epistemology is a way of knowing. According to Creswell (2013), epistemology is “what counts as knowledge and how knowledge claims are justified” (p. 20). In qualitative research, every step is based on the researcher's knowledge with a recognition of bias in order to accurately report the findings, thereby strengthening the study's trustworthiness. The main goal for this study was to describe the use of AR tools

in U.S. education from examples of published research and individuals' perspectives, understand it from individuals' experiences, and interpret the findings to set up basic dimensions for implementation in Kuwait education. To accomplish this goal, I chose an epistemology, methodology, and methods I felt would best shed light on the subject of AR in education (see Figure 5).



*Figure 5.* Epistemology, methodology, and methods used in this study.

Crotty (1998) described different research methods between cultures by stating that “different ways of viewing the world shape different ways of researching the world” (p. 66). The appropriate method to use to understand the meaning cultural and institutional practices is social constructionism. Social constructionism is the making of meaning as knowledge is constructed rather than discovered and this is how we know the

reality behind the practice. Therefore, social constructionism is the belief that reality is known through social interaction and language. It is a method of human sciences that assumes the meaning of human action stems from the perspective of individuals' experiences. Crotty described these meanings as "constructed by human beings as those human beings engage with the world they are interpreting" (p. 43). Therefore, social constructionism was used as it was the most appropriate theoretical perspective to frame this study. The study's findings were based on social interactions found within certain events, individuals, places, and times.

### **Researcher Stance/My Story**

My main goal since I started my bachelor's degree in education many years ago has been to provide a quality, meaningful learning experience that increases learners' knowledge. I graduated and started my career as an elementary teacher in a public school in Kuwait. I taught first, second, third, and fourth grades. I tried my best to engage my students and provide them with an exceptional learning experience that would remain with them for life with simple, creative instructional tools. I came to the United States to continue my graduate studies and I earned two master's degrees--one in educational leadership and the other in instructional technology. I worked as a teacher assistant during my master's degree and a graduate assistant for almost two years during my doctoral studies. Those working experiences along with gained knowledge through the courses and the revelation of mobile learning encouraged me to search for more advanced instructional tools. I discovered AR while I was searching for new and future instructional tools based on the mobile learning topic. There were many mobile learning tools but AR application got my attention. Augmented reality is one of the most efficient

tools to be used in the teaching and learning process as it can be used in formal and informal settings and can match with students' learning styles.

I think teachers need to understand the term *augmented reality* and have the knowledge about these tools and their use in classroom to benefit their learners with the existing curriculum. With the integration of technology in classrooms, teachers in Kuwait still do not have minimal knowledge about AR applications. What are they? How can we use them? Are they appropriate to be used as educational tools? I started an informal search about the use of AR applications in education in Kuwait. However, I did not locate any information. Unfortunately, many technology tools that could be considered as learning tools are not used in our classrooms in Kuwait. In contrast, these tools have been integrated in U.S. classrooms. The differences in practice between the two countries interested me. Many questions were raised in my mind. I talked to my colleague teachers in Kuwait and they all expressed an interest in the topic. However, full integration of these types of applications does not yet exist. The new generation is living in a digital world. Teachers have the power to catch this generation's attention with these new technologies. It did not take long for me to realize I needed to investigate this matter. Hopefully, the findings of this research can result in a call for noticeable changes in the practices in Kuwait.

### **Ethical Considerations**

As a number of ethical issues might arise during data collection and analysis, this study carefully took several of them into consideration. Prior to conducting individual interviews in the United States, I obtained Institutional Review Board approval from the University of Northern Colorado (see Appendix A). There was no need to obtain

approval in Kuwait since I had connections with the school. I was able to gain access to school buildings because I am a teacher. In addition, full descriptions of the study, participants, procedures, and activities were provided. Consent forms outlined the purpose of the study and explained all the potential risks and benefits associated with participation in the study. All the participants from both countries were able to sign and return the consent forms. Participants were given pseudonyms and all the obtained data was securely stored.

## **Methodological Framework**

### **Case Study Approach**

For this research, I chose a qualitative case study. Qualitative research basically advances policy and practices by providing a solid foundation of knowledge (Remler & Van Ryzin, 2015). Merriam (1998) indicated qualitative studies could be used by many disciplines and applied fields of practice. Merriam and Tisdell (2016) explained,

Qualitative case studies share with other forms of qualitative research the search for meaning and understanding, the researcher as the primary instrument of data collection and analysis, an inductive investigative strategy, and end product being richly descriptive. (p. 37)

Specifically, a case study is defined as “an in-depth description and analysis of a bounded system” (Merriam & Tisdell, 2016, p. 37).

This case study was focused on understanding the foundation and structures of AR application integration in the United States in order to build recommendations for Kuwait. The reasons I chose a case study for this research was to know how individuals interpreted their experiences, how they constructed the world, and what meaning they attributed to their experiences in order to pass this experience to Kuwait. The elements of this study qualified as a qualitative case study as it explored a bounded system. The

number of people involved in this study as participants was limited; there was one particular program, one particular tool, and a unique case as the goal was to investigate the readiness of one county school district from the six counties in Kuwait. Merriam and Tisdell (2016) clarified that all qualitative research is interested in is how meaning is constructed and how people make sense of their lives and their worlds. The primary goal of qualitative studies is to uncover and interpret these meanings. The final interpretation would be based on the researcher's understanding of the participants' understanding of the phenomenon of interest (Merriam & Tisdell, 2016).

### **The Context**

The main purpose of this study was to introduce the AR application as an instructional tool for Kuwait based on the U.S. experience and examples of published research. To better understand the research questions, I recruited participants from different groups as follows:

- Public school teachers from the United States. Participants in this group had already established knowledge, pedagogy, and methods of AR application integration for a long period of time.
- Veteran teachers from Kuwait. This group was chosen to discover the perspectives of expert teachers in public elementary schools, their readiness to apply AR, and how this technology might best fit into their curriculum.

The different groups helped to view the technology implementation of the AR tool from different views to enrich the discussion.

## **Methodology**

### **Participants**

Participants were chosen based on nonprobability sampling and on the study's objectives. I selected my U.S. participants based on their AR integration. Some participants I had met in educational conferences. I found other participants based on their online activities on sites such as YouTube, blogs, or they were in their county's or school's news. Snowball sampling, also known as respondent-driven sampling, was used to choose participants from Kuwait (Remler & Van Ryzin, 2015). Other members in the population for inclusion in the sample recommended some participants. Teacher educators I knew were contacted and recommended other educators and/or those new participants recommended others.

Initial communications were via email to get participant approval to take part in this study (see Appendix B). Phone calls were placed to further explain the study and its purpose for participants who volunteered. A follow-up email was sent to all participants after phone calls were made. All volunteers were asked to sign a volunteer form (see Appendix C) and a consent form (see Appendices D and E), which were sent to them by email or fax or delivered in person. They were also given the opportunity to select a pseudonym for purposes of the research. Five U.S. participants agreed to the interviews but the number declined to three due to participant circumstances. However, saturation was reached with three participants who provided enough information that reflected factual knowledge, experiences, and opinions in terms of AR integration in U.S. classrooms. Based on Creswell (2013) "saturation in qualitative research is a state in



which the researcher makes the subjective determination that new data will not provide any new information or insights for the developing categories” (p. 627).

As for the focus groups, 21 teacher-participants from Kuwait were divided into four groups. Each focus group consisted of approximately five to seven members, which was within the accepted size of a traditional focus group to be “small enough for everyone to have opportunity to share insights and yet large enough to provide density of perceptions” (Krueger & Casey, 2009, p. 6). Specifically, three focus groups consisted of five participants and one focus group had seven. Participants in the focus groups represented the School District of Hawalli County in Kuwait. In terms of the state of technology integration in Kuwait, teacher-participants recently integrated technology tools and devices such as keynote, YouTube, projectors, and iPads©. It is important to note that these technology integration attempts were based on the teachers’ knowledge and efforts. The school did not require teachers to integrate any types of technology or provide any formal training on how to use technology or integration strategies.

Participants from the United States were encouraged to provide descriptive information about their use of AR applications in the educational setting. After each interview, notes along with the video and audio tapes were reviewed along with transcripts to summarize and interpret all of the obtained information. This study was designed to gain understanding of AR integration in education, what challenges educators might face regarding the students’ learning styles, and the content. The information was expected to be subjective and related to each individual’s experiences.

**Demographics.** The target population of this study was educators in the educational field. Participants of this study consisted of three teacher educators from the

United States. In addition, the focus groups consisted of four groups of veteran teachers representing elementary schools in the School District of Hawalli County--one of six counties in Kuwait.

The U.S. teacher educators were mainly White (90%), all were U.S. residents, two (66.67%) were female, and one was male (33.33%). They are all taught in public schools situated in urban cities located in the southeast region of the United States. The four focus groups in Kuwait consisted of all female veteran teachers, which is usual for careers in the educational sectors in Kuwait. They were all graduates of a Kuwait educational system at the university level. No foreigners were among the participants in Kuwait and none of them were familiar with AR as a learning tool. The age range was between 35 and 55. They were all teaching in public elementary schools in urban cities of Kuwait.

**Potential benefits to participants.** The benefits to the participants were mostly intellectual knowledge to help a specific group, namely Kuwaiti teachers. Teacher educators from the United States were given the opportunity to voice their opinions and share their experiences. Kuwaiti groups benefited from increased knowledge as they were introduced to a new learning tool and learned how to use it in the educational setting. In addition, the Kuwaiti focus groups of teachers provided me with artifacts such as lesson plans, classroom examples, and presentations so I could gain more insight regarding the teaching and learning process. All participants received a thank you letter. Participants involved in individual interviews received a \$10 gift card by email while members in the focus group received a new flash drive as a complimentary gift by the end of the focus group session.

**Consent forms.** Before participation in the study began, I asked participants to complete a consent form that described the research, outlined their participation, stated the risks and benefits of participation to them, and provided a list of rights for participation such as the ability to withdraw at any time for any reason (Appendices D and E).

## **Method**

In this study, there were individual interviews and focus group interviews. Interviews were designed for teacher educators from the United States only while the focus groups were designed for teachers from Kuwait.

An interviewing method was chosen to collect data from selected individuals. The main purpose of using this method was to help know what individuals' opinions and thoughts were regarding their experiences of AR. Self-report data were desired for this study to learn more about the implementation of AR in the classroom from the implementer's thoughts, feelings, and intentions rather than observations. The questions were designed to elicit certain responses (see Appendix F for a list of structured questions). Besides asking about AR, the set of questions also contained some background questions such as their education and their qualifications in addition to their previous experiences and interests in teaching with technology tools. There was a need to listen to the teacher educators as they were experts since they integrated AR applications in their classrooms. Finally, all collected responses from the selected individuals were compared and contrasted.

The main purpose of using the focus group method in this study was to present an AR application as an instructional tool to try to understand what Kuwaiti veteran teachers

thought of the application and explored their views in a social context. The focus group interviews consisted of four groups of five to seven members and generally the focus group interviews lasted one to two hours. Four to six structured questions were covered in that period of time (see Appendix G). The discussion was divided into four main parts:

- The opening part was where I welcomed and introduced the members of the group and explained the purpose of the topic and the rules of the focus group.
- The second part of the discussion was the AR presentation. The instructional tool was introduced in detail to the teacher-participants.
- In the third part, I asked the main research questions.
- The fourth part was the closing where I gave participants the chance to include more input. I then thanked them for their participation.

**Individual interviews: Questions, processes, and instructions.**

*Questions.* I concentrated on two different types of questions (see Appendix F):

- First, I asked participants about AR applications knowledge and how to integrate them in their teaching and learning process.
- Second, I asked participants about their students' needs, skills, and interests in general and the outcomes of AR applications.

*Process.* I sent an email to each participant as a reminder within a week before the initial meeting (see Appendix H). An email sent as a reminder a day before and included the exact day and time with simple instructions. An automatic reminder was sent through text message to each participant the same day of the meeting.

**Instructions.** Each participant had the choice to have the meeting in person, by phone, or Skype. I started the interview questions (see Appendix F). They were welcome to share any artifacts. A set of designed semi-structured questions was used in the interview to explore areas of interests; unstructured questions were asked if I saw the need to elaborate further on the answers. Any leading questions were avoided. The interview questions were divided into three parts:

- Opening questions: To learn more about a participant's background and interests.
- Middle questions: Core questions of the interview were asked based on the research questions.
- Closing question: Participants had the time to include any further information; share activities, materials, suggestions, and opinions; or provide examples of activities they conducted based on the curriculum with an AR application. The future of using an AR application in the classroom was explored based on individual experiences.

After finishing the interviews, I asked them if they had any additional comments. I thanked each participant and sent a \$10 electronic gift card along with a thank you letter as a complimentary gift by email.

**Focus group questions, processes, and instructions: Kuwait.**

**Questions.** I concentrated on three different points (see Appendix G):

- First, I asked them about their current use of technology.
- Second, I asked them about their students' needs, skills, and interests in general.

- Third, I discussed AR applications with them, what they were, how to use them, and how well they thought AR would work in their classrooms.

*Process.* Individual phone calls were placed as a reminder within a week before the focus group meeting. An email was sent as a reminder a day before the focus group meeting. The email included the exact time and place with simple directions for attending the focus group (see Appendix I). An automatic reminder was sent through text message to each participant in the focus group including the same information as the email sent the day before.

*Instructions.* I conducted all of the focus group discussions in person. Each participant from the Kuwaiti focus group had the choice to download the AR application a day ahead or to use one of the provided electronic tablets from the researcher. They watched a number of short videos about using this application in education. I provided them with a number of printed pictures and plain text to examine the application using their mobile devices or the provided iPad tablets. I asked them to discuss their thoughts of how they could use this application in their classrooms. Finally, I presented the U.S. teachers' examples of AR integration.

I asked them to list a number of examples of their curriculum and classroom activities that could be integrated with AR applications. After finishing the discussion with the group, I thanked them and provided them with new flash drives as a complimentary gift. The same procedures were applied for all focus groups.

### **Data Collection Procedures**

Data collection procedures consistent with the social constructionism model of qualitative research were used. According to Crotty (1998), social constructionism can

be defined as an attempt to understand and explain human and social reality. Participants' experiences and perceptions along with examples from the published research were used as a way of data gathering. All interviews were audio and video recorded and focus group discussions were recorded orally and digitally saved on a password-protected device for transcription and accuracy. In addition, a volunteer research assistant was responsible for taking notes as a second method in case any unexpected issues occurred during recording and to note general descriptions of the focus group such as atmosphere, general feelings, etc. I also reported notes after each focus group meeting. Participants were encouraged to send me an email with their lesson plans as a PDF file or any other form of artifact such as videos, photos, or websites they felt like sharing. According to Merriam (1998), artifacts can include documents, public records, personal documents, and physical materials.

### **Trustworthiness**

The methods used to ensure trustworthiness of this research study included member checking, triangulation, and audit trails. To establish the trustworthiness credibility that represents internal validity, I used member check and triangulation methods. In the case of member checking, I checked and compared each of the participant's responses during and after the interviews with other participants' responses. In addition, participants were asked to validate the transcripts. Therefore, member checks or respondent validation was used to strengthen the study's validity by returning the transcriptions and tentative interpretations based on the transcriptions back to the participants for reviewing to make sure the interpretations were plausible. This was an

important way of ruling out any misinterpretations of meanings of the participants' responses and to identify my own biases and any misunderstanding (Merriam, 2009).

Triangulation was also used since the study had multiple sources. In fact, triangulation was used across the interviews to strengthen the credibility and dependability of the data. Multiple sources of data were used throughout the interviews by collecting data from people with different perspectives (Merriam, 2009).

Triangulation involves using data from more than one source to gather a more complete picture of the subject of interest. In this way, I gathered evidence from one person or artifact to confirm and/or build upon the evidence from another person or artifact. In fact, contradictory evidence or new evidence not present in the other interview/focus group took place in the findings. Therefore, triangulation helped me gather a more complete picture by looking at both sides of an issue to fully understand it.

Dependability, which is the qualitative term for reliability, was established using triangulation along with audit trail methods. I established an audit trail by documenting the research communication, activities, and decisions. According to Creswell and Miller (2000), "An audit trail is established by researchers documenting the inquiry process through journaling and memoing, keeping a research log of all activities, developing a data collection chronology, and recording data analysis procedures clearly" (p. 128). Therefore, an audit trail was a particularly important method to validate the research process as it justified why a particular technique or sample or theme was chosen. Credibility of the research was established through this process of documentation (Creswell & Miller, 2000). Thus, credibility issues were addressed by using audit trails in addition to member checking (Merriam, 1998). In addition, the findings of this



research study were transferable but not generalizable. Case studies do not seek generalizability and it is impossible to achieve with in small groups as the findings cannot represent other similar populations. However, this research study included detailed, rich descriptions. Therefore, the findings along with the future implications are transferable and invite the readers to make connections between the elements of this research study and their own experience.

### **Data Analysis**

Data were analyzed using a thematic analysis procedure as it offered a flexible approach to search across the interviews and focus group data. Braun and Clarke (2006) defined thematic analysis as a “method for identifying, analyzing, and reporting patterns (themes) within data” (p. 6). A thematic analysis identified emerging themes and issue-relevant meanings based on understanding the individuals’ experiences in detail. According to Erickson (1986), “The basic task of data analysis is to generate assertions that vary in scope and level of inference, largely through induction, and to establish an evidentiary warrant for the assertions one wishes to make” (p. 146). Wolcott’s (1994) three stages of analysis were used:

- Description: Working with data as a fact and letting it speak for itself. Also, notes, interviews, or journals are important to draw the final conclusion.
- Analysis: Analysis can expand and build on description with finding key relationships in descriptive data.
- Interpretation: The main goal for the final interpretation is the finding makes more sense than the data. Moreover, it is not restricted or scientific.

These three stages allowed me to engage with others in a helpful conversation about data analysis. In Table 1, the six phases of thematic analysis are outlined. Table 2 provides a visual model for data collection and analysis.

Table 1

*Six Phases of Thematic Analysis*

Phase	Description of the Process
1. Familiarizing yourself with your data:	Transcribing data (if necessary), reading and rereading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collecting data relevant to each code.
3. Searching for themes:	Collecting codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking in the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic “map” of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells; generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

*Note.* Adopted from Braun and Clarke (2006).

Transcribe<sup>®</sup> software was used to transcribe the data after collection. This software offers a writing environment with an audio player in a single screen for easy edit. It supports different file formats, has different levels of speed, and can be used offline. However, a final version of the transcripts was revised manually. Dragon<sup>®</sup>, a speech recognition software, was used for transcription purposes and NVivo 10<sup>®</sup> was used for data organization.

Table 2

*Visual Model for Data Collection and Analysis*

Phase	Step	Procedure	Instrument	Product	Research Questions
Phase 1 Interviews with U.S. teacher educators	Data Collection	Interview	Interview protocol/questions	Recorder	RQ1
	Data Analysis	Thematic Analysis		Transcribe <sup>®</sup> Dragon <sup>®</sup> NVivo 10 <sup>®</sup>	
	Data Organization				
Phase 2 Focus group with Kuwait teachers (Case Study)	Data Collection	Focus group	Questions	Tablets, photos, video, lesson plans, Aurasma application, recorder	RQ2 RQ3
	Data Analysis	Thematic Analysis			
	Data Organization			Transcribe <sup>®</sup>  NVivo 10 <sup>®</sup>	
Discussion and conclusion	Results	Interpret and explain the results		The conclusion of the study	RQ1 RQ2 RQ3

### Summary

This study used a qualitative case study method for richness of explanation to discover how teacher educators could integrate and benefit from AR applications in the

educational setting. Participants were from two different populations: U.S. teacher educators and Kuwaiti veteran teachers. Participants were chosen based on nonprobability sampling, specifically snowball sampling. Interviews were conducted with U.S. teacher instructors and focus groups for teachers in Kuwait.

To establish trustworthiness, credibility was verified through triangulation and member check methods. Dependability was confirmed by triangulation along with audit trail methods. Lastly, thematic analysis was used for data analysis. Chapter IV describes the findings and analysis. Chapter V concludes with a discussion of the dissertation.

## **CHAPTER IV**

### **FINDINGS**

This chapter provides the findings of the data described in Chapter III and subsequently collected. It also describes themes formed in relation to the study research questions. The purpose of this study was to understand the importance and feasibility of integrating augmented reality (AR) in the educational setting in the State of Kuwait. This study was designed as a qualitative case study. As a researcher, I wanted more than numerical data; rather, I desired to listen, comprehend, and interpret individuals' life stories and experiences. Interviews and focus groups were used as data collection methods. I employed thematic analysis to identify common themes. Words, phrases, and common concepts were identified after they appeared repeatedly while reading the transcripts several times. Ten themes in total resulted from the analysis--five themes based on U.S. data and five themes from Kuwait data. I also considered my personal thoughts as an observer of the interviews and focus groups' dialogue along with participants' attitudes. All sessions were automatically recorded on more than one device to avoid any technical difficulties and saved in an MP3 format for transcription purposes. Participants from the United States participated in interviews while participants from Kuwait were asked to be part of focus group discussions. In this study, I noticed a few phrases were used repeatedly by almost all of the participants such as: "engage," "motivate," and "life skills." It was clear the goal of integrating technology was to

improve the learner's learning experience. Table 3 provides an overview of the research questions and resulting themes.

Table 3

*Overview of Research Questions and Themes*

Research Questions	Themes
1. What are the perceptions of veteran Kuwaiti teachers in public elementary schools regarding the transference of AR practices in the United States to educational settings in Kuwait?	Life-long learning Familiarity with technology Differentiated instruction Student ownership Performance and outcomes
2. What are the perceptions of veteran Kuwaiti teachers in public elementary schools regarding the transference of AR practices in the United States to educational settings in Kuwait?	Acquiring life-long learning skills New generation
3. What are the Kuwaiti teachers' current perceptions about their ability to implement AR applications in their classroom?	Professional development Issues and barriers Effective teaching

### **Interviews**

Three interviews were conducted with three educators who used AR technologies in the educational setting in the United States. Participants were contacted through emails and followed up by several reminders. The participants signed consent forms before the interviews started.

Primarily, all of the participants were educators in the educational field who integrated AR technology in their classrooms. The U.S. participants shared their experiences based on the level of integration and the type of AR technology used. It was

important to note that each participant had had at least one experience with a particular type of AR technology such as AR sandbox or AR mobile device applications while other participants had experience with very highly technical AR tools like Hololens.

The first set of interview questions was designed to learn more about the participants' backgrounds regarding their education, years of experience, goals of teaching, and teaching tools. The remaining questions were designed to provide more in-depth data about their AR technology integration in education. By the end of the interviews, all of the participants had the chance to add additional comments if they desired.

As for the interview format, all three interviews were conducted electronically. In fact, two of the interviews were in an electronic format due to the distance of the participants' locations; whereas the third participant preferred this format over the in-person interview due to his work schedule despite the fact that I offered to meet at any place and time that best worked for him. Therefore, digital communication was the adopted method in this study to facilitate the interviews. Although all of the interviews were audio recorded, video calls were also made for better interaction, connection, and observation.

### **Identified Themes**

#### **U.S. Participants**

The interviews with the U.S. participants were primarily intended to answer the first research question in this study. They were designed to provide more insight pertaining to AR integration in education from the beginning to convey the process of integration to teachers in Kuwait. Themes were developed based on the gathered data

from the interviews in addition to my reflective journal during the interviews. NVivo11<sup>®</sup> was used for data organization and categorization. The recorded interviews were transcribed twice. The first transcript was completed automatically using Dragon<sup>®</sup> software. Then transcripts were revised manually to avoid any errors through misinterpretation of the digital transcription process. All of the transcripts were ready for data analysis within a few weeks after the last interview was conducted and before focus group discussions started.

Three total interviews were conducted with U.S. participants. Howard, Jennet, and Jane (pseudonyms) had integrated AR technology as an instructional tool in their classrooms. Additionally, Howard had conducted a demonstration for AR use with a number of his students and presented the classroom's AR equipment through the video call. Thematic data analysis was used as the main data analysis method in this research study. All three transcriptions were read carefully several times in order to reach saturation and to get a general sense of the overall data before forming the final themes. The process of reading helped in selecting keywords, sketching ideas, and noting some observations that served as codes. All of the codes were compared and then developed into themes and then these themes were collapsed into larger ones from the three conducted interviews. Five themes were identified: Life-long learning, familiarity with technology, differentiated instruction, student ownership, and performance and outcomes. Each theme is discussed in detail in the following paragraphs.

**Life-long learning.** Jennet stated, "Technology is relevant to everyday life." Howard spoke about learning by using fun to reach its full potential: "It's the power of technology...it's fun and innovative and that just captures interest and then they don't



even realize that the learning is in the process and that's exciting.” The participants in the study reported that AR used in their classrooms to expand the students’ learning provided them with opportunities that other instructional technologies could not offer. Jennet mentioned that AR helped her and her students to obtain new knowledge and learning. In addition, her students were able to see the relevance of the subject in depth. Therefore, it was more likely to be an adventure for the students--the opportunity to discover and explore their own abilities and skills and even go beyond their expected limits. Howard said, “As a whole my class goal is to teach specific life goals.” He clarified how AR helped him meet that goal:

Students in my class are learning about whatever it is that they can learn about, so that’s where all the virtual and augmented reality learning takes place...it is not a structured class... Teachers wouldn’t cover everything, and so they would come into it saying, “I don’t know really how to do this work” and so it’s life. Learning how to learn the proper way instead of every year of school is always a spoonful.

He expressed that using technologies such as AR was more likely to assist the teacher to focus on student learning and developing life skills. Participants explained that with AR, students have the opportunity to create their own learning and this type of learning lasts for life and helps construct their knowledge. The educator-participants explained how AR had the ability to simplify the teaching and learning process for both the teacher and the student. Howard specified:

That changes my perspective of me having to teach them all time and makes it into, I’m kind of a supervisor and the students are teaching other students... change the dynamic of the class and it is just more exciting because they’re invested.

Likewise, Jane supported the opinion that AR as a tool expanded student learning. She shared an example of AR use, stating,

You go to a museum and stare at a beautiful painting, but you might need to learn more about it - you might need to research after, but with AR, we can learn on the spot, we run an audio or a video to go with that and to know what techniques have been used. This will expand the student learning.

Although AR integration differed from one participant to another, in general, all of the educators expressed how AR was able to motivate and engage students in the learning process and even go beyond classroom limits for a rich learning experience. Participants indicated the use of AR has the capability of engaging and motivating learners to learn more, be creative, and use their knowledge outside of the classroom. The features of AR technology are different than a regular photo or video. Howard claimed: “Unbelievable! It is unlike anything I've ever seen, it's literally a step from the movies.” Therefore, educators were curious of what AR could bring to the classroom. Based on its integration, the outcomes were fascinating.

**Differentiated instruction.** Howard explained the importance of delivering instruction that can meet diverse individuals’ needs with AR. All of the participants explained how technology was important in differentiating instruction and AR was different than other instructional technology tools--it is an interactive learning tool that can be used with different materials such as photos, videos, text, sounds, and links. Jennet stated, “I thought it would be efficient [that] one device could help us teach a dozen of topics.” Participants explained they were able to tailor the instruction based on needs and interests by simply integrating AR tools. Jane expressed her point of integrating AR to meet certain objectives:

My philosophy of technology integration is the right tool for the right task. So it depends on the learning objectives, your content and what is the goal that you want to achieve... AR is a tool that can fit in different tasks for diverse learning styles.

She explained how students with different needs were able to work in groups or individually using AR. In addition, Jane commented, “You are able to learn on the spot ideally.”

**Familiarity with technology.** Some participants reported moderate to high levels of difficulty when they first used AR tools in their classroom. Jennet met another teacher who actually used AR and she liked the idea of AR integration in the classroom, thinking this would motivate her students. Jennet said, “It was such a nightmare trying to understand the directions.” She added, “[Initially, I had a] lot of headaches, but when it was finished, it was a great experience for this type of learning.” She added, “It took most of the school year to get it together; we got it working I guess in February or March of last year.” She said it took a while to figure out how to use AR: “I’ve seen the use of it on the Internet and YouTube and then I met another teacher [who] built one. He sent me a link to the instructions. Well, for me it wasn’t easy, but I got our technology department involved and we got it working.”

Howard reported his experience with AR: “I chose this because the principal told me to do it. I have actually never heard of this before. He had come to me and said you need to look into this and... and I did and I was like, this can't be real!”

Jane said she started using AR for an activity within the content area in her classroom. She stated AR technology is not mature enough to be used in classrooms that often. Students could receive the same level of instruction with much easier technologies. Jane claimed, “... it is a lot of work for teachers, so it will increase the teacher’s load significantly compared for one lesson... I think that it will be in the future.” Jane claimed AR is still a new technology in the classrooms: “Right now, it’s

still very new and [a] less known tool and schools don't have enough support for emerging types of technologies." She added, "It depends on the teachers' education in the school." For Jane, the outcomes based on the rubric were almost the same compared with other technology tools. Howard argued, "It was really hard to find teachers teaching this type of technology, and the reason why it's hard is because it just came out to the public!"

However, when it came to the learners, things were different. Participants clarified that today's learners are more accepting of dealing with technology. Jennet specified, "So many of the kids had cell phones." Therefore, using AR in classroom was not that complicated to them. In addition, Jane stated, "It's hard to manage but it's worth it."

One of the issues teachers faced was the limitation of resources that might limit the integration of AR. Jennet stated, "The only problem that we have... that we are working on, is that we don't get so many kids around at a time." However, participants claimed that AR is a future tool. Jane said, "I think it's definitely gonna increase." Jennet also confirmed, "I definitely see it becoming more and more used." She added, "A year ago, I knew one person in our state who had one [AR box] and now there are more."

**Student ownership.** Participants said that students with this type of expertise would have the knowledge to move forward independently. Jennet expressed, "It gets them excited, it's a curiosity and it helped them visualize what they were talking, so I think it gives them ownership." Howard discussed the importance of encouraging students to take ownership of their education. Integration of instructional technology

tools is one of the elements to create a relevant learning process for students. Jennet described how her students' attitudes shifted after introducing the lesson with an AR tool. Students were more interested in the subject as they were learning while exploring. Some students snuck in between classes or after school to keep working on their projects: "I have kids come back from high school this year and tell me that their freshman world geography classes--that things that we did with the box helped them visualize what they were talking [about], so I think it gives them ownership."

In addition, Howard explained the outcomes of the student ownership and how providing them with opportunities to self-learning would have a positive impact on their future. He explained that in general, the students who have been involved in their learning are usually well-prepared for a very bright future: "really strong students...are the ones that are self-driven."

As a matter of fact, when participants were asked how they and their students figured out how to work with AR tools, Howard replied, "My goal here is to make them self-reliant and helping others." He commented, "We go round and round, and then I [say], 'okay, how would you do this if I wasn't here? How would you figure [the problem] out?'" This was one example of how participants talked about how their students were learning by doing and trying plus using and building upon prior knowledge.

Participants explained that learning occurred while students were taking these opportunities to use AR. While using AR, students have the chance to work in groups, generate questions, and discuss. Jennet said, "Technology allows us to do things that we couldn't do before and do them easily and more quickly."

**Performance and outcomes.** Howard said, “AR will give you a lot more possibility and ability to do things... I had students working on AR and there is a difference in performance of their outcomes since they have been exposed to that type of technology.” Jennet explained her goal: “What I want to have at the end of year is a curiosity and a love for science.” Integrating AR helped her to reach that goal and her students’ outcomes were outstanding. Indeed, Howard explained, “The subject material could be super fascinating.” As for Jane, she said:

Learners are getting the information right on the spot when they need and where they need, so it will help them to focus on the task and present the information in a multimedia way. So it is better than just a plain text, especially for those kind of activities that teachers need to demonstrate, and it is also better for the learners to go back and review, and therefore the instructor can only demonstrate once in the classroom.

After integration of AR, Howard and Jennet remarked regarding the outcomes of using the tool in the classroom:

Howard: Students really really really enjoy it...all items are like a real thing and it enhances what you learn...it is a tool that can definitely assist teachers.

Jennet: I think it’s amazing, I have students hanging around after school on Fridays because they wanted to play with it and playing with their learning but they were so excited, so curious, and asking questions and they're getting [more] excited... generating a level of interest that I usually don't get!!!

Jennet supported her opinion with an example,

We have some things that were less effective, like showing downland satellite images! Didn't make a lot of sense to them, so when they saw the AR box, they were “Oh!” The color changes, the elevation changes, so they start understanding different things and [AR] helped them to make those connections.

Moreover, Jennet added, “You've got to be creative.” She continued, “It has got to be engaging enough that they’re actually paying attention to it, and not watching what other classmates are doing.” However, Jennet clarified that AR is a great tool but it will

not eliminate the role of other ways of teaching and learning. Jennet said, “We don't completely replace the other things that we have done...this is more like these subjective experiences together, everything we talked about.”

Similarly, Jane emphasized AR outcomes as she said, “I think it will be useful and beneficial in situations that teachers want to increase the student’s engagement and draw attention to the content.” In fact, Jane explained how AR is ideal to seek information anytime and anywhere to help students focus on their tasks:

For some types of activities, teachers need to demonstrate, and it is also better for the learners to go back and review. And therefore the instructor can only demonstrate once in the classroom, but if you created like learning materials and learners can review whenever they want and will have the similar features of reality, this will be great. It’s like learning on the spot. (She supported her point by further saying) I think for those tasks that need visuals about how to do activities or for those activities that need information right on the spot that will be a good application.

### **Focus Groups**

Twenty-one teacher-participants participated for this part of data collection. Artifacts such as curriculum and curriculum standards for primary education in Kuwait (learning unit and annual planning booklets) and guidelines for a competency-based lesson plan were collected to provide additional evidence. Sessions started by lecturing the participants about AR technology in education with a demonstration on the use of AR applications. After teacher-participants constructed a decent knowledge of what AR was and how it could be used in the educational setting, the discussion part started with three sets of questions. The first set of the focus group questions was formed to gain more insight into participants’ pedagogy such as degree, years of experience, types of instructional tools they used, their goal of teaching, and so on. These questions aimed to know more about their backgrounds, interests, abilities using technology, and their goals

behind the teaching process. The second set of questions was specifically related to AR technology. The final questions intentionally gave participants the chance to give their opinions and add their input.

All four focus group meetings were conducted in person in elementary school buildings in the State of Kuwait. Specifically, the meetings were held in the meeting room, computer lab, or teachers' room in each school. Teachers volunteered to participate in the audio-recorded sessions and all of the groups reached the required capacity--five people each in three groups and seven in one group. A number of participants showed discomfort in using video sessions; therefore, I ended up with audio recording only. It is important to note the number of volunteers in each group was supposed to be from six to eight. However, the number declined to five in three groups due to the short notice as some teachers were committed with other school activities at the time of the focus group discussions. A computer, iPads, and iPhones were used for the sessions. Food and drinks were provided and participants were welcome to share any artifacts; in addition, they had the chance to talk about their experiences with technology integration.

Ultimately, the focus group method was used to enrich the discussion and discover the willingness of Kuwait schools to integrate this type of technology. Teacher-participants were engaged as the format of focus groups helped to smooth and enrich the discussion. Moreover, having more than one group from different schools assisted in understanding the level of technology integration in Kuwait.

In terms of the data analysis, the same process was used for all four focus groups from Kuwait for research questions two and three. While the participants from Kuwait



were all English language teachers, the PowerPoint presentation was delivered and discussed in English. However, since the native language in Kuwait is Arabic, some teachers used both languages (English and Arabic) in their discussion so transcripts were written twice. First, transcripts were based on the recorded sessions; the purpose of the second transcripts was to translate Arabic statements into English for the purpose of data coding. Five main themes emerged: effective teaching, acquiring lifelong learning skills, new generation, professional development, and issues and barriers. Each theme is reported in detail in the following paragraphs.

**Effective teaching.** Teachers expressed their interest in the AR tool. The majority of teacher-participants pointed out that AR has the ability to grab learners' attention. Zara stated, "It is a way to attract my learners' attention, it looks very attractive and almost all of them have experience with using similar technologies or maybe games." Nora stated, "I think I can use the tool in my curriculum to explain complicated information or concepts to help my visual learners...better than introducing basic information." Particularly, teachers indicated they might use AR for certain topics. Dana stated, "[AR might be] good for solid topics." Similarly, Reem said, "AR looks like it can bring real life situations or locations to the class." Similarly, Zain commented, "It will change my learning environment." Teachers mentioned that AR technology looked like a great interactive tool to motivate and engage learners. Nora said, "I think it's a great tool to use in the classroom to motivate and engage my students not just to prepare them for the final exam but to help them think out of the box." She added, "I need to develop their communication skills and encourage them to use the language with each other and in public." Asmaa said her goal of technology integration was to create

“attractive” content. Sara commented, “Yes, I want my students to have fun while learning.” Teacher-participants all expressed that in order to have effective teaching, they needed to vary their strategies. All of the teacher-participants focused on two points as noted by Mona: “motivation and engagement!” They claimed that effective teaching must engage the learner in the learning process and must motivate the learner to attain more knowledge. In fact, the majority of the teacher-participants agreed with Mona. They also thought AR could develop learners’ communication skills and promote critical thinking. In addition, Zahra, Aya, and Dalal emphasized the need to adopt technologies that have the ability to deliver the content effectively in a short time. Aya said, “I need tools like AR to save time when introducing a new lesson...instead of spending couple of hours repeating the same information over and over.” Students benefit from learning if they get involved in the process. Marriam suggested,

I think I prefer to let my students create their own AR activity or project. Because our students got used to take the viewer role...they go the movie theaters, they watch 3D movies, and we always show them videos. But if they get the chance to be creator of something like AR, it will be absolutely amazing!

Another key point by Manal focused on AR technology and learning styles. She explained, “I can reach other students...like visual learners...different learning styles.”

**Acquiring life-long learning skills.** Participants explained that one of the goals they wanted to achieve for their students was to help them acquire new skills and use those skills in real-life situations. Teacher-participants included “life-long learning” as one of their main goals while teaching. Reem had used technology tools such as projectors and iPads in her classroom and had noticed positive outcomes. She said, “With AR...I mean it is new, so they will be excited about it. I think students will not just learn skills but they will master it.” Asmaa explained that integrating AR in her

classroom would be mainly to help students construct knowledge that would benefit them. She reported: “I want my students to be lifelong learners, so it is not only about the curriculum... It is about life and how they can use what they are now learning in the classroom to situations they may face in real life.”

Nora commented, “I can see that AR will help those who lack imagination.” She explained that videos were not that attractive for them; it was like watching a documentary movie. Hoor claimed new requirements in the curriculum emphasized acquiring skills and her role as a teacher was to build lesson plans to attain that goal. On the other hand, the other three focus groups stated that acquiring skills is needed but it is hard to achieve with the current curriculum plus the school calendar; altogether, it is very demanding. Teacher-participants liked the concept of AR as a mixed reality. They explained that AR features would minimize the time students could learn effectively, construct knowledge, and acquire lifelong learning skills.

**New generation.** All of the teacher-participants agreed they were dealing with a new generation of learners. Technology played a great role in shaping young people’s lifestyles. Nora stated, “I’m dealing with new generation that can not take things slow because of their fast lifestyle. If I do not present the new concept in the first ten minutes of the class, I will lose them!” Hoor commented, “They are used to get quick information on a finger click from the Internet.” Asmaa explained, “It’s the 21<sup>st</sup> century, I guess we must adopt these types of technologies.” Marya explained, “Technology is their life, it is everything to them...so we as teachers we are forced to use it...it is the way they like.”

In addition, teacher-participants reported every family in Kuwait now has at least one tablet and almost a mobile device for each member in one single family. “The

economic status in Kuwait allows each kid to own a mobile device,” said Aziza. Similarly, Dalal commented, “It is almost every student I have has a phone...smart phone actually! Even the first graders.” “They use their devices by the end of the day...not during the school day, as they are not allowed to,” said Manal. Mobile devices have become part of day-to-day life and are for almost all ages. In fact, mobile devices are kids’ favorite toys now. Reem commented, “We pass our phones to our kids; it is the only thing to make them busy.” In addition, Hana shared a situation that happened to her: “I use iPads in my classrooms most often and one time I had an issue with it, I tried and tried with no hope, but one of my fifth grade students fixed it! They are the experts now.” Nora provided an example:

Traditional methods are not working with the new learners; I couldn’t grab their attention when I used to show them picture or cards...so I switched to projectors...the excitement of technology in the classroom has changed their attitude, they are more engaged as they only focus on the screen, my voice tone is lower and I did not need to shout!

Ultimately, teacher-participants agreed that every generation has its own way of learning. Since this generation’s focus seems to be on technology, AR is a type of technology students can appreciate and from which they can learn.

**Professional development.** Teacher-participants did not actually use the words “professional development” but they indicated the need for training as part of adopting new technology tools. Augmented reality technology was a new tool for the teacher-participants. Aziza stated, “It is something new to me, but it can be considered as a learning tool, I think it can be.” Nora stated, “The app needs to be practiced, maybe we need training... ahh it is not... user friendly. [AR] might be easy for professionals or trained people.” Hoor commented, “I think [AR] is going to be hard.” Participant Zara

commented, “[AR is] not practical.” In like manner, Alia said, “It could be...but not one of my main tools.” Marya explained, “It might not be a main tool, but it is a great addition.” Other teacher-participants claimed it would be hard if schools asked to have AR as a mandatory instructional tool. Reem stated, “If so, I certainly need training!” Other teachers explained that society demands that we develop education but they keep ignoring that we also need to develop ourselves. Mona commented, “The world is going faster than ever, we can’t just roll with it!” Teachers discussed their concerns regarding AR integration and the need for professional development. “It is a great tool, but I guess if it has been applied correctly!” said Dalal.

**Issues and barriers.** Some veteran teachers hesitated to adopt these types of technologies. In fact, they stated AR might be a great choice for new teachers who need to use tools to help them deliver the content. Some teachers explained they needed time and resources to create AR for one lesson. “It’s time consuming,” said Marriam. Zain agreed: “In order to use this tool you introduced, I need to create videos, have photos or animation and build content, while there are easy tools around.” Some teachers thought it was not an easy technology to use in the classroom. “Hard to apply in elementary schools...maybe middle or high,” Rana said. In contrast, others disagreed with that point as technology becomes part of our daily life. Farrah argued, “I may disagree! Students in every age and level have the skills to use smart devices such as phones and tablets...so it is not an issue.” Teachers also mentioned current curricula in Kuwait in their discussion as most of the topics were out of date. They described the curriculum as “boring and needs to be changed.” Nora stated, “Unfortunately, our curriculums are not up-to-date.” However, they claimed some topics could come to life with AR. “There are

topics like aquariums, spaceships, platinum, zoos or Ramadan...these topics will be amazingly introduced to the learners by AR,” said Amal.

On the other hand as was mentioned earlier, teachers agreed with the need to adopt new technology. Teachers expressed the idea that maybe with AR they could add more excitement to the content. Nora added, “Maybe we can go beyond the class or the concept with this technology... Ahh...to think outside the box!”

Yet, teachers expressed hesitation in allowing cameras and Internet in their classrooms because of the culture and traditions. Zara argued, “[There is] no control on these devices if they are connected to the Internet. Students may go out of control and many problems may arise.” Hana noted, “This will bring a whole new issue to our schools.” Teachers said they would not be able to monitor each learner’s personal device. They discussed that issues might arise with easy access to social media. This point might hold them back from integrating technology. “This makes us think twice!” said Sara. “It is going be my responsibility, since I am the teacher,” said Hoor. Reem noted, “Maybe I can have some control if the school has its own devices with restrictions.” “If our school provides us with iPads, even if four or five devices, we can manage,” said Mona. Amal suggested, “It will be great if they update our outdated computer labs to a tablets lab!”

### **Summary**

Findings of this study were the perceptions and reflections of participants from both countries—the United States and the State of Kuwait. Participants answered the study research questions based on their personal experiences and knowledge. U.S. participants shared and reflected their experiences with AR integration in the learning

setting. On the other hand, teacher-participants in Kuwait were introduced to AR as a new instructional tool to be used in their classrooms. Teacher-participants discussed the current learning environment in Kuwait, integration potentials, obstacles they might face, and their learning goals. Major themes were identified in interview meetings and focus group discussions. Chapter V discusses the significance of these findings, lists a number of strategies for AR implementation specifically tailored for schools in Kuwait, provides limitations and recommendations, and draws conclusions about the overall study.

## **CHAPTER V**

### **CONCLUSION**

#### **Introduction**

The main goal of this chapter is to discuss the findings presented in Chapter IV based on the theoretical framework highlighted in Chapter III. The basics of social constructionism stand on the idea that knowledge is constructed rather than discovered. Therefore, it is important to understand social interactions, languages, and dialogues to understand the reality behind the practice of augmented reality (AR) integration. As the researcher of this study, I observed and conducted all of the interviews and focus group discussions in an attempt to gain more insight into the advantages and concerns of AR integration. The first stage of this study was based on U.S. educators' experiences with AR integration. The findings of the conducted interviews helped make sense of why and how augmented reality technology was used in U.S. classrooms. The second stage was an interpretation of the findings of the interviews along with published research in order to prepare a presentation about AR in education as an instructional tool for teacher-participants in Kuwait.

The goals of this research study were to:

1. Investigate the conceptual meaning of AR in the U.S. classroom,
2. Review the use of AR applications in education within the United States,  
and



3. Provide a number of suggestions and recommendations for successful integration of AR applications based on U.S. implementation, particularly for public schools in the State of Kuwait.

In addition, three research questions guided this research study.

- Q1 How and why have teacher educators in the United States used AR applications as an instructional tool in education settings?
- Q2 What are the perceptions of veteran Kuwaiti teachers in public elementary schools regarding the transference of AR practices in the United States to educational settings in Kuwait?
- Q3 What are the Kuwaiti teachers' current perceptions about their ability to implement AR applications in their classroom?

### **Findings Related to the Research Questions**

The findings of this research study were based on participants' perceptions and reflections. The following section discuss each research questions.

#### **Research Question 1**

The first research question is divided into two parts. The first part of the question is how did educators in the United States use AR in the classroom? And the second part of the question is questioning the reasons behind this integration: why did they use AR in their classrooms?

**How did they use augmented reality in the classroom?** Educators indicated the process of integrating was smooth as the learners had been already exposed to different types of technologies in the classroom as well as in their daily lives. All it took was to incorporate 21<sup>st</sup> century skills in the learning process. Livingstone and Bober (2004) reported that 98% of children and young people have used Internet tools.

In fact, AR added a new level of excitement, was interactive, enhanced learners' understanding, and was able to engage the learners. The findings of this study reflected previous work by Livingstone and Bober (2004) who advocated that technologies engage children creatively and socially, develop intellectual and personal characteristics, and facilitate active and critical participation. Moreover, AR integration in U.S. classrooms is based on building learners' knowledge. Afreen (2014) stated, "The reasons behind these levels of acceptance may be that the very purpose of any education is to provide knowledge which is achieved by providing more and more information about [the] subject" (p. 235).

The process of integration was an adventure for both teachers and their learners, who applied previous knowledge of using technology. However, they used it within their curriculum. In addition, U.S. participants indicated they could customize their own resources and many premade materials were available for beginner teachers. All it took was to have an Internet connection, set up accounts, and use smart mobile devices to bring plain materials to life.

**Why have teacher educators in the United States use augmented reality applications as an instructional tool in education settings?** Reasons behind this integration varied from one participant to another but, in general, it was more likely to be used as an approach to motivate and engage students during the teaching and learning process and go beyond the curriculum to provide the learner with a rich learning experience that lasts for life. Similarly, Lee (2012) found students could strengthen their motivation for learning and enhance their educational, realism-based practices with AR: "AR has the potential to have learners more engaged and motivated in discovering

resources and applying them to the real world from variety of diverse perspectives that never been implemented in the real world” (p. 404). The findings of this study indicated AR was able to change the learning environment and students interacted positively to the content. Lee explained,

It is highly likely that AR can make educational environments more productive, pleasurable, and interactive than ever before. AR not only has the power to engage a learner in a variety of interactive ways that have never been possible before but also can provide each individual with one’s unique discovery path with rich content from computer-generated three-dimensional environments and models. (p. 409)

Educators confirmed they needed to keep up with the new digital world as the new generation of learners was accepting technology more than ever. Moreover, AR helped teachers support learning objectives, enhanced the learners’ understanding, and even took students beyond prior knowledge levels. There were hidden details in the content; with AR, students were able to study these significant details. Features of AR are designed to bring “augmented” reality to the classroom; by doing just that, students are able to learn more than they would be exposed in a regular textbook. Afreen (2014) confirmed that with technology, “teachers can share their knowledge easily with students in or out of classrooms; this concept is beneficial to the students with all types of understanding levels” (p. 235).

The current study had similar findings to Lee (2012) in terms of student ownership: “AR may appeal to constructivist notions of education where students take control of their own learning and [thus AR] could provide opportunities for more authentic learning and training styles” (p. 409). Participants in the current study explained that learners were accountable and had ownership. U.S. participants explained they had examined and confirmed the effectiveness of AR as it wa used to introduce new

materials or to give feedback. Augmented reality promotes an efficiency of learning and incorporates surroundings by delivering information at the right time and right place to provide learners within a rich content (Lee, 2012). U.S. participants' feedback showed that integration of AR had multiple learning gains.

### **Research Question 2**

In response to the second research question, teacher-participants from Kuwait expressed their acceptance of AR as part of being up-to-date with the latest technology in the educational field. Obviously, there was some uncertainty at the beginning of the discussion as it was a new tool to these teachers. Yet, there was acknowledgment of the advantage of integrating these types of technologies. In addition, AR was seen as a way to motivate and engage learners. In fact, Lee (2012) found AR tools are able to engage students in learning and increase their motivation as it has a positive impact on their learning experiences. A number of teachers expressed acceptance of the AR tool as it was similar to other mobile applications and games they used on an almost daily basis and for their classroom's practices. But AR is not just a tool for drill and practice; rather, it is to enhance learning. A study by Inan, Lowther, Ross, and Strahl (2010) revealed "technology was used infrequently as a learning tool, but rather used to deliver instruction such as drill and practice" (p. 540). In fact, the U.S. participants discussed this point as their students had already used different types of technologies in their daily lives so the process of AR integration went smoothly. However, teacher-participants from Kuwait had not thought of AR as an instructional tool before but after AR was introduced to them, they tended to accept the tool as long as it had the ability to engage learners and enhance their learning experience. Koutromanos et al. (2015) found AR had

a positive effect on students by an involvement in learning that resulted in great learning outcomes.

The majority of the teacher-participants explained they used technology to mainly provide students with a great learning experience. They had examined students' outcomes with low technology tools such as using keynote, projectors, YouTube, and using iPads for learning games and flashcards. Therefore, teacher-participants agreed with AR integration to maximize students' outcomes. This aligned with research by Chen, Lambert, and Guidry (as cited in Lacey et al., 2014) and Nelson, Laird, and Kuh (as cited in Lacey et al., 2014) who reported that student engagement had increased with the effective use of educational technology. Polly, Mims, Shepherd, and Inan (2010) found technology is able to support student productivity, research, and problem solving.

Nonetheless, teacher-participants all agreed that the transference of AR would not be immediate with the current resources. Some attempts might happen in the future since the current study had just introduced the AR tool to the teacher-participants. However, it would not be a full integration due to the limited use of smart devices and lack of Internet connection in schools. In addition, professional development would be needed to prepare teachers for AR integration. Teachers claimed technology could not be integrated through individual attempts; government support was needed.

### **Research Question 3**

As for the third research question, the teacher-participants expressed an urgent need to have professional development in order to use AR technology. They had many questions related to AR once I introduced the technology tool to them during the discussion. They were trying to figure out how AR worked, why teachers needed it, and

how they could connect it to the content. They also mentioned their need to have support or guidance from a specialist if things went wrong with the technology. The teacher-participants' reactions, questions, and resistance regarding AR use in their classrooms were expected. "Resistance to change (or perhaps fear of change) seems prevalent, even in a society where mobile technology is pervasive" (Lacey et al., 2014, p. 6). Therefore, the findings of the current study supported findings like those of Inan et al. (2010) who emphasized the need to have teacher professional development: "Introducing technology gradually and promoting teachers' current practices with continuous support will more effectively enhance teacher use of technology as a learning tool overtime" (p. 545). In addition, the current study listed professional development as one of the main strategies to promote AR integration. It was shown by previous studies that teachers' knowledge was reflected in their practices; the most common tools used in educational settings were due to teacher familiarity with them (Becker & Ravitz, as cited in Inan et al., 2010; Ross & Lowther, as cited in Inan et al., 2010).

Furthermore, teachers expressed concerns regarding their ability to integrate AR to the current, narrow learning environment. For example, teachers were anxious that learners would misuse mobile devices. However, Lacey et al. (2014) reported that teachers in their integration technology project successfully held students accountable. In addition to using AR effectively, teachers need a high-speed Internet connection; also, there is a need to have the school get electronic devices or to have district permission to allow students bring their own devices. In fact, teacher-participants expressed the need to renew their computer labs, noting "it would be great if the county replaced the old outdated computers with iPads!" It was also hard to get grants or additional funds as

public schools need to follow a certain process to get any additional funding. The teacher-participants often expressed the importance of solving these issues in order to use AR in particular and to integrate other types of technologies.

### **Discussion**

Technology can be a valuable asset in today's world. For instance, today's researchers are able to save time and money by conducting online interviews and focus groups with participants from different locations with no travel expenses. Regarding the interviews in this study, my participants were from different states in the United States, specifically from the Southwest region. They all preferred an online interview as it was more convenient--even to participants living within the same area. In addition, I felt educators already had too many responsibilities with very tight schedules. Thus, they were more comfortable with online interviews. As the researcher of the study, online interviews were also more convenient as they gave me access to participants from different regions, they eliminated the location constraint, and they were easy to schedule with less scheduling conflicts. On the other hand, disadvantages associated with the online interviews were very limited; most were related to technical difficulties that arose during the interviews such as Internet connection issues and recording. All in all, technology was an asset for me, even in this study.

Is technology (specifically AR) as good for education as it is for other parts of our modern lives? The use of AR was supported in quite a number of published studies conducted in the field. However, as my study moved from theory to practice, I came across a number of difficulties in finding schools that actually used AR in their classrooms. The number of schools that actually integrated AR in the United States was

very limited. Many schools indicated AR integration was the beginning phase of an experiment. However, all of the U.S. participants expressed optimism for this type of technology and labeled AR as the future. In fact, one of the participants expressed his enthusiasm of the possibilities and positive outcomes regarding AR as a global educational tool. Speaking of a global AR summit held at his school in the United States, he said, “There are people from different countries who came to visit...there was Ireland, Switzerland and Poland and China...we had Egypt and we had Haiti and France and Brazil, and so these people from all over the globe came to the school for the summit.”

On the other hand, conducting virtual focus groups was not an option for me. Augmented reality technology is a new tool that has not been used at the schools in Kuwait. Therefore, there was a need to prepare a detailed presentation and a demonstration to introduce and explain this type of technology and how it could be used in the classrooms. In addition, no qualified volunteers were available to present the topic. Also, the Internet connection was not strong enough to make video calls to present the topic for the teachers or be able to solve any technical issues that might arise. According to Larkins (2015), “Technical problems may develop, and both moderators and participants must have a level of familiarity with technology and how to respond to difficulties” (p. 23). It also helped me to have direct observations of reactions from the teacher-participants. “In face to face interviews there is no significant delay between question and answer, the interviewer and interviewee can directly react on what the other says or does.” (Opdenakker, 2006, p. 3). Thus, I conducted all four focus group discussions in person by traveling back to Kuwait during their school days to arrange and conduct the meetings.



From my observations of the focus group discussions, attitudes, and reactions, initially I felt most of the teacher-participants disagreed with the idea of integrating AR technology in the classroom. They claimed it was hard to use and not a practical instructional tool; also, there was a lack of time and funding to implement AR technology in the classroom. They pointed out they were unable to provide each student with a mobile device or a tablet. Although the majority of the students owned smart devices, the school restricted the use of personal technology in the classroom. In addition, the Internet caused many issues as it was not yet available in many schools in Kuwait. Most of the teachers used their own personal devices and data plans for their work. They also claimed AR technology required time to be created as one AR activity might take several hours to be created and then be used just once (after which it would not be applicable). However, as the discussion expanded, their attitudes shifted and they were more open and accepting to the use of AR technology as we discussed current changes in the curriculum and students' needs. Discussion tended to be more enthusiastic as they brainstormed and came up with many ways and objectives that could fit with AR technology integration. Regardless of the previously mentioned constraints, teacher-participants became excited about AR integration.

The common theme in all of the focus group discussions was how the participants' opinions of AR integration in education shifted from disagreeing with the use of AR to approval of the tool. Initially, the majority of teachers were somehow hesitant as they thought of their duties and responsibilities to meet curriculum deadlines and how to provide their students with a rich educational environment. Added to that, teacher-participants in Kuwait were unfamiliar with the concept of AR and its use in the

classroom. However, presenting the tool based on the U.S. educators' experiences increased the Kuwaiti participants' acceptance level of AR as an instructional tool.

Before this research, teachers and learners in Kuwait were already managing to use mobile devices as instructional tools; devices such as tablets already existed in the educational setting without any support or funds from the school. Currently, teachers in Kuwait are using their own tablets and personal Internet data to assist them in achieving lesson objectives. Although there is a limitation to the use of mobile devices due to the fact there is no official funding to support teachers and provide them with needed amounts of tablets, teachers have been encouraged by their principals and supervisors to use mobile devices and tablets.

Nora said,

The app is great for explaining some complicated concepts...this is when we need to use augmented reality technology and specifically for visual learners... The most important thing that must be considered is that I'm dealing with new generation that can't take things slow...there is no patience, they can't work on slow patterns, so they want the single information as soon as possible and that is because of their fast life style and their use of technology.

Kuwait teachers-participants expressed their passion for teaching as their goal has been to provide their students with learning that can last. Hoor said, "I want my students to be lifelong learners, so it is not only about the curriculum, it is about life and how they can use what they are now learning in real life." Sara agreed: "My goal in teaching is to help my students use what they learned in real life."

On the other side of the world, teacher-participants from the United States who had already used AR technology explained their goal of using different technologies (specifically AR technology) was to create an experience that lasted with students. According to Howard, "I try to teach them specific life goals." The majority of the

teacher-participants confirmed AR was a tool that had the ability to create that type of learning and teaching process. The U.S. participants shared the same goals as teachers from Kuwait who agreed with Howard who said, “For me, my goal is creativity; my goal is to prepare them for the future.”

A quick glance at the constructed themes from both countries’ participants confirmed the two sets of themes were very close in meaning and goals. Themes formed from U.S. participants’ interviews were based on their own perceptions and experiences using AR integration while Kuwaiti teacher-participants’ themes were based on their concerns and needs in order to conduct this integration based on the current level of technology integration in education in the schools in Kuwait. However, despite those concerns and needs, the Kuwaiti participants were enthusiastic about the possibility of AR in their classrooms.

### **Implications of the Study**

Based on participants’ experiences and responses, this study was able to provide educators with a number of suggestions for a smooth integration. The following section presents a number of strategies that would support a successful integration of AR technology. These strategies are based on participants’ recommendations, suggestions, and researcher reflection regarding current use of technology in the State of Kuwait. Additionally, these strategies are listed based on their level of importance for implementation in Kuwaiti schools:

1. **Revise policies.** Bring Your Own Device (BYOD) is one of the movements that needs to be considered by educators and policy makers in Kuwait.

Based on the literature, the BYOD movement would assist in solving the

school's technology needs with limited funds, saving both a school's time and money. In terms of security issues, schools could establish a separate network for students. Ullman (2013) suggested that to make BYOD successful, schools should consider a separate network for security reasons and have a policy regarding which types of devices are acceptable. In addition, Ullman advised teachers to have a document signed by both students and parents. Ullman's study reported the BYOD project was a big success: "It taught students how to collaborate around subject-matter content, it gave students who were less tech-savvy increased digital literacy skills" (p. 36). Mobile phones are widely used all over the globe and offer a great opportunity to expand access to learning through mobile learning (Estable, 2013). Recent data have shown most Kuwaiti students have their own smart devices but are unable to use them due to an electronic devices policy instituted by the Kuwait Ministry of Education. Thus, schools have banned the use of mobile phones in schools. In addition, teachers would need to go through a very long process to obtain permission for their students to use personal devices for class tasks. For example, teachers need to receive written permission from the district and then approval from the school's principal to allow students to use their personal devices in the classroom. Teachers are also required to send consent forms to students' parents. In fact, the process might take couple of weeks or months. The policy is on hold at present because administrators in the Ministry of Education in Kuwait have banned the use of mobile devices inside a school

building until further notice due to the student misuse of smart devices.

Schools in Kuwait have witnessed negative phenomena such as cyber bullying and students paying more attention to their phones in terms of non-academic events such as texting, gaming, using social media, etc.

Administrator and teacher concerns were limited to students' misuse of technology. After all, use of smart mobile devices has been in existence for more than a decade; what is needed is to have a well-stated and organized policy with government authorities to provide enhanced learning resources to students within their comfort zone (Afreen, 2014). To encourage our students to be more digitally active and engaged in this digital age and apply the BYOD policy effectively, it is important to embed skill and knowledge of digital citizenship when students use different types of technology and the Internet. Therefore, schools and teachers must promote digital citizenship skill and build character that best fits this digital world.

2. Professional development. The majority of teacher-participants expressed their need for trainings, which must be considered for successful integration. In fact, the finding of the current study supported research by Lacey et al. (2014), which emphasized the importance of professional development. Lacey et al. stated that training and support were critical to get teachers comfortable with instructional tools. Teachers must understand new educational tools and how to implement them within their curriculum to provide quality learning. Therefore, workshops, conferences, and classrooms visits would help teachers in exchanging ideas and experiences

for better integration and valuable reflection. Other options to further teachers' knowledge are professional, online, self-paced training programs that are available for free or for a minimum fee. For example, the Apple Teacher Program, Khan Academy, Lynda.com and many others build teachers' skills. In addition to the trainings and workshops, teachers are in need of mentors because sometimes technology looks easy to implement but when it comes to implementation, many difficulties might arise. Therefore, having a mentor would make integration more practical. The most important point is to understand teachers' basic technology skills in order to plan appropriate staff development training.

3. Financial support. According to a recent report by Oxford Business Group (2017), Kuwait's government allocated 9.5% of its 2016 budget to education. In terms of demographics, school budgets need to be increased to smooth the process of integration to provide educational technology resources. Availability of resources in the school would provide an enhanced experience for as many students as needed. However, AR integration could be done with one device as long as it was integrated into creative and interactive methods. Therefore, this strategy could be considered if schools decided to expand their resources and purchase iPad carts to charge, sync, and secure devices or to build an iPad lab for their students.
4. Effective teaching and learning. To have an effective teaching and learning system that integrates technology, teachers need to be empowered to make

the right decision and adjust the curriculum to meet their students' needs.

Participants who have successfully integrated AR technology explained the need to be more independent. Howard said,

Most teachers...have to follow a very strict course guideline because they have to be ready for the next class and...there is a class after class after class and...of course exams... For me my goal is creativity; my goal is to prepare for the future.

To have a successful integration of technology in general and specifically with AR tools is to have a student-centered classroom. It is necessary to move from the teacher-centered classroom to the student-centered classroom to create an effective learning environment. It is also important to give students space to discover their own skills and abilities and go beyond their limits. This finding aligned with research by Koutromanos et al. (2015) who indicated AR could promote a student-centered rather than a teacher-centered classroom. With AR, teachers provide the guidelines and there is no need to spoon-feed information to students. Students are provided an opportunity to discover themselves on their own and create whatever they want while they work on AR. Similarly, Inan et al. (2010) reported, "Classroom practices tend to be more student-centered when technology [is] integrated into lessons where students use production or research software" (p. 544).

### **Limitations**

The current study was designed to be a case study, to introduce AR technology to elementary teachers in Kuwait, and to discover the ability to integrate AR as an instructional tool. Based on recent research and a number of conferences I have attended, AR technology was chosen as it is a new and future instructional tool. A couple of limitations were identified. As mentioned earlier, AR is mostly frequently found in

games and media. Therefore, it was really challenging to find participants. Additionally, the number of interviews decreased due to the current study timeframe. Many U.S. participants did not respond as the study went through the data collection phase. Some teachers opted out as their AR integration was part of an experimental project. Others were involved in schoolwork and could not commit to aiding the current study. In addition, AR is a new instructional tool and the number of schools that have already integrated AR was very limited. Therefore, I had different participants from different states. I had expected to have at least five U.S. participants but due to necessity, the number decreased to three participants. This likely could affect transference of the AR integration experience to teachers in Kuwait. The U.S. interviews were conducted online using video calls as current resources prevented me as the researcher of the study from traveling all over the region. In addition, the only interviewee who was located nearby preferred to have an online interview due to his schedule. Generally, a video call was the best option as it provided a direct communication and helped in observing each participant's reactions and attitudes.

Another limitation I faced during this research was cultural acceptance and attitude. Teachers in Kuwait were overwhelmed with their duties and responsibilities in addition to the large number of students they were teaching. For instance, each teacher had about three to four classes and each class had about 23 to 30 students. Teacher-participants in some focus groups were in defense mode from the moment I started talking about AR in classrooms. The first focus group I met was very defensive; in fact, they were in verbal attack mode. It seemed to them that I was adding more to their plates. As a matter of fact, the purpose of this research study was to have their opinions



and perspectives with regard to whether or not AR should be integrated in Kuwait classrooms. Their role was to be experts in the study in terms of integration in Kuwait classrooms. Fortunately, I was able to stop this defensive attitude from re-occurring in the other focus groups meetings by explaining the purpose of the study and to keep reminding them with almost every question and discussion that the purpose of this study was to simply explore the readiness of AR integration into the current situation. It must be noted that level of education and a person's age made a difference in teachers' attitudes and acceptance of AR integration. Teacher-participants with master's degrees as well as younger teachers were more accepting.

Other limitations were confined to technical difficulties that might arise in every data collection process in terms of Internet connection, devices, and software. Overall, the limitations of this study were mostly related to the participants and those limitations could be avoided by expanding the data collection timeframe.

### **Recommendations for Future Research**

This study was flexible enough with sufficient positive findings to have a second large-scale investigation of integrating AR applications among the schools in Kuwait to expand the findings in terms of data collection. This could be done in a study with focus group participants along with observations of the integration process. A second focus group discussion could be conducted to identify the level of success and participants' attitudes after the integration. This topic is new to the education field in Kuwait and needs more in-depth studies to provide solid standards for AR integrations.

Recently, Apple Inc. (2017) introduced a new AR application—ARKit—at their annual special event. The new ARKit app would give educators and learners the chance

to experience AR in the educational setting at no additional cost. Particularly, Apple announced that ARKit has advanced features, allowing iPad/iPhone users to easily create unparalleled AR experiences. Therefore, since the ARKit is an official application on all Apple devices, any predictions of AR being merely a fad are eliminated. In fact, one of the participants in this study who experienced AR in his classroom commented, “It is not [merely a fad] because they are able to experience the whole educational aspect.” In addition, the inclusion of AR on these devices solves issues educators might face such as accessibility and availability of AR technology. In fact, it emphasizes research that marks AR as a future technology. Creative educators need to take advantage of the accessibility and availability of the AR app.

### **Conclusion**

In the era of the digital world, technology plays a significant role in the future of the teaching and learning process (Baule, 2001). It is essential for every educator to bring educational content to life. When a teacher brings technology into the classroom, listening becomes discovering, interest becomes wonder, and passive learning becomes active exploration (Apple Inc., 2017). This research study is one of very few research studies to present a new instructional technology tool such as AR for schools in Kuwait. Kuwait has a vision of improving the quality of teaching and monitoring the impact of reforms on both students and schools (Oxford Business Group, 2017). This study benefits the educational sector and the listed strategies have been tailored based on the current level of technology integration in Kuwait. Several studies proved that instructional tools have the ability to improve the quality of teaching (Chang, Morreale, & Medicherla, 2010; Johnson, Levine, Smith, & Stone 2010; Küçük et al., 2014). The

primary finding of this study is teachers in Kuwait had the readiness to use AR technology as an instructional tool in the near future. It should be noted that technology integration in Kuwait schools has been in progress for the last five years so the new curriculum could take advantage of AR and teachers have the enthusiasm necessary to take further steps in using this technology in the classroom. In fact, according to UNICEF (Oxford Business Group, 2017), most Kuwaiti students leave school with solid skills but the country has room for improvement. As a teacher-participant from Kuwait said, “Teachers will definitely use augmented reality and there are already a number of integrations of similar technologies in our classrooms.”

Augmented reality is a fascinating tool that could be used by teachers in classrooms. However, whether a specific type of technology is an application or a device, it is not the main goal of teaching and does not define the process of teaching and learning. The current study aimed to introduce a new educational technology to teachers in Kuwait to keep them up-to date with present tools in the field and enhance the teaching and learning process. The main goal of this study aligned with Hockly’s (2012) research wherein he stated, “As with any technology, it is not the technology itself that enhances teaching or learning, but rather the use to which it is put” (p. 82). Nonetheless, the goal of technology integration is to create a constructive learning experience and a lifelong learning environment. As a matter of fact, “Constructivist-oriented pedagogies frequently assign students to use digital learning tools” (Inan et al., 2010, p. 541). The components of AR technology qualify AR as a tool to be used to simplify the learning process and improve the quality of the learning. The intention of this study was to

present an AR tool and to discover the readiness and feasibility of Kuwait schools to design a strategic implementation of AR integration.

During the data collection in Kuwait, I noticed the participants' ability to discuss and reflect was different from U.S. participants. At the beginning of the discussion during the Kuwaiti focus groups, I felt somehow the majority of participants were trying to provide the perfect correct answer rather than reflect on the process or on their own experiences. Their answers most likely were aimed toward obtaining perfection rather than expressing reality. I tried to remind them there was no right or wrong answer for the questions; rather, they were points of view even their points of view might differ from others. In fact, I considered their attitudes as part of their culture. People in certain regions are forced to do things perfectly (rather than differently) by following their traditions and the majority. Some of the teacher-participants were shy and their answers were more likely to be in the form of a word or two or a very short statement. It took them some time and effort to be more comfortable and become encouraged and involved in the discussion.

Overall though, there was an acceptance and willingness among teachers from Kuwait toward AR integration as teachers had previously developed a good technology background with other instructional tools similar to AR. Today's teachers have recognized the importance of involving students in the teaching and learning process. Learners need to circulate and interact with each other. In addition, the new generation of learners has a hard time sitting still for hours. They also have gotten used to technology in their daily lives. A study conducted by Lacey et al. (2014) affirmed that the new technology is fundamentally changing the way students of all ages collaborate,

communicate, participate, and ultimately learn. In addition, their study stated that teachers must offer a curriculum that is engaging and sustained by the latest technology tools. Teacher-participants explained that learners are now used to getting information in an instant from the Internet so this technology should not be difficult to integrate into the learning process.

This study identified a number of issues and barriers teachers might face in terms of AR integration in Kuwait. This study was specifically designed to introduce AR technology to teachers in Kuwait, to understand the possibility of integration from teachers' perspectives, and to develop a practical framework for implementation. If educators look back on technology integration in the classroom during the past years, it is impressive to see how far they have come. Every journey has its challenges and all it needs is a level of support. Augmented reality technologies provide a meaningful learning experience with supplementary and contextual information based on learners. In addition, effective teachers should vary their instructional tools and strategies, which is the goal of this integration rather than the technologies themselves. In the future, the majority of the teacher-participants in Kuwait will have the opportunity to integrate AR in their classrooms after technology is presented to them as education in Kuwait moves forward to the next level (Oxford Business Group, 2017).

The teacher-centered classroom is what most students recall when they remember school. This is not always inspirational. What we need is to create a student-centered environment--let our students choose, collaborate, communicate, use critical thinking, and be creative. These skills are needed to create a learning environment where learning does not stop when the school bell rings at the end of the day. Technology such as AR

could help foster the interest needed to develop these skills. “Education is not the learning of facts, but the training of the mind to think” (Albert Einstein, n.d.).

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**APPENDIX A**  
**INSTITUTIONAL REVIEW BOARD APPROVAL**





DATE: November 7, 2016

TO: Abrar Almoosa, M.A  
FROM: University of Northern Colorado (UNCO) IRB

PROJECT TITLE: [973560-2] A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation

SUBMISSION TYPE: Amendment/Modification

ACTION: APPROVAL/VERIFICATION OF EXEMPT STATUS

DECISION DATE: November 7, 2016

EXPIRATION DATE: November 7, 2020

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB approves this project and verifies its status as EXEMPT according to federal IRB regulations.

**Abrar -**

**Thank you for clearly highlighting and making the requested amendments to your IRB application materials. Your protocols are verified/approved exempt. Please be sure use these amended and approved materials in your participant recruitment and data collection protocols.**

**Best wishes with your interesting research.**

**Sincerely,**

**Dr. Megan Stellino, UNC IRB Co-Chair**

We will retain a copy of this correspondence within our records for a duration of 4 years.

If you have any questions, please contact Sherry May at 970-351-1910 or [Sherry.May@unco.edu](mailto:Sherry.May@unco.edu). Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

**APPENDIX B**  
**EMAIL INVITATION TO PARTICIPATE**  
**IN THE STUDY**

## Recruitment Letter

Hello,

My name is Abrar Almoosa and I'm a doctoral student in educational technology department. I'm conducting my dissertation about integration of Augmented Reality Technology in the educational setting. I'm sending this email to invite you to participate in my study by taking approximately minutes of your time to join a focus group interview that will contain approximately 6 teachers. Any participant who will complete the interview will get a flash drive along with a Thank you letter "certificate of participation".

If any one of you is interested, please response back to this email. Please do not hesitate to contact me if you have any questions.

Sincerely,

Abrar Almoosa  
Email: [almo2206@bears.unco.edu](mailto:almo2206@bears.unco.edu)

**APPENDIX C**  
**PARTICIPANT VOLUNTEER FORM**

### Participant Volunteer Form

Please read this carefully before signing it! Be sure to choose your group format.

I wish to volunteer to help with the research project known as A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation. I understand that by volunteering, I am signing up to participate in:

- An in-person focus group discussion.

I understand that participation is voluntary, and if chosen to participate, I will receive the following benefits:

- A flash drive and a thank you letter “Certificate of Participation”.

I also understand that my work as a teacher will not be directly affected by my participation in this research.

I would like to participate (on the following time of day, format, etc.):

\_\_\_\_\_

(Name; PLEASE PRINT)

\_\_\_\_\_

Age\* (Date)

\_\_\_\_\_

(Email)

\_\_\_\_\_

(Phone Number)

\*You must be at least 18 years old to participate.

**APPENDIX D**  
**CONSENT FORM: INTERVIEW**



## **Informed Consent for Interview Participants in Research**

University of Northern Colorado

Project Title: A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation

Researcher: Abrar Almoosa, doctoral student, Department of Educational Technology

Phone Number: 970-926-3332

Email: [almo2206@bears.unco.edu](mailto:almo2206@bears.unco.edu)

Research Advisor: Mia Williams, Ph.D. Department of Educational Technology

Phone: 970-351-2414

Email: [mia.williams@unco.edu](mailto:mia.williams@unco.edu)

Dear teacher educator,

I am conducting research to find how we can implement augmented reality applications in the educational settings. If you grant permission, you will be involved in:

- Attending an individual interview (online or face-to-face) for approximately one hour in one of the following locations (School meeting room / Public Library).
- Participants will be invited to share artifacts. Possible artifacts might include: their lesson plans or any other form of artifact such as videos, photos or web site they may feel like sharing. Artifacts will be shared without any individual's identification information (children and adults). Any artifacts of individuals who are not consenting to participation in the study will not be allowed. All the collected artifacts will be destroyed at the end of three years.

Questions will involve the following topics: Why do we need to integrate augmented reality in classroom? What are the benefits of this integration? How can we integrate augmented reality in the current curriculum?

You must be at least 18 years old to participate in this research.

By agreeing to participate in this research, you are agreeing to allow me to record and use your responses for this research. I will keep these records private and will not divulge any information about these records except to report group summaries in my final research paper.

I foresee no risks to subjects beyond those that are normally encountered by University of Northern Colorado faculty and teacher's students. University of Northern Colorado rules prohibit me from discussing with anyone any comments made during (this interview) without the participant's express consent or a court order. I will use an electronic recording device to capture conversations, therefore all discussions will be audio recorded. Although all information will be kept in secured, password-protected computer located at my home, there is a possibility that information can be stolen electronically or (in the case of a face-to-face interview) stolen from my locked car, although the information will be placed on the secure computer at my home as quickly as possible, and all information on the recorder will be erased. For your participation, you will receive a \$10 gift card by email after the interview.

Finally, any paperwork (such as this consent form) that is associated with this research will be stored in a locked file cabinet at my home. For your participation, a copy of the final research report will be given to you at your request.

During the research process, you will be able to decide if you wish to continue in this research, and you have the right to end this research without any consequences to future services at University of Northern Colorado. Although this study is designed to explore augmented reality integration in education, the researcher and the University of Northern Colorado do not guarantee any results as a consequence of your participation. In addition, participation or lack of participation in this research will not directly affect or benefit the participant.

Please feel free to email me or phone me at 961-926-3333 if you have any questions or concerns about this research and please retain one copy of this letter for your records. Thank you for assisting me with my research.

Sincerely, Abrar Almoosa

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Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions, please sign below if you would like to participate in this research. A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

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Participant's Signature

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Date

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Researcher's Signature

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Date

If you give permission for Abrar Almoosa to use your situation with a fictitious name and removing all other identifiers as an example in the research reports, please initial here:

\_\_\_\_\_ (Initials)



**APPENDIX E**  
**CONSENT FORM: FOCUS GROUP**



## **Informed Consent for Focus Group Participants in Research**

University of Northern Colorado  
Project Title: A Qualitative Case Study in Augmented Reality Applications in Education:  
Dimensions of Strategic Implementation

Researcher: Abrar Almoosa, doctoral student, Department of Educational Technology  
Phone Number: 970-926-3332  
Email: almo2206@bears.unco.edu

Research Advisor: Mia Williams, Ph.D. Department of Educational Technology  
Phone: 970-351-2414  
Email: mia.williams@unco.edu

Dear teacher,

I am conducting research to find how we can implement augmented reality applications in the educational settings. If you grant permission, you will be involved in:

- Attending one face-to-face focus group discussion for approximately one hour in one of the following locations (School meeting room / Public Library).
- Participants will be invited to share artifacts. Possible artifacts might include: their lesson plans or any other form of artifact such as videos, photos or web site they may feel like sharing. Artifacts will be shared without any individual's identification information (children and adults). Any artifacts of individuals who are not consenting to participation in the study will not be allowed. All the collected artifacts will be destroyed at the end of three years.

Questions will involve the following topics: Why do we need to integrate augmented reality in classroom? What are the benefits of this integration? How can we integrate augmented reality in the current curriculum?

You must be at least 18 years old to participate in this research.

By agreeing to participate in this research, you are agreeing to allow me to record and use your responses for this research. I will keep these records private and will not divulge any information about these records except to report group summaries in my final research paper.

I foresee no risks to subjects beyond those that are normally encountered by University of Northern Colorado faculty and teacher's students. University of Northern Colorado rules prohibit me from discussing with anyone any comments made during (focus group session) without the participant's express consent or a court order. I will use an electronic recording device to capture conversations, therefore all discussions will be audio recorded. Although all information will be

kept in secured, password-protected computer located at my home, there is a possibility that information can be stolen electronically or (in the case of a face-to-face group session) stolen from my locked car, although the information will be placed on the secure computer at my home as quickly as possible, and all information on the recorder will be erased. For your participation, you will receive a new flash drive by the end of the focus group discussion.

Finally, any paperwork (such as this consent form) that is associated with this research will be stored in a locked file cabinet at my home. For your participation, a copy of the final research report will be given to you at your request.

During the research process, you will be able to decide if you wish to continue in this research, and you have the right to end this research without any consequences to future services at University of Northern Colorado. Although this study is designed to explore augmented reality integration in education, the researcher and the University of Northern Colorado do not guarantee any results as a consequence of your participation. In addition, participation or lack of participation in this research will benefit the Kuwaiti participants through the understanding of the new technology.

Please feel free to email me or phone me at [970-926-3333](tel:970-926-3333) if you have any questions or concerns about this research and please retain one copy of this letter for your records. Thank you for assisting me with my research.

Sincerely, Abrar Almoosa

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Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions, please sign below if you would like to participate in this research. A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1910.

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Participant's Signature

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Date

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Researcher's Signature

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Date

If you give permission for Abrar Almoosa to use your situation with a fictitious name and removing all other identifiers as an example in the research reports, please initial here:

\_\_\_\_\_ (Initials)

**APPENDIX F**  
**INTERVIEW QUESTIONS**

## **A. Questioning Route**

### **Interview possible questions**

#### **I. INTRODUCTION**

Thank you for agreeing to meet with me today. My name is Abrar Almoosa. I am the researcher of the study. The purpose of this semi-structured interview is to gather information about the use of augmented reality application in education. Your perceptions and views will assist me to explore how the application is used as an instructional technology and how can it can be implemented in the classroom.

There are no right or wrong answers, but rather different points of view. Feel free to share your point of view, even if it differs from someone else's. Before we get started, let's share some ground rules. I will be recording the session because I do not want to miss any of your comments. Please participate as you would a regular conversation with a friend. Your names will be kept confidential. This session will last about an hour.

#### **II. OPENING QUESTION**

To begin, I would like to ask you to introduce yourself – using just your first name and tell me how long you have been integrating augmented reality application. Could you please tell what courses you have integrated AR with and are you still applying them?

#### **III. GENERAL QUESTIONS**

The next set of questions is related to your perceptions about AR.

What is important for you in your teaching?

What is the most important goal student should obtain from your teaching or your class?

What is the goal of integrating technology in education?

#### IV. SPECIFIC QUESTIONS

What do you think of augmented reality application as an instructional tool?

Why did you choose augmented reality applications?

How does it enrich the learning process environment?

Describe the type of learning goals or objectives that can best fit with AR application.

What are your objectives when you specifically integrate AR in the curriculum?

How do you recognize the use of augmented reality application over the other technology learning tools?

How do you see the use of AR in schools?

How do you evaluate student's outcomes and performance after AR integration?

What are the student responses of AR in which they are currently participating?

How can this type of technology be used in K-12 settings?

What are the barriers and assets to implementation?

What is the future of AR in education?

#### V. CONCLUSION

Let me see if I can summarize what I've heard you say. <summarizes>. Did I summarize your thoughts very well? Did I misunderstand anything? What else would need to be included in a summary?

I want to thank you for sharing your thoughts and feelings with us. This has been valuable information for the study.

**APPENDIX G**  
**FOCUS GROUP QUESTIONS**

This research will have one set of focus group. It will consist of two focus groups of veteran's teachers from Kuwait.

***Introductions:***

Each participant will be asked to introduce their names (Not the real name) and a brief introduction about him/her self. What types of instructional technologies they have used in the classroom?

***Kuwait focus groups:***

Teachers in this group will listen to a brief explanation of an augmented reality application and their use in education. I will show them the app and provide them with tablets and a number of interactive printed materials to experience how the application works. They will review the United States experiences along with a number of lesson plans. They will be asked about their perspective regarding the augmented reality technology, what do they think? Can they implement the AR technology in their curriculum? What do they think of augmented reality as an instructional tool? Does AR benefit them in their learning context? Are they going to integrate it in their teaching process? Can they provide examples for using AR in classroom?

Together, we will come up with a number of examples of when and how the teachers can benefit from this technology in their teaching process.

**Introduction questions:**

What is important for you in your teaching?

What is the most important goal student should obtain from your teaching or your class?

How it would enrich the learning process environment?



What is the goal of integrating technology in education?

What are the instructional technology tools you use in your classroom?

**Main questions after introducing AR application:**

What do you think of augmented reality application as an instructional tool?

Describe the type of learning goals or objectives that can best fit with AR application.

How do you see the use of AR in schools in the future?

Do you think this type of technology can be used in K-12 settings in Kuwait?

What are the barriers and assets to implementation?

**APPENDIX H**

**REMINDER TO ATTEND INTERVIEW**

### **Reminder to Attend Interview Meeting**

(Email reminder script for interview)

Hello, (teacher educator's first name). How are you? This is a reminder that you are scheduled to participate in an interview on (time and day) (Online or Face-to-face) in a research study titled "A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation". In return for participating in this research, you will receive:

A \$10 gift card and a thank you letter.

The interview will be focused on the use of augmented reality technology as an instructional tool. An opportunity to express your opinion and its effectiveness in the teaching and learning process.

Will you be still able to attend?

(If yes) Thank you! I'll talk to you on (repeat time, day and location again).

(If no) I'm sorry to hear that. Thank you for volunteering and have a great day.

By agreeing to participate in this study, you are helping the educational system to further understand this new technology and its use in education. Your voice is important.

Thank you,  
Abrar Almoosa

**APPENDIX I**

**REMINDER TO ATTEND FOCUS  
GROUP SESSIONS**

## **Reminder to Attend Interview Meeting – Focus Group**

### **(Email reminder script for focus group)**

Hello, (teacher's first name). This is a reminder that you are scheduled to participate in a research study titled "A Qualitative Case Study in Augmented Reality Applications in Education: Dimensions of Strategic Implementation". The focus group discussion is a one-hour-session on (time and day) at (Location); see the map below for the location. You do not need to bring anything but yourself; snacks and drinks will be provided to thank you for your willingness to come and participate. In return for participating in this research, you will receive:

New flash drive and a thank you letter.

The discussion will be focused on the use of technology in Kuwait classrooms and it will introduce augmented reality technology as an instructional tool.

Thank you,  
Abrar Almoosa