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# Virtual Reality Game Classroom Implementation: Teacher Perspectives and Student Learning Outcomes

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UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

VIRTUAL REALITY GAME CLASSROOM IMPLEMENTATION:  
TEACHER PERSPECTIVES AND STUDENT  
LEARNING OUTCOMES

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

Mohammed Mubarak Alfadil

College of Education and Behavioral Sciences  
Department of Educational Technology

May 2017

This Dissertation by: Mohammed Mubarak Alfadil

Entitled: *Virtual Reality Game Classroom Implementation: Teacher Perspectives and Student Learning Outcomes*

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

Accepted by the Doctoral Committee

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## ABSTRACT

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This study explored the influence of the virtual reality game (VRG) *House of Languages* on the ESL vocabulary acquisition of intermediate school students and establish how VR technology aids in improving the ESL vocabulary skills.

A quasi-experimental design helped determine the impact of the VR use intervention on the learning process over the traditional ESL vocabulary acquisition method. Participation of 64 students divided randomly into an experimental group and control group; each group contained 32 students and their teacher from a local suburban intermediate school in the eastern region of Saudi Arabia.

The findings from this study of independent *t*-tests at the end of experimental period indicated that students using the VR game *House of Languages* had greater achievement in learning vocabulary than those using the traditional method in learning vocabulary. The findings of paired *t*-tests indicated that the students in both the experimental group and control group scored higher in the post-test compared to their pre-test scores. Also, the descriptive statistics used to analyze teacher' and students' perceptions surveys indicate a perceived usefulness of VRG in the learning process.

In spite of the fact that the participants of this study were intermediate school students, the VR technology made it applicable to primary school and high school

students. So, it would be essential to create awareness among the educators that the use of the new VR technology as an effective vocabulary acquisition method in learning process should be engaged in all K12 stages not only to improve the vocabulary acquisition but to go beyond that to enhance the degree of achievement.

## **DEDICATION**

I dedicate this dissertation to those who have been the source of my strength throughout my PhD journey; my Mom and my brother Hadi. It is my prayer that I will be as much of an influence on my family as you have been on me.

## **ACKNOWLEDGEMENTS**

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## TABLE OF CONTENTS

CHAPTER		
I.	INTRODUCTION .....	1
	Learning Vocabulary .....	2
	Virtual Reality and Education.....	4
	Purpose Statement.....	5
	Research Questions.....	6
	The Rationale for the Study .....	6
	Significance of the Study .....	7
	Delimitation .....	8
	Definition of Terms.....	8
II.	REVIEW OF LITERATURE .....	10
	Computer Games .....	10
	Teaching Second Language .....	11
	Age and Learning a Language .....	13
	Behavioral Response of Learners .....	14
	Experiential Learning.....	16
	Foreign Language Vocabulary Acquisition .....	17
	Virtual Reality.....	19
	Initial Attempts at Virtual Reality.....	20
	Creating Virtual Reality .....	23
	Virtual Reality and Education.....	23
	Use in Education .....	23
	Transforming Apps .....	25
III.	METHODOLOGY .....	28
	Sample.....	30
	Variables .....	30
	The Dependent Variable(s) .....	30
	The Independent Variable.....	31

CHAPTER  
III.

continued

Instruments.....	31
Pre-/Post-vocabulary Test.....	31
Perception Surveys.....	32
Technology Intervention.....	33
<i>House of Languages</i> Virtual Reality Apps .....	33
Virtual Reality Environments .....	34
Samsung Galaxy Smartphone Gear VR.....	35
Procedures.....	35
Data Analysis.....	39
Validity and Reliability.....	40
Construct and Content Validity .....	40
Reliability.....	41
Conclusion .....	41
IV. RESULT .....	42
Reliability and Validity.....	43
Reliability.....	43
Construct and Content Validity .....	43
Data Analysis.....	45
Independent Sample <i>t</i> -test Analysis.....	46
Paired Sample <i>t</i> -test Analysis .....	53
Descriptive Data Analysis for Research Questions 2 and 3 .....	57
Summary of Finding .....	62
V. DISCUSSION.....	64
Results.....	66
Finding 1: Greater Achievement in Learning Vocabulary .....	66
Findings 2 and 3: Vocabulary Development Within Each Group .....	70

## CHAPTER

### V. continued

Findings 4: Teacher Loved Virtual Reality .....	72
Finding5: Learning, Challenging and Having Fun .....	73
Limitations .....	75
Implications.....	75
Future Research .....	77
Conclusion .....	79
REFERENCES .....	81
APPENDICES	
A. Vocabulary Test.....	91
B. Teacher Survey .....	95
C. Student Survey .....	98
D. Example of Topics and Target Vocabulary Used in the Vocabulary Pre- and Post-test.....	102
E. Content Expert Review Form: Participants' Survey.....	105
F. Content Expert Review Form: Teachers' Survey .....	110
G. Content Expert Review Form: Pre-/Post-test.....	113
H. Assent Form for Human Participants in Research: Students .....	117
I. Consent Form for Human Participants in Research: Parent .....	120
J. Consent Form for Human Participants in Research: Teacher.....	123
K. Institutional Review Board Approval for Study .....	125

## LIST OF TABLES

Table		
1.	Level Description Vocabulary Knowledge Scale .....	32
2.	Procedural Step and Timeline .....	37
3.	Altman's Benchmark Scale.....	41
4.	Independent Sample Statistics for Both Experimental and Control Group .....	47
5.	Independent Samples <i>t</i> -test: Pre-test.....	48
6.	Independent Samples <i>t</i> -test: Post-test .....	50
7.	Independent Samples <i>t</i> -Test (Pre-test) .....	51
8.	Paired Samples Statistics: Experimental Group .....	53
9.	Paired Samples Test: Experimental Group .....	54
10.	Paired Samples <i>t</i> -test: Control Group .....	55
11.	Paired Samples Test: Control Group .....	56

## LIST OF FIGURES

Figure		
1.	The Stereoscopic Motion Picture and the Optical Device .....	20
2.	Science Fiction Story Foreseen Virtual Reality .....	21
3.	Morton Heilig’s Sensorama .....	22
4.	Myron Kruegere’s Artificial Reality .....	23
5.	Quasi-Experimental Design .....	28
6.	Logo of the House of Languages Virtual Reality Game .....	33
7.	Sample of the Game Virtual Reality Environments .....	34
8.	Sample of Samsung Gear VR .....	35
9.	Mean Levels of Vocabulary Acquisition for Students in Experimental Group and Control Group (Significant Differences Observed) .....	52
10.	Teacher Perception of the Usefulness of Virtual Reality .....	57
11.	Participants’ Perceptions of the Usefulness of Virtual Reality .....	59

## **CHAPTER I**

### **INTRODUCTION**

World economies constantly face challenges due to the lack of skilled workers in the workforce. The majority of schools do not teach all the skills required for every job. This is despite the fact that technical and manual skills are necessary, experience also matters during job interviews. In fact, these were among the top five aspects that human resource specialists look for in an applicant's portfolio (Mathis & Jackson, 2010). Thus, more and more people are interested in learning specific "special" skills to save time and money.

Traditional educational programs are losing courage to provide an alternative way to produce the kinds of skilled candidates employers want. For example, highly skilled jobs in many firms that are connected to advancing and maintaining complex technological systems are hard to fill. But, on the other hand, unskilled employees may have to work two jobs to meet their own daily needs. This imbalance provides for its own problem and solution. Rather than encouraging people to go to school to learn new skills through traditional learning methods, alternative opportunities for just in time training can give candidates tools to help them learn from their current lives instead of requiring formal education (Hunt, 2012). Technology is critical in this process.

## **Learning Vocabulary**

One particular skill that would look impressive in a portfolio pertains to vocabulary prowess. However, a rich and extensive vocabulary is not easily acquired. In a study that measuring the extent of vocabulary reveals that a typical high school student's vocabulary was about 10,000 words (Graves, 2016). Improving the vocabulary of high school students has not always been easy. Pedagogical practices are often described as dull and rely on rote memorization, choral response, citation, repetition and regurgitation on examinations. However, several ways of improving vocabulary has been designed, particularly catering to the learner's interests and learning styles (Ellsworth, 2005).

Traditionally, it is common preconception that one's vocabulary is improved in the educational setting. Basically, people acquire skills naturally in school. However, in an article, written by Brahic (2012), the author argues that people should reconsider this widely held assumption. The author asserts that if society takes a look at history of human development, particularly in the establishment of educational facilities and institutions, it reveals that schools came in quite late in the story of human evolution. For centuries, people managed to learn without classrooms and courses. How then did humans acquire the skills, more specifically pertaining to language acquisition? The answer that a renowned psychologist provides was that learning has been facilitated through experience, interaction and observation. Research by Hunt (2012) concluded YouTube was a commonplace example of technology allowing skill improvement and made things possible in the learning process that were unimaginable in the past. Through this tool, skilled experts share their experiences with the public all over the world to

address the challenge of limited of skills. For instance, one who wants to play guitar as Brian Setzer plays, just search for “Stray Cats” where you can virtually sit with him to provide suggestions and show you how to use different tips and tricks. However, the interaction here is also generally one-sided. In the past, a car owner could fill the gas and drive the car, but the majority of people had no knowledge of what happens in the car engine. Today, thanks to technology, if the car owner wants to know about or even attempt to fix the engine, information and tutorials that explain what is going on under the hood can be found on YouTube (Hunt, 2012). Through this type of independent learning, people have gained basic knowledge of vocabulary specific to the area they were learning about through the videos. This expanded their basic understanding of the subject, but may not have provided a depth of knowledge to be proficient in the subject.

Foreign language speakers have often struggled with limited vocabulary in general as they were learning a new language. This struggle could be intensified when trying to learn vocabulary, or jargon, for a specific field of study. The importance of the vocabulary to foreign language learners has focused on effective vocabulary teaching strategies that have lead to an increase in the acquisition of vocabulary, especially in writing development as well as writing performance. A study in 2016 demonstrated the productive knowledge of vocabulary in a foreign language is correlated strongly with the foreign language writing performance. Their results indicated the higher performing of foreign language writers examined in this study had significantly higher total productive vocabulary test scores (Johnson, Acevedo, & Mercado 2016). Hence, development of productive vocabulary knowledge in the foreign language is of importance in the development of other foreign language vocabulary skills.



In this study, the researcher focused on identifying the influence of Virtual Reality (VR) games on the ESL vocabulary skills of intermediate school students, while assessing if VR games could be a valuable strategy in the foreign vocabulary learning process. The researcher selected foreign language vocabulary skills for this study because of the limited research on foreign language vocabulary acquisition through VR technology and the availability of VR software on the topic.

### **Virtual Reality and Education**

Many people think of VR as an innovative technology related with science fiction works such as the science fiction films, and TV shows. Many already have seen today's VR in many different kinds of applications, particularly with video games on computers, tablets, and smartphones. In fact, much of our daily activity occurs in a virtual environment by using online tools. Virtual reality is also used for a different kind of movie going experience at theaters to navigate virtually new places through smartphone applications. Although most experience VR in entertainment form, there are other uses for it, including culture heritage, education, military, arts and industrial section (Loureiro & Bettencourt, 2014). At this point of time, the majority of educators have not yet understood that VR could be used as a teaching and learning tool to enhance a student's learning experience by implications of these developments in the learning process (Ludlow, 2015). A study conducted in a physical classroom through the 3D immersive virtual environment confirmed that the learners tended to feel more confident, open, participatory, creative, and understanding, because they were definitely interested in learning (Loureiro & Bettencourt, 2014).

In another study conducted by McMahon, Cihak, Wright, and Bell, (2016), the authors confirmed that the use of Augmented Reality intervention was an effective approach for teaching science vocabulary to Postsecondary Education Students With Intellectual Disabilities and Autism. One student with autism spectrum disorders (ASD) had 30% correct responses for the definition questions of human bones and 80% correct responses for the definition questions of human bones after using Augmented Reality vocabulary intervention. In the same study, all four students *agree* or *strongly agree* that they would like to use Augmented Reality to learn because it would be a helpful tool to improve their science vocabulary. Virtual Reality and Augmented Reality technologies share many similarities, thus, this research inferred that the potential for VR foreign language vocabulary activities would have a similar positive effects on students' learning and experiences.

### **Purpose Statement**

The researcher of this study hoped to establish the role of VR games in improving the foreign language vocabulary skills of intermediate school students. Virtual reality is a promising new technology that would give the illusion of immersion in an environment that is digitally generated and does not physically exist (Achille et al., 2016). If not now, in the coming future, VR would be the future of the coming generations and would take place in both adult education and workplace development. Jennifer Wu and Philipp Kraemer supported that, "the development and implementation of the Tactical Language Training System successfully utilizes a virtual environment to promote foreign language learning among U.S military personnel. Learners practice interactions with virtual native speakers in a mission-based game" (Sivan, 2016, 302-303).

In this study, through a high-impact application *House of Languages*, the teacher would bring the benefits of learning trips and life experiences to the classroom without the expense needed of an educational trip. Students got a hands-on experience to discover, interact, learn and enjoy in 12 different locations, such as the airport, cinema, zoo, café, museum, among other locations. The researcher hoped to bring the course content to the hands and minds of students in a fun, engaging setting using creative learning methods through immersion in a virtual environment. This paper explored the various effects of VR games to students, particularly relating to their learning process in vocabulary acquisition.

### **Research Questions**

In this paper, the researcher formulated the following questions to help establish the goals and objectives of the study:

- Q1     Is there a statistically significant difference between vocabulary knowledge of intermediate school students who engage learning with and without use of a virtual reality vocabulary learning game?
  - Q1a.   What is the change in vocabulary acquisition of the experimental group?
  - Q1b.   What is the change in vocabulary acquisition of the control group?
- Q2     What are the perceptions of teachers who integrate a virtual reality vocabulary learning game into their pedagogical practices for teaching vocabulary skills to intermediate school students?
- Q3     What are the perceptions of intermediate school students who use a virtual reality vocabulary learning game as a learning method for developing vocabulary?

### **The Rationale for the Study**

This study was hereby endorsed to aid the academic in designing an effective and efficient technique that could help promote both how students acquire new foreign

language vocabulary skills, as well as further their ability to use the vocabulary in authentic contexts. The purpose was to establish a useful tool to improve students' qualifications and credentials and improve their portfolio. This study mitigated many parents' concerns over the negative effects that computers would have on their children by exposing some of the positive effects that computer games can also have. This particular study encouraged the educator to merge VR games as a teaching and learning tool to enhance a student's learning experience and improve the foreign language vocabulary skills. This study was the first using VR games, such as *House of Languages*, to improve students' foreign language vocabulary skills in the current published literature.

### **Significance of the Study**

The significance of this study would rest upon how merging VR games into the learning process enhanced a student's learning experience and improved the foreign language vocabulary skills of students. In fact, this study is unique. It would be one of the first known studies to test VR's efficacy as a foreign language vocabulary learning tool. Screens are a part of a student's life. Screens are what currently facilitate communication between friends and family. Screens are their source of entertainment and more importantly it is where they get their information (Winge & Embry, 2013). Games have been employed many times as a learning tool--just look at companies like Luminosity, but little has been reported about full engagement in learning. Virtual reality games like *House of Languages* transports the student to a new place that they must adapt and learn to continue with the game, and further sets attainable goals that actually show results at

the completion of the program. Researcher' goal, in this endeavor, is to show that VR does in fact improve vocabulary acquisition in secondary languages.

### **Delimitation**

This study included 64 students from Amer bin Senan, intermediate school in the eastern province of Saudi Arabia. The participants were divided in two groups--the experimental group and the control group. The experiment was run for 14 days. During this time, the students followed the program prescribed to them and measured to see whether there had been improvement in their foreign language vocabulary skills.

### **Definition of Terms**

**Vocabulary Skills.** The ability of individual of uses the effective vocabulary way in order to expand knowledge and word meaning (Palermo et al., 2014).

**Virtual Reality.** "It is a computer simulation of a real situation where the human subject may interact with the virtual environment, sometimes by the mean of non-conventional interface like glasses and helmets on which the scene is represented and the sounds reproduced" (Achille et al., 2016. p. 140).

**Virtual Environment.** "A very important aspect of virtual reality is the environment in which it takes place and must be carefully engineered to achieve a convincing experience" (Virtual Reality Environments--Virtual Reality, 2016).

**Samsung Gear VR.** A mobile VR headset (developed by Samsung in partnership with Oculus), that allows users to immerse in a virtual environment.

**House of Languages.** Is new VR application to master many languages such as English, German, French, Russian or Spanish. It is a highly useful for gaining new words

through several channels of perception in VR (Fox3D Entertainment, 2016).

Through this app, the user can:

- See the object and its corresponding name,
- Hear the name of the object,
- Repeat the name of the object.

## CHAPTER II

### REVIEW OF LITERATURE

#### Computer Games

Computer games are popular among children and teenagers, even may adults participate, because the games are exciting and fun to play. During the recent years, many parents have raised their concerns over the negative effects that computer games have on their children. But, their worries should be reduced because research shows that games can be used to enhance learning Debabi and Bensebaa (2016) approved that using serious game enhanced algorithmic learning and teaching. Result showed that the students who played *AlgoGame* have encouraged and positive result in writing the sorting algorithm comparing to the students who write an algorithm of sorting without knowing about the game. In Malaysia, research on computer game based learning endorsed that the Educational Game (EG) is engaging and motivate students in approaches that traditional learning has not. Students who used the Educational Game version, gained a significant higher achievement mean scores in comparison with the achievement of the students who used the traditional learning with the Wilk's lambda value of .950 as indicative of the significance,  $F(3,192) = 3.336, p < .05$  (Teh, Wan Ismail, & Toh, 2010)

One reason gaming promotes learning and builds necessary skills is because games provide mental challenges to the players. Younis and Loh (2010) claimed, "serious games are computer games with entertainment characteristics, but designed for serious

purposes like corporate training and education” (p. 1). Likewise, teachers who are advocates of modern methods in teaching find digital video games help students learn essential skills, such as adopting, adapting, collaborating, creating, and writing. How? Digital gaming from exiting Commercial Off-the-Shelf (COTS) game are taken and goes through a process known as modification or modding.

Modding, modification is defined as “a design process that allows game ‘modders’ to explore concepts, apply skills, and test them within virtual environments that mimic the real world” (Younis & Loh, 2010. p. 1). Likewise, modding of COTS games vary in classrooms in the form of such learning activities: for experiential learning, for teaching computer programming logical thinking skills, and script writing, as well as serves as a technical platform to introduce learners to the concepts of information technology and story writing skills (Younis & Loh, 2010).

Secondly, game-based learning teaches content that is able to contribute to the standards of learning theories and 21st century skills. For example, massively multiplayer online game (MMOG) like *World of Warcraft* and *Call of Duty* teaches the importance of collaboration. Likewise, these games also foster better communication and help reenact or practice strategies that can be used in real-life scenarios. Lastly, well-designed games (i.e., even in children games like Angry Birds) often require players to solve various complex problems and, thus, gamers learn critical thinking and problem solving skills (Miller, 2012).

### **Teaching Second Language**

Teaching a second language to children involves a different, yet feasible approach (Marcos, 2009). The language training programs used in elementary schools has three



distinct types (Ngai & Janusch, 2015). These include language immersion program, foreign language in elementary schools' programs (FLES) and foreign language exploratory programs (FLEX). These three different programs employ different strategies that would facilitate second-language acquisition.

For example the Immersion program would allow the students to spend a fraction or their entire day at school using a foreign language in learning the entire subject curriculum including Math, History and Science. Under this program, the said foreign language is used as the medium of instruction. Given this format, a child will achieve proficiency and is predicted to achieve a higher level of proficiency as compared to the students being groomed using a different language program (Ngai & Janusch, 2015).

On the other hand, the foreign language in elementary schools programs or FLES offers a different approach. Compared to the immersion program, this approach is more common. Instead of being used as a medium of instruction, a foreign language is taught as a separate subject. Usually, this subject is trained thrice or even more in a week just like any other subjects like Science or Math. Learning the second language rely on the regularity of conducting the class and the chance that allows students to practice (Rhodes, 2014).

The last program option in teaching second language to children is the foreign language exploratory program or FLEX. Under this program, the students are introduced to diverse cultures and languages as a broad-spectrum. In this program, the students are given enough time to discover different languages by having different information presented about a given language. However, proficiency of the language is not the

something that parents should expect since this program is only after providing a basis for future learning (Curtain, Donato, & Gilbert, 2016).

### **Age and Learning a Language**

The correlation of age and learning a language offers a complex analysis (DeKeyser, 2013). The relationship of these two variables has varying interpretation depending on when the study was conducted and the modulating variables involved in the research. On the question of whether older adults can still successfully learn foreign language, the answer that most research suggests that there is no deterioration in one's ability to learn despite aging (DeKeyser, 2013). However, certain considerations like the deterioration of senses like hearing and vision (Nikolov, 2009). This means that age is not a significant factor in the acquisition of language. In fact, on the contrary, older adults can actually be a good parameter for learning a foreign language. The perils on the acquiring a new language in old age are often attributed to the difficulties that the learners experiences inside the classroom setting, the learner's attention span and the teaching method being used.

One common misconception on the age and second-language acquisition was mentioned in on the "critical period hypothesis" in 1960. This is based on theory of brain development stating that after puberty the brain loses what is termed as cerebral plasticity which makes second language acquisition more complicated for adults than in children (Lenneberg, 1967). However, in 1978, Walsh and Diller said that adults possess a superior language learning capabilities. This is brought about by the highly developed cognitive system, which makes associations and generalizations more elaborate in adults compared to children. Time does however, changes a lot and this is one theory that has

been contradicted at present. In Dr. Mitsutomi's (2000) article on the Fundamental Principles of Language Teaching and Learning, pointed out that compared to adults, children learn easily especially in terms of second language acquisition. The professor added that the reason for adult's difficulty in learning is due to their fear and lack of confidence that they can still acquire a new language. In addition, language acquisition unlike any other skills requires time for learning. This is one facet of learning with which adults may be in conflict.

### **Behavioral Response of Learners**

Learning a second language is not only secluded to this biological component of the learning but also involves their behavioral response to the stimulus being presented to them (Ellis, 2015). One significant gradient to effectively teaching and learning a second language involves the person doing the mentoring. The language professor has a lot to do with motivating the student to learn and acquire the knowledge and skills being taught. Mansour (1975) conducted a study at the Michigan State University analyzing the contribution of foreign language teachers particularly in a first year Spanish class. In his study he employed the use of electric approach in addressing the problem. This approach involves the combination of class visitation, the instructional rating instrument and teaching method of the instructor. In one of his findings he said that foreign language teachers often lack the credentials for teaching a foreign language class (Mansour, 1975). It is not enough that a foreign language teacher can speak the language. The knowledge on classroom management is just as important. Universities, colleges, K-12 schools, and language training facilities should consider that in hiring teachers to teach foreign language should first and foremost be teachers. Although it is also important that the

instructor can speak the language, it should not be discounted that they must be able to handle the class and facilitate the discussion for better class absorption. This is emphasized because students learn differently from one another therefore; the teacher must be able to adjust to the learning style of every student in the class (Mansour, 1975). These adjustments in learning could be best addressed if the person teaching the language training program has been trained in the teaching profession or has the pedagogical background to diversity learning to address a variety of learning styles.

In several studies (Krashen, 2003; Swain, 1993; Van Lier, 1996) concerning second language acquisition, the instructional context is an important factor of consideration. Van Lier (1996) noted that the learner must want to learn the language. This means that the learner must not be forced into learning and should be personally motivated into learning. If this is something that the learner personally wants, then the learner will be exerting effort in acquiring the language as compared to merely being pushed into learning. Krashen (2003) mentioned the importance of a comprehensible input in teaching a second language. This entails that the materials used in learning should not be too complicated to ensure mastery. The degree of difficulty must be properly sequenced to ensure the gradual progression of knowledge. On the other hand, a decade earlier, Swain (1993) said that interaction must follow the acquisition of new knowledge. This ensures that the learner will be able to practice the new knowledge that will help contribute in the learner's competence. Exercises like sentences construction, which can be used in casual conversations and letter writing, should be done since this have high relevance and usefulness for the learner. Thus, interaction is a crucial component in second language acquisition (Cummins & Swain, 1986).

Other important components of an effective language-training program include the methods and materials that are utilized to facilitate the learning experience. Finally, it must be noted that there is no right or wrong way to teach a language, as there will be no program sufficient enough to ensure proficiency and mastery (Ellis, 2015). Teaching must be accorded to the needs of the student and must be able to fit their learning ability. The instructor holds a valuable role in identifying what the students need; therefore it is also just as important that the teachers must be well-trained in assessing the students' needs and how they should be taught (Goe, Holdheide, & Miller, 2014). In addition, evaluation and assessment is another important component in language training program. The pre-test was needed to assess the existing knowledge of the student on the language, while the exit exam or post-test assessed whether the student was able to acquire the necessary knowledge after the training program. All these components must be integrated in the language program to ensure that the goal is achieved.

### **Experiential Learning**

The foundation of experiential learning is traced back to the development in cognitive psychology theories and humanistic psychology theories. According to Kolb (2015), experiential learning is “A particular form of learning from life experiences; often contrasted it with lecture and classroom learning” (p. 10). Keeton and Tate (1978) defined it as

Learning in which the learner is directly in touch with the realities being studied. It is contrasted with learner who only reads about, hears about, talks about, or writes about these realities but never comes into contact with them as part of the learning process. (p. 64)

Hence, experiential learning emphasizes learning from the direct individuals' life experiences. Today, educational institutes offer this broach of learning in different ways,

such as internships, classroom experiences that add direct experience to learners' academic studies and in different kind of projects, depending on the field. According to Arbaugh, DeArmond, and Rau (2013) 27% of climax cited articles in management educational journals addressed topics of experiential learning. Obviously, research including experiential learning has increased in education, health care, engineering, computer science and space science.

### **Foreign Language Vocabulary Acquisition**

With the growing demand of globalization, more and more people are deciding to familiarize themselves with other languages. Take the case of the Chinese, Koreans and Japanese who are taking up English as a special course to equip their populations with knowledge of the said language in preparation of a global societal context (Honna & Takeshita, 2014). This came with their (Honna & Takeshita, 2014) belief that learning this skill would give them an edge especially in the field of business and international relations.

In the case of second language refers to any language learned in addition to one's native language. With the case of the native English speakers, a second language would be Spanish, Thai, Filipino, Mandarin, among many others (Cook, 2008). Therefore, second-language acquisition is the process that facilitates the learning of a second language. It must be noted however, that second-language acquisition does not pertain to the practice of teaching a certain language, rather on what the learner does in order to learn a new language (Elis, 2008).

Vocabulary acquisition is a key component to learning and using a language. As an area of study, vocabulary acquisition has closely been connected with the field of

psychology, more specifically with cognitive psychology. In psychology, acquisition in its sense was originally used to giving meaning to the subconscious nature of the learning process (Krashen, 1982). However, most educational psychologist would refer bilingualism to pertain to any form of multilingualism, which is not generally the essence of second-language acquisition. The acquisition of a second language is not to be differentiated from learning a foreign language since the process is similar, however the situation is presented differently (Baker, 2011).

The most notable difference, perhaps, of second-language acquisition in comparison to learning to acquire a person's first language is the degree of competence that the speaker will eventually develop from learning the first language. A native speaker will also have the fluency and fluidity in speaking with his native tongue and this is something that will be difficult to achieve for a foreign speaker (Ellis, 2015). However, studies show that children trying to learn a second language may be able to achieve native-like fluency similar to a native speaker compared to an adult learner (Bailey, Madden, & Krashen, 1974; Brown, 1973). This only happens on rare instances when the learner of a second language undergoes a speech plateau where the knowledge and skills have been fossilized into their system (Bailey et al., 1974; Brown, 1973). Common errors on learning a second language may be traced in pronunciation and syntax. An example of this would be an Arab speaker trying to learn English. Due to the "B" sounding pronunciation of the letter P, they may carry this around in their second-language acquisition thus making the English "P" sounding B-ish like *People*, becoming *Beoble*. Despite the fact that the acquisition of foreign language vocabulary is a standout amongst the most fundamental strides to learning, the final goal of language acquisition is to

comprehend the language and fruitfully utilize it in everyday interactions. For the purpose of this study, the acquisition of vocabulary in a non-native language was measured by this definition using an established instrument to judge the change in the level of understanding of a set of vocabulary, however, the focus of the study was on the integration of the VR technology to facilitate the process of vocabulary acquisition and not the acquisition itself. Furthermore, because of this focus, the context and distinction between second language learning and foreign language learning contexts was irrelevant.

### **Virtual Reality**

Virtual Reality is “A computer technology that gives the illusion, to those who use it, of being immersed in a virtual environment that does not really exist. It is a computer simulation of a real situation where the human subject may interact with the virtual environment, sometime by the mean of non-conventional interface like glasses and helmets on which the scene is represented and the sounds reproduced” (Achille et al., 2016. p. 140).

Stevenson and Lindberg (2015) in the Oxford Dictionary, defined Virtual Reality as “The computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors” (p. 431).

Concepts of virtual reality existed before Jaron Lanier coined the term of *Virtual Reality* in 1987. The following is a brief glimpse into the technology progression and innovators’ path for developing the virtual reality that is overwhelmingly popular and fashionable as evident today.



## Initial Attempts at Virtual Reality

The first attempt in discovery of 3-D was in 1838 by Charles Wheatstone, when he created a *stereoscopic motion picture*. Charles Wheatstone's believed that the human's brain treats the different two-dimensional pictures from each eye to see a particular object of three dimensions Zone (2014). We can see similar concepts of this today used in Google Cardboard (see Figure 1).



*Figure 1: The Stereoscopic Motion Picture and the Optical.* Reprinted from *History of Virtual Reality*, n.d. Retrieved April 11, 2017, from <https://www.vrs.org.uk/virtual-reality/history.html>. Copyright 2017 by Virtual Reality Society. Reprinted with permission.

*Pygmalion's Spectacles* by science fiction writer Stanley Weinbaum in 1930s was the second attempt that describes a goggle-based virtual reality. *Pygmalion's Spectacles*

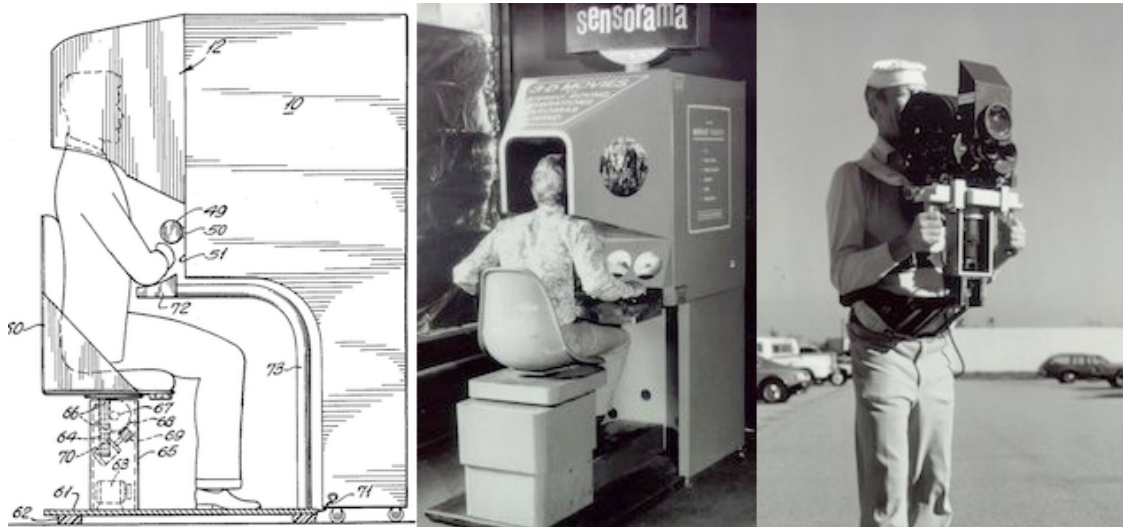
talks about the idea of a pair of goggles that enable the wearers to enter completely in the action of a story and gives sight, smell, taste and touch to the experience (Weinbaum, 2015). Pygmalion's Spectacles, enhances the idea of the virtual reality has been a part of our lives for decades (see Figure 2).



Figure 2: Science Fiction Story Foreseen Virtual Reality. Reprinted from *History of Virtual Reality*, n.d. Retrieved April 11, 2017, from <https://www.vrs.org.uk/virtual-reality/history.html>. Copyright 2017 by Virtual Reality Society. Reprinted with permission.

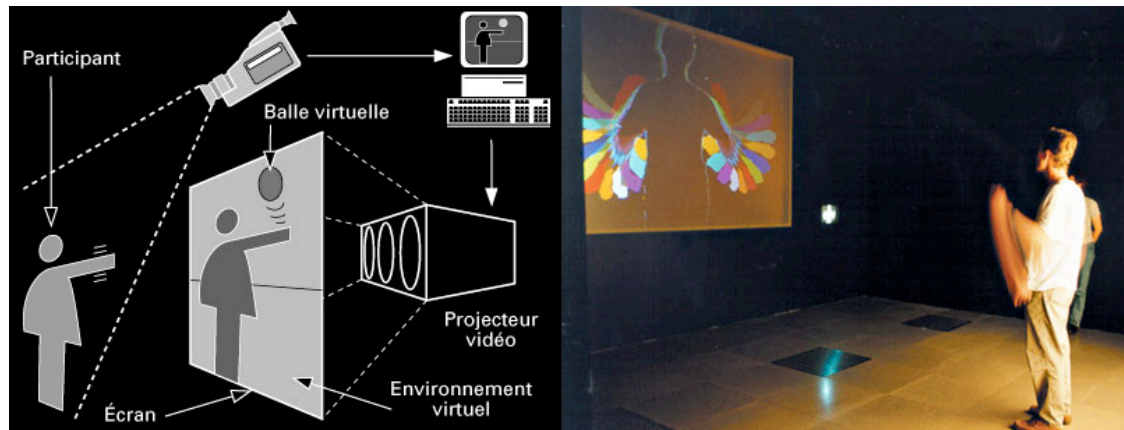
*Sensorama* by Morton Heilig in the mid of 1950s was the first creation that immerse audiences into a film through an arcade-style theatre cabinet that stimulate all the senses. Heilig created six films were titled, *Motorcycle*, *Belly Dancer*, *Dune Buggy*, *Helicopter*, *A date with Sabina*, and *I'm a Coca Cola Bottle*. All these films involved 3D, sounds, colors smell and feelings of motion (Jonassen, 2004), similar to what we term a

4D experience today. Later in 1960 Morton Heilig invented the *Telesphere Mask*, which considered the first VR head mounted display (HMD; see Figure 3). The headset offered 3D vision compounded with stereo sound (Plant & Murrell, 2007).



*Figure 3: Morton Heilig's Sensorama. Reprinted from History of Virtual Reality, n.d. Retrieved April 11, 2017, from <https://www.vrs.org.uk/virtual-reality/history.html>. Copyright 2017 by Virtual Reality Society. Reprinted with permission.*

In 1969 a virtual reality computer artist, Myron Kruegere, developed *Artificial Reality* (see Figure 4). Artificial Reality was a group of experiences utilized a sensory floor to perceive the applicants' actions around the environment (Plant & Murrell, 2007).



*Figure 4: Myron Krueger's Artificial Reality. Reprinted from *History of Virtual Reality*, n.d. Retrieved April 11, 2017, from <https://www.vrs.org.uk/virtual-reality/history.html>. Copyright 2017 by Virtual Reality Society. Reprinted with permission.*

## Creating Virtual Reality

After all the early attempts at virtual reality, there was not a term to describe all these developments in this research area or field. In 1987 Jaron Lanier coined the term “Virtual Reality” when his company Visual Programming Lab (VPL) developed a range of virtual reality gear. VPL was the first company that sold virtual reality goggles in the world.

## Virtual Reality and Education

### Use in Education

Education has adopted virtual reality in the teaching/learning process to present complex data in an accessible, fun and easy way for students to learn. Thus, virtual reality not only allows students to interact with each other individually or in a group in a 3D environment, but goes beyond that to enable students from interacting with objects in the virtual reality environment to find out, explore and to build their own knowledge.

Piovesan, Passerino, & Pereira (2012) outlined many advantages of using virtual reality for educational purposes:

The Virtual Reality can be used to make the learning more interesting and fun with the purpose of improving the motivation and attention, decreasing costs when using the objective and the real environment no matter how expensive the simulation is. It also makes possible that situations that were impossible to explored in the real world can be done, for example: exploring a planet like Mars, traveling inside the human body, doing submarines explorations or inside caves, visiting very small places to be seen (molecules) or very expensive or very far away, or yet because this place is in the past (historical places). (p. 256)

This supports that the virtual reality may be newcomers to instructional practice as a valid mechanism for motivating and engaging learners.

Astronomy students can discover the solar system and how it rotates by physical engagement in VR environment, which is not a possible experience in real life. *Titans of Space and GeoDome* is an experience that VR user can see planets, stars, and earth and move around them. Hence, virtual reality helps students and teachers to find out and explore precise information of objects and micro and macro visualizations that cannot be possible to experience them in real life with the naked eye as evidenced through qualitative results in a study by Young, Farnsworth, Grabe, and Guy (2012).

The vastness of the universe--that was significant. [In the GeoDome] it was easy for the students to see how many stars and galaxies there are and it was quite eye-opening. It was also easy for the students to recognize the orbits and different rotations of the planets. It made them want to learn more. (p. 634)

This brings new experiential opportunities to teaching and learning.

Zarzuela, Díaz Pernas, Martínez, Ortega, and Rodríguez (2013) conducted a study on a serious game with augmented reality for children and handicapped people about the animal, and the result showed Augmented Reality is very beneficial to strength the long-

term memory of knowledge. In this study (Zarzuela et al., 2013), participants increased their knowledge about a study topic “animals” when they remembered the answers clearly after redoing the same questions again after few days. Tarng, Ou, Yu, Liou, and Liou (2015) created an ecology education system by combining mobile technologies and the Augmented Reality (AR) for learning butterfly ecology on the university campus to investigate whether using the virtual butterfly ecological system would lead to different learning effectiveness. The statistical result showed that the experimental group that used the virtual butterfly ecological system has a better accomplish learning tasks and the participants feel comfortable to receive knowledge than the control group.

### **Transforming Apps**

The following is a brief glimpse at the most recent virtual reality apps that may have the most pervasive impact on education:

- *LectureVR* (Immersive VR Education, 2016) enables learners from anywhere in the world to attend their classes and communicate with their classmates virtually within a VR environment.
- *Titans of Space* (Drash VR LLC, n.d.) enables learners to take a deep-dive journey into our solar system and bring them beyond that to find out and explore precise information of solar system that cannot be seen with the naked eye.
- *House of Languages* (Fox3D Entertainment, 2016) a new VR application to master many languages such as English, German, French, Russian or Spanish. It is a highly useful for gaining new words through several

channels of perception in VR (Fox3D Entertainment, 2016). Through this app, the user can:

- See the object and its corresponding name,
- Hear the name of the object,
- Repeat the name of the object.
- *Unimersiv* (Unimersiv, 2016) is a package of educational virtual reality apps, containing 4 educational experiences: 1. Explore the International Space Station 2. Human Anatomy VR 3. Travel to learn about Stonehenge in Wiltshire, England, as it was 5000 years ago in VR. 4. Explore the Titanic virtually like never before.
- *InMind* (Nival | Games, 2015) scientific game enables learners to experience the tour into the patient's brain looking for the neurons that cause mental disorder (Ergürel, 2016).
- *Egyptian Mysteries* (Unimersiv, 2016) investigation game that teaches learners about the ancient Egypt through journey inside the pyramid of Giza and inside Ramses. Help learner to improve the problem-solving skills through finding out what happened to the hero's brother that disappeared.

These examples are just several of the initiatives that bring virtual reality into the classroom setting. Applications and research in this area for k-12 and higher education are just starting. Hence, modernizing production in the virtual reality applications will serve a wide range of people and organizations: practitioners, nurses, administrators, universities, clinics, healthcare companies and private sector (Ghanbarzadeh, Ghapanchi, Blumensein, & Talaei-Khoei, 2014). This study leads a new initiative through using

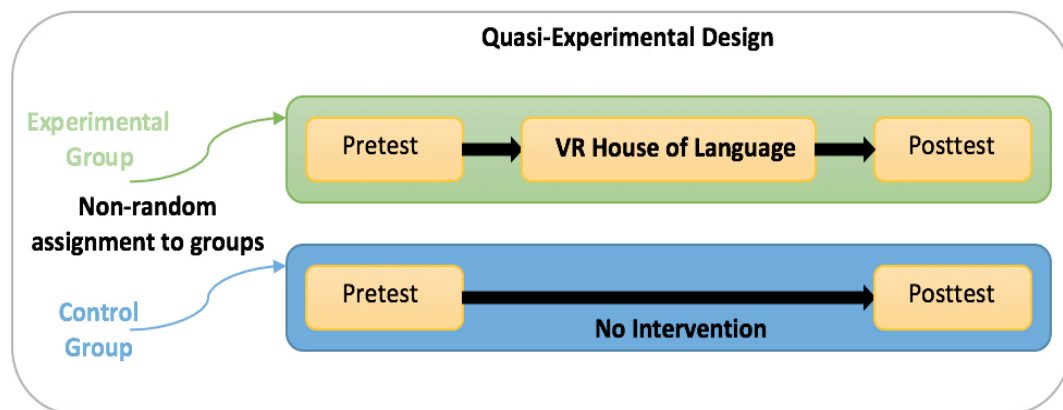
*House of Languages* App developed by the Estonian game company Fox3D, and Samsung VRGear (powered by Oculus, 2015) for the purpose of exploring virtual reality in classroom contexts as a means to improve the foreign language vocabulary skills of intermediate school students.



### CHAPTER III

### METHODOLOGY

Qualitative, experimental and descriptive research methods (Glass & Hopkins, 2008) are all concerned with providing descriptions of a situation that happens naturally; however, for the purpose of this study the design using quasi-experimental methods provides a clear path to understanding the research questions. It also involves the collection techniques used to specify, delineate, or describe naturally occurring phenomena with experimental manipulation. According to White and Sabarwal (2014) quasi-experimental methods that involve the creation of a comparison group are most often used when it is not possible to randomize individuals or groups to treatment and control groups (see Figure 5).



*Figure 5: Quasi-Experimental Design*

The researcher used the quasi-experimental design for three reasons. a) Difficulty of randomizing subjects: because this study used a convenience sampling, the sample can't be fully randomized. (b) Small available sample size: the implementation in this study occurred in Eastern Region, Saudi Arabia, so the expected sample size was small because of the number of students in the classroom. Moreover, the expected sample in the teacher's perception survey was one teacher considering the number of the classroom that did participate in this study. (c) Difficulty to randomize by locations: because the implementation in this study occurred in intermediate school classrooms in the Amer bin Senan school in the Eastern Region, Saudi Arabia, so it was difficult to randomize the school by location. An assignment to the school was not by randomization because the researcher sent six applications to six different schools that teach English as a second language and with minority of English native-speaker students hoping to get an acceptance from one school to conduct the study.

The purpose of this study was to explore the various effects of virtual reality games to students, particularly relating to their learning process in vocabulary acquisition. In this paper, the researcher formulated the following questions to help establish the goals and objectives of the study:

- Q1     Is there a statistically significant difference between vocabulary knowledge of intermediate school students who engage learning with and without use of a virtual reality vocabulary learning game?
  - Q1a.   What is the change in vocabulary acquisition of the experimental group?
  - Q1b.   What is the change in vocabulary acquisition of the control group?

- Q2     What are the perceptions of teachers who integrate a virtual reality vocabulary learning game into their pedagogical practices for teaching vocabulary skills to intermediate school students?
- Q3     What are the perceptions of intermediate school students who use a virtual reality vocabulary learning game as a learning method for developing vocabulary?

### **Sample**

Participants of this study were students age 12-15 who were engaged in vocabulary acquisition in a non-native language learning course and their teacher. They were selected using convenience sampling so the school was non-randomly selected and the subgroups were randomly selected. The vocabulary acquisition program was analyzed in terms of efficiency and effectiveness with and without the inclusion of virtual reality for 14 days, 4 times per week during school-day class time. The implementation in this study occurred in intermediate school classrooms in the Amer bin Senan school in the Eastern Region, AL-Khobar, the kingdom of Saudi Arabia.

### **Variables**

With respect to the quantitative analysis, the researcher adopted quasi-experimental methods. Quasi-experimental methods enable the researcher to manage the research situation so that causal relationships amongst variables may be evaluated (Cooper & Schindler, 2008).

#### **The Dependent Variable(s)**

The dependent variables were the vocabulary skill acquisition and vocabulary level. Post-test analysis was used, where pre-intervention and post-intervention data collection points was compared amongst all groups. This data was intended to establish the various effects of virtual reality games to students, particularly relating to their

learning process in vocabulary acquisition. The skill acquisition was measured as the development change from pre-tests to post-tests.

### **The Independent Variable**

Independent variable was the method of study to facilitate in the teaching and learning process. The method category included the use of traditional book and lecture, and the use of the gaming intervention only. The participants were divided in two groups, the experimental group and the control group. The experiment was run for 14 days, 4 times per week. During this time, the students followed the program prescribed to them to see whether there was improvement of their vocabulary acquisition.

### **Instruments**

#### **Pre-/Post-vocabulary Test**

A pre-/post-test was developed by the researcher and reviewed by three experts as well as the classroom teacher. A 30-word vocabulary test was given to the students. The words were taken from 6 different topics combined in one test in which students were asked to answer it. The test measured vocabulary learning objectives of the participant groups (Appendix A). The researcher developed the test on Wesche and Paribakht Vocabulary Knowledge Scale (VKS). The basic idea of the scale is to measure progressive degrees of word knowledge. Students have to rate how well they know a word on the following scale:

- I. I don't remember having seen this word before.
- II. I have seen this word before, but I don't know what it means.
- III. I have seen this word before, and I think it means \_\_\_\_\_. (translation in Arabic)

IV. I know this word. It means \_\_\_\_\_. (translation in Arabic)

Paribakht and Wesche (1993) noted, “This five-level description Vocabulary Knowledge Scale represented an attempt to capture different levels of self-perceived knowledge of specific words” (p. 15). These levels were as follows in Table 1. In case of incorrect answers in the pre-/post-test in Level III and Level IV, students were reassigned to the lowest level to which can give an accurate answer.

Table 1

<i>Level Description Vocabulary Knowledge Scale</i>	
Vocabulary Level	Interpretation
Level I	Never Seen
Level II	Seen but Don't Know
Level III	Think I Know
Level IV	Sure I Know

### **Perception Surveys**

Perception Survey is a value-chain assessment methodology that gives the researcher a better understanding of teacher and students impressions of virtual reality technology effectiveness. Two different surveys were developed to measure participants' and teacher's perceptions of the usefulness of the Virtual Reality Game in the learning process (see Appendices B and C). The participants' survey consisted of 10 items while the teacher's survey consisted of 4 items in a Likert scale answered. Each item had 4 responses from *strongly disagree* to *strongly agree*. The surveys consisted of two sections; biography, and participants' and teacher's perceptions of the usefulness of Virtual Reality. The student perception survey was used in combination with Pre-/Post-

vocabulary Test that measured student achievement to provide valuable feedback to the researcher. Another goal of a perception survey is to explore the perception about virtual reality technology among all students.

### Technology Intervention

#### *House of Languages* Virtual Reality Apps

The author of this paper suggests the use of a virtual reality environment game called *House of Languages* to facilitate vocabulary acquisition. *House of Languages* created by the Estonian game company Fox3D, is a virtual reality app to learn Spanish, German, Russian and English (see Figure 6).

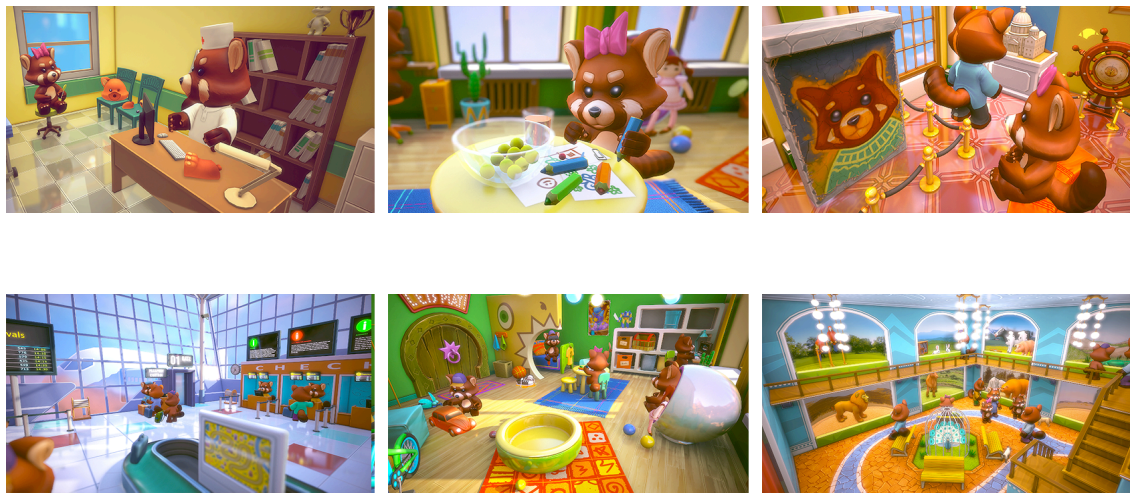


Figure 6: Logo of the *House of Languages* Virtual Reality Game. Reprinted from Fox3D Entertainment, n.d. Retrieved April 11, 2017, from <http://fox3d.com/vr>. Copyright 2017 by Fox3D VR. Reprinted with permission.

However, prior to the start of the vocabulary acquisition program the student vocabulary was tested to assess the level of their vocabulary prior to the program. After the 14 day program, the students were tested again to see if there had been any improvement in their vocabulary.

## Virtual Reality Environments

The Virtual Reality experience in *House of Languages* places players in a cartoon house with a pretty raccoon character host named *Mr. Woo* who walks with the player around the environment teaching the player a foreign language (see Figure 7). When players gaze at 3D objects within the game environment, they are able to observe objects' names and hear the pronunciation. The objective of the game is to facilitate students to learn new foreign words and improve their language skills in an interactive VR environment. Figure 7 presents screen shots of the software *House of Language* environment. You can see different scenes for which vocabulary can be learned.



*Figure 7:* Sample of the game virtual reality environments. Reprinted from Fox3D Entertainment, n.d. Retrieved April 11, 2017, from <http://fox3d.com/vr>. Copyright 2017 by Fox3D VR. Reprinted with permission.

## Samsung Galaxy Smartphone Gear VR

Samsung (2016) stated,

The Gear VR turns your Samsung Galaxy smartphone into a completely portable and wireless virtual reality machine by snapping your phone into the headset. The immersive Super AMOLED screen plus a powerful processor create vivid surroundings and movements so realistic, you'll feel like you've been dropped right into the center of the action. (p. 1)

Figure 8 presents Samsung Galaxy Smartphone *Gear VR*. The headgear works with the Samsung Galaxy smartphone, which you can see in the figure to provide a high quality VR experience.



*Figure 8:* Sample of Samsung Gear VR. Reprinted from Fox3D Entertainment, n.d. Retrieved April 11, 2017, from <http://fox3d.com/vr>. Copyright 2017 by Fox3D VR. Reprinted with permission.

## Procedures

Research design is the general plan for testing a specific hypothesis or research question (Catania, 1998). In this case, the question being presented by the researcher was based on the two-language training programs which yield better results. The research, aimed at establishing causal relationships amongst variables (participants' age,



presentation of lesson, training time and type of evaluation to measure learning), was facilitated through experimentation.

In this specific context, the researcher believes the study required experimental methods to provide a clear path to understanding the research questions. The experiment lasted for 14 days, 4 times per week which commenced and concluded with an evaluation (pre-test and post-test). It was established that the training program varied on several aspects: (a) the presentation of lessons, (b) training time, and (c) type of evaluation to measure learning. Each of these variables affected the conduct of the vocabulary acquisition program. These methods can be explained and classified through multiple characteristics or elements (see Table 2). This warranted the use of primary data. The following plan was followed for accomplishing the experiment:

Two data points (pre and post) across the groups involved in the implementation was evaluated to determine the impacts of the Virtual Reality Game on vocabulary skills. At the end of the treatment, after the post-test was administered, there were two surveys to measure the perceptions of participants in the experimental group (a) the students of *VR House of Languages* as a learning tool and (b) teacher perceptions of implementation of the virtual reality game in the learning and teaching process.

Table 2

*Procedural Step and Timeline*

Procedural Step	Timeline
Develop Pre-/Post-test and review for validity and reliability	Prior to data collection
Develop Teacher Survey	Prior to data collection
Develop Student Survey	Prior to data collection
Select Control and Experimental Groups	
Administer Pre-test	First class session of the experiment period
Vocabulary Learning Activities implemented by classroom teacher. Experimental group will use VR technology during this time.	12 days (experiment period minus first and last day) for 35-45 minutes of game playing
Observation by researcher of classrooms	Approximately four times per week during the experimental period
Administer Post-Test	Last class session of the experiment period
Administer Teacher Survey	
Administer Student Survey	

Initially, a researcher played a brief explanation video to the intervention group to introduce the VR Gear and *House of Languages App*, including their functionalities, and to model how to use the proposed technique. Additionally, participants took a training session for ten minutes on how to wear the VR headset and how to deal with the hand movements and VR headset buttons to set the game. The training session aimed to make sure that participants feel relaxed and more comfortable with the technology and processes.

Students in the experimental group depended on only the virtual reality game during the experiment period to meet the requirement of the course. The teacher used virtual reality technology on two occasions separated by two weeks, for 35-45 minutes of exposure to the virtual reality. During the class time, students rotated wearing VR headsets for 5 minutes for each student to be sure that all students have the same chance to play the VR game.

The control group depended on the traditional way of learning vocabulary, using the book, lecture and worksheets during the experimental period in the learning process. On the other hand, the intervention group depended on only the virtual reality game during the experiment period to meet the requirement of the course.

Both groups took a comprehensive vocabulary test of 30 words that matched vocabulary content to know their baseline in the beginning of the experiment period. This test contained various vocabularies from basic level to advanced vocabulary level (see Appendix D). At the end of the experiment period, the two groups again took the same comprehensive vocabulary test. The questions in the pre- and post-exam were identical; the question order was randomized from the pre-test.

Results from these exams were collected before and after the experiment period from each group and were processed and analyzed quantitatively through SPSS. The researcher chose this design to determine if virtual reality games would improve the vocabulary skills by comparing and analyzing the results of the intervention group with the result of the control group.

Surveys were administered to both student and teacher participants in the experimental group only. The content of the survey focused on the intervention (see

Appendices B and C). Participants needed from five to ten minutes to complete the survey. The intent of the survey was to support investigation of the student and teacher participants' perceptions of the usefulness of the virtual reality game in the learning process of vocabulary acquisition. The survey was completed by the participants directly after taking the post-test. After conducting the survey quantitatively, data was processed and analyzed through SPSS.

### **Data Analysis**

For the purpose of evaluation, the proponent used Independent Sample *t*-tests, Paired Sample *t*-test and Descriptive Statistics Analysis to answer the research questions. In addition, to assume the difference, the proponents applied the use of frequency distribution, weighted mean, and percentage. To be more specific, the researcher looked to the sample means and standard deviations for classroom outcomes to measure by intervention status.

Independent *t*-test analysis was considered an “analysis of independencies” to compare means across groups of participants that were not related to each other in any way. Independent T-test analysis was conducted to compare the post-test scores to find any significance between the experimental and control groups in vocabulary acquisition.

A paired Sample *t*-test is considered an “analysis of dependencies” to compare means across variables that are based on repeated observations. However, the Paired Sample *t*-test was conducted to compare the pre-test scores with the post-test scores in each group; the goal was to know if there was improvement in vocabulary acquisition in each group existing.

The researcher used the Descriptive Statistics analysis to analyze teacher's and students' perceptions of the usefulness of the virtual reality game in the learning process. The researcher used appropriate charts, graphs, and percentages to report the result of each survey item.

### **Validity and Reliability**

#### **Construct and Content Validity**

To look at construct and content validity, I used experts in the fields of educational technology and K-12 education. The researcher plus three content expert reviewers participated in the Content Expert Review. All the expert reviewers were employed at K-12 schools. The reviewers were selected because they had similar background training of at least 10 years' experience in teaching English as a second language. The experts conducted their review independently. To maintain independence of the reviews, all reviewers were asked to conduct the reviews individually; the identity of the other reviewers was not revealed to any reviewer aside from the author.

For each Survey item, the reviewers were asked to rate the item's relation to virtual reality (VR) and the VR dimension of survey items. Each expert was first asked to rate the survey items to the relation to VR - whether it is consistent or inconsistent. Reviewers then rated whether they thought the VR dimension of survey items was related to the *House of Languages* application and/or Virtual Reality. All experts examined the same questions used in the survey Content Expert Review Form developed by the researcher (see Appendices E, F, and G).

## Reliability

To examine internal consistency, the researcher used SPSS to calculate Cronbach's Alpha for both pre-/post-test and participants' and teacher's perceptions surveys. The reliability was interpreted according to Altman's Benchmark Scale (Gwet, 2014), as follows:

Table 3

*Altman's Benchmark Scale*

Cronbach's Alpha	Interpretation
0.81 to 1.00	Very Good Reliability
0.61 to 0.80	Good Reliability
0.41 to 0.60	Moderate Reliability
0.21 to 0.40	Fair Reliability
Less than 0.20	Poor Reliability

## Conclusion

The data collection and analysis presented in this chapter yielded interesting results about the vocabulary levels of intermediate school students who engage learning with and without use of a virtual reality vocabulary learning game. Additionally, perceptions of the teacher participant and students provide insight about their experiences with VR. This data and subsequent analysis are presented in the following chapters.

## **CHAPTER IV**

### **RESULT**

This chapter considers the reliability and validity of the testing, as well as the analysis underpinning the collected data. The purpose of this study was to examine the effects of virtual reality (VR) technology in facilitating learning processes in ESL vocabulary acquisition for students. The research questions were the following:

- Q1     Is there a statistically significant difference between vocabulary knowledge of intermediate school students who engage learning with and without use of a virtual reality vocabulary learning game?
  - Q1a.   What is the change in vocabulary acquisition of the experimental group?
  - Q1b.   What is the change in vocabulary acquisition of the control group?
- Q2     What are the perceptions of teachers who integrate a virtual reality vocabulary learning game into their pedagogical practices for teaching vocabulary skills to intermediate school students?
- Q3     What are the perceptions of intermediate school students who use a virtual reality vocabulary learning game as a learning method for developing vocabulary?

Data analysis includes independent t-tests and paired samples t-tests. In addition, descriptive statistics were used to describe the survey results regarding participant's and teacher's perceptions of the usefulness of VR. The researcher used an alpha level of 0.05 as a standard in analyzing data. The results of the analyses are presented for each research question.

## **Reliability and Validity**

### **Reliability**

Reliability was examined for both vocabulary test and participants' survey using an internal consistency procedure to calculate Cronbach's Alpha. According to Altman's Benchmark Scale (Gwet, 2014), an  $\alpha$  between 0.81 and 1.00 is very reliable (see Table 3). The vocabulary test showed high reliability (Cronbach's  $\alpha = 0.899$ ). The participants' survey also showed very good reliability (Cronbach's  $\alpha = 0.879$ ). The teacher survey reliability is not measured as only a single survey response was collected.

### **Construct and Content Validity**

Construct and content validity refers to the extent to which a specific item in the test and the surveys reflect content domain (DeVellis, 2012). To look at the construct and content validity of the test and surveys, three experts in K-12 education, as well as the researcher, reviewed the items in both the vocabulary test and all participant surveys. All experts examined the same items using Content Expert Review Forms developed by the researcher (see Appendix E, F, and G). The experts were selected upon their experiences and backgrounds. All expert reviewers had similar background training of at least 10 years' experience in teaching English as a second language. To maintain the independence of the reviews, all reviewers were asked to conduct the reviews individually; the identity of the other reviewers was not known to anyone but the researcher. In the vocabulary test created to match vocabulary content, reviewers were asked to rate:

- (1) How consistent was the test in relation to the content to be taught in classrooms during the experimental period?



- (2) Were there any spelling errors?
- (3) Were there any grammatical mistakes?
- (4) Did the reviewer have any other recommendations to further improve the test?

Responses from the experts were in 100% agreement that the test was consistent in relation to the content. Also, the experts were in 100% agreement that the test was free of spelling errors and grammatical mistakes. According to the experts' responses, the vocabulary test can be considered to have construct and content validity. Initially, the vocabulary test consisted of both words and pictures. The recommendations of all the experts were to exclude the pictures from the test. The first expert noted "due to the nature of Saudi students and the vocabulary test design (provided with pictures), all baseline correct responses will be expected. It is very easy for the students to guess the meaning of the words by looking to the pictures without even reading the words." The second expert noted "I'd recommend to remove the pictures!" The third experts indicated "Good luck, but I prefer the test without pictures." Following the reviewers' recommendations, the pictures were removed from the test.

In the participant and teacher survey, reviewers were asked to rate:

- 1. How consistent was the survey in relation to the VR Game being used in the classroom during the experimental period?
- 2. Which dimension the survey item belong to--where dimension refers to VR technology or the House of Languages Application?

Responses from the experts were in 100% agreement that the survey items were consistent in relation to the VR Game. Also, the experts were in 100% agreement that the survey items belonged to at least one of the dimensions that survey contained. According

to the experts' responses, the participant and teacher surveys can be considered to have construct and content validity.

### **Data Analysis**

In this study, 64 intermediate school students participated and were divided randomly into two groups; each group contained 32 students. The experimental group used the VR technology in the learning process in ESL vocabulary acquisition. The control group used the traditional learning method in ESL vocabulary acquisition. All students in the experimental group and control group were administered the pre-test to measure a baseline at the onset of the experimental period. The researcher created the vocabulary test (Appendix A) of 30 words that match vocabulary content being taught in classrooms during the experimental period. The same comprehensive vocabulary test (Post-test) was administered to all groups of students at the accomplishment of the 2-week period of time to compare if a significant difference existed in their learning effectiveness.

The return rate of the pre- and post-tests given was 100%. The return rate of the participants' survey from the experimental group was 100%, while the control group did not take the participants' survey because they did not use the technology. Each test item was scored according to Wesche and Paribakht Vocabulary Knowledge Scale (VKS), rated from 1 to 4 (see Table 3). Individual pre-test and post-test scores were calculated by summing each student's ratings, with a possible range from 30 to 120 for the total rating of the test. Once the students completed the tests and the survey, the researcher scored the results. The results were imported into Excel for analysis. The data was analyzed by using SPSS version 23 (IBM Corp, 2015).

### Independent Sample *t*-test Analysis

- Q1 Is there a statistically significant difference between vocabulary knowledge of intermediate school students who engage learning with and without use of a virtual reality vocabulary learning game?

The corresponding hypothesis test considered the means of the post-test scores for the experimental and control groups ( $H_0: \mu_1 = \mu_2$ ,  $H_a: \mu_1 \neq \mu_2$ ). Before this hypothesis could be tested, it first had to be established that no initial differences existed between the two groups. Baseline scores on the vocabulary pre-test for the students indicated that the students had acceptable initial knowledge of the content topics. Table 4 shows the pre-test average of the experimental group ( $\bar{x} = 58.53$ ) and the control group ( $\bar{x} = 59.06$ ). Table 5 shows the variance of populations are equal ( $p = 0.795$ ), as such the independent samples test assumes equal variances. Table 5 also shows no statistically significant difference in pre-test scores between students in the experimental group and control group [ $t(145) = 62$ ;  $p > .05$  two-tailed], suggesting both groups had the same vocabulary level at the onset of the experimental period. As it appears both groups come from similar populations prior to treatment, the hypothesis can be tested regarding post-test scores to see if a difference between the two groups exists after the experiment was conducted.

Table 4

*Independent Sample Statistics for Both Experimental and Control Groups*

	Mean	Standard Deviation	<i>N</i>
Pre-Test			
Treatment	58.53	14.70	32
Control	59.06	14.62	32
Total	58.80	14.55	64
Post-Test			
Treatment	81.47	18.68	32
Control	71.16	13.09	32
Total	76.31	16.83	64

Table 5

*Independent Samples t-test: Pre-test*

Pre-test	<i>F</i>	Sig.	<i>t</i>	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal Variances									
Assumed	.068	.795	.145	62.000	.885	.5313	3.665	-6.795	7.8572
Not Assumed			.145	61.998	.885	.5313	3.665	-6.795	7.8572

An independent samples  $t$ -test was conducted to see if a statistically significant mean difference in post-test vocabulary levels between the experimental and control group exists. As Table 6 shows, the variance of populations for post-test scores are not equal ( $p = 0.003$ ) the independent samples test will no use assumed equal variances. Table 6 also shows, a statistically significant difference does exist in post-test scores between students using the VR vocabulary learning game and those that did not [ $t (55.53) = 2.56; p < .05$  two-tailed].

Table 7 shows the variance of populations for the difference are not equal ( $p = 0.000$ ), and will not be assumed in the independent samples test. As Table 7 shows, a statistically significant difference does exist in the difference between the pre-test and post-test scores among students using the VR vocabulary learning game and those that did not [ $t (38.25) = 3.82; p < .05$  two-tailed].

The groups show little difference at the beginning of the experiment, while showing statistically significant differences after the treatment. Furthermore, the result at the end of experimental period indicated that students using the VR game *House of Languages* had greater achievement in learning vocabulary than those using the traditional method in learning vocabulary.

Table 6

*Independent Samples t-test: Post-test*

Post-test	<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal Variances									
Assumed	9.89	.003	2.56	62.00	.013	10.313	4.033	2.251	18.374
Not Assumed			2.56	55.53	.013	10.313	4.033	2.232	18.393

Table 7

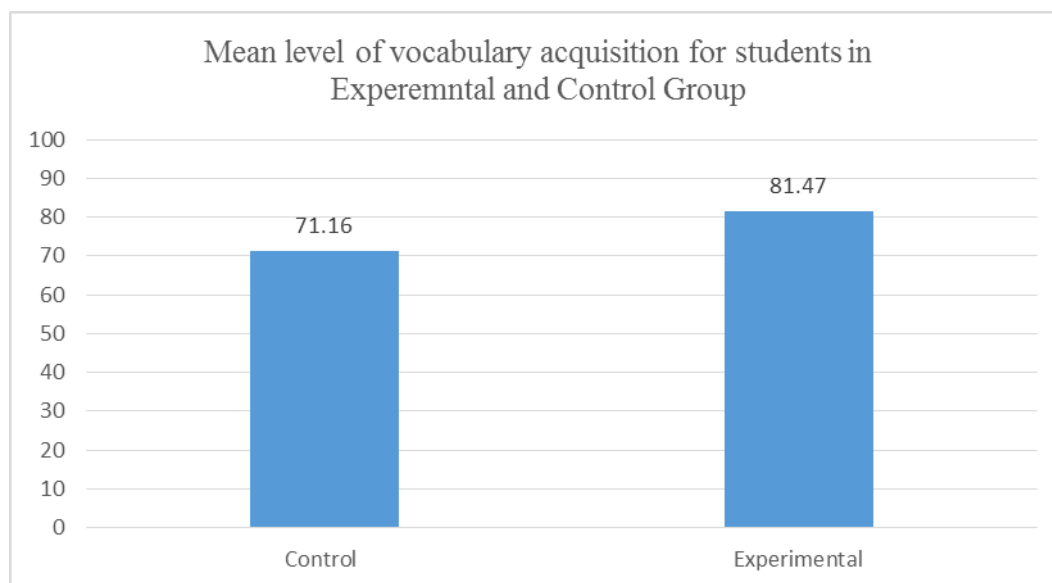
*Independent Samples t-test: Difference between the Pre- and Post-tests*

Levene's Test for Equality of Variance			<i>t</i> -test for Equality of Means						
Difference	<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal Variances									
Assumed	21.45	.000	3.82	62.00	.000	10.844	2.842	5.165	16.523
Not Assumed			3.82	38.25	.000	10.844	2.842	5.094	16.594



The mean difference between the two groups is shown in Table 6, along with the 95% confidence interval of the difference. The effect size for difference between means (mean difference = 10.313, 95% *CI*: 2.232 to 18.393) in the treatment conditions was medium (eta squared  $\eta^2 = 0.09$ ). Students who used the VR method scored 0.09 standard deviations higher on the vocabulary acquisition test (than the untreated population of  $\bar{x} = 71.16$ ).

The sample means are displayed in Figure 9, where students in VR group scored significantly higher on vocabulary acquisition than students in the traditional group (for VR group,  $\bar{x} = 81.47$ ,  $sd = 18.68$ ; for traditional group,  $\bar{x} = 71.16$ ,  $sd = 13.09$ ).



*Figure 9:* Mean levels of vocabulary acquisition for students in Experimental Group and Control Group (Significant Differences Observed)

### Paired Sample *t*-test Analysis

A paired sample *t*-test was used to evaluate the difference between each group's individual's pre-test and post-test scores to see whether there was an improvement in vocabulary acquisition in each group.

Q1a. What is the change in vocabulary acquisition of the experimental group?

The corresponding hypothesis test considers the mean differences of the pre-test and post-test scores for the experimental group ( $H_0: \mu_d = 0$ , with  $H_a: \mu_d \neq 0$ ). A paired-samples *t*-test was conducted to evaluate the impact of the VR technology game *House of Languages* on students' ratings on the vocabulary acquisition. The experimental group result (shown in Tables 8 and 9) indicated a statistically significant increase in the vocabulary levels scores from pre-test ( $\bar{x} = 58.53$ ,  $sd = 14.69$ ) to post-test ( $\bar{x} = 81.47$ ,  $sd = 18.68$ ) [ $t(31) = 8.539$ ,  $p < .05$  (two-tailed)]. Students in the experimental group scored higher in the post-test compared to their pre-test scores.

Table 8

*Paired Samples Statistics: Experimental Group*

Group	Mean	<i>N</i>	Standard Deviation	Std. Error Mean
Experimental Post	81.47	32	18.68	3.303
Experimental Pre	58.53	32	14.69	2.599

Table 9

*Paired Samples t-test: Experimental Group*

Group	Paired Difference					<i>t</i>	<i>df</i>	Sig. (2-tailed)
	Mean	Standard Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Experimental Post - Pre	22.94	15.195	2.686	17.46	28.42	8.539	31	< 0.001

The mean increase vocabulary levels score was 22.94 with a 95% confidence interval ranging from 17.46 to 28.42. Effect size was large ( $\eta^2 = .7$ ), with a substantial difference in the vocabulary acquisition test scores obtained before and after the intervention.

Q1b. What is the change in vocabulary acquisition of the control group?

The corresponding hypothesis test considers the mean differences of the pre-test and post-test scores for the control group ( $H_0: \mu_d = 0$ , with  $H_a: \mu_d \neq 0$ ). A paired-samples  $t$ -test was conducted to evaluate the impact of the traditional method in learning vocabulary on students' scores on the vocabulary acquisition. The control group result in Table 10 and 11, indicates a statistically significant increase in the vocabulary levels scores from pre-test ( $\bar{x} = 59.06$ ,  $sd = 14.62$ ) to post-test ( $\bar{x} = 71.16$ ,  $sd = 13.09$ ) [ $t(31) = 13.075$ ,  $p < .05$  (two-tailed)]. Students in the control group had better post-test scores compared to their pre-test scores.

Table 10

*Paired Samples Statistics: Control Group*

Group	Mean	N	Standard Deviation	Std. Error Mean
Control Post	71.16	32	13.09	2.314
Control Pre	59.06	32	14.62	2.584

Table 11

*Paired Samples t-test: Control Group*

Group	Paired Difference					<i>t</i>	<i>df</i>	Sig. (2-tailed)
	Mean	Standard Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Control Post - Pre	12.094	5.232	0.925	10.21	13.98	13.075	31	< 0.001

The mean increase vocabulary levels score was 12.094 with a 95% confidence interval ranging from 10.21 to 13.98. Effect size was large ( $\eta^2 = .8$ ). There was a large effect, with a substantial difference in the vocabulary acquisition test scores obtained at the beginning and end of the experimental period.

### **Descriptive Data Analysis for Research Questions 2 and 3**

Two surveys were administered to both students and teacher participants in the experimental group only. The content of the surveys was focused on the intervention (see Appendices A and B). Control group participants did not complete the survey because they did not use the VR technology. The intent of the survey was to support investigation of the students and teacher participants' perceptions of the usefulness of VR Game in the learning process of vocabulary acquisition.

Q2     What are the perceptions of teachers who integrate a virtual reality vocabulary learning game into their pedagogical practices for teaching vocabulary skills to intermediate school students?

After the students in the experimental group finished using VR game *House of Languages*, the experimental classroom teacher was surveyed as to his perception of VR in term of usefulness as a learning method for developing vocabulary acquisition. Figure 10 shows the teacher indicated that he *strongly agreed* using of VR Games in class benefited his teaching (Q1). Also, there was a clear acceptance from the teacher regarding the usage VR technology and the VRG *House of Languages* during the classroom (Q2). The teacher indicated that the VRG presented a meaningful learning activity (Q3). Finally, the teacher indicated he *strongly agreed* that the VRG allows teachers to address individual learner differences in one learning activity (Q4).

	Q1	Q2	Q3	Q4
■ Strongly Agree	✓	✓	✓	✓
■ Agree				
■ Disagree				
■ Strongly Disagree				

Figure 10. Teacher perception of the usefulness of Virtual Reality

Q3 What are the perceptions of intermediate school students who use a virtual reality vocabulary learning game as a learning method for developing vocabulary?

A survey was conducted to analyze the perceptions of the experimental group students after using the VR vocabulary learning game *House of Languages* as a learning method for developing vocabulary acquisition. The majority of the student's responses stated they liked VR Technology. Students generally perceived *House of Languages* as learning, challenging and having fun. The result in *Figure 11* shows more than 90% of students' responses were *strongly agree* or *agree* that they learned English vocabulary because they used the VR Game *House of Language*. More than 88% of students *agreed* or *strongly agreed* that vocabulary topics presented by *House of Language* were interesting. About 96% of students believed that their school should continue to use the VR Games for learning. Approximately 94% of student indicated that the VR game *House of Language*, helped them understand what other native English speaking teens and classmates were saying. Only 6% of students reported not enjoying the VR technology equipment.

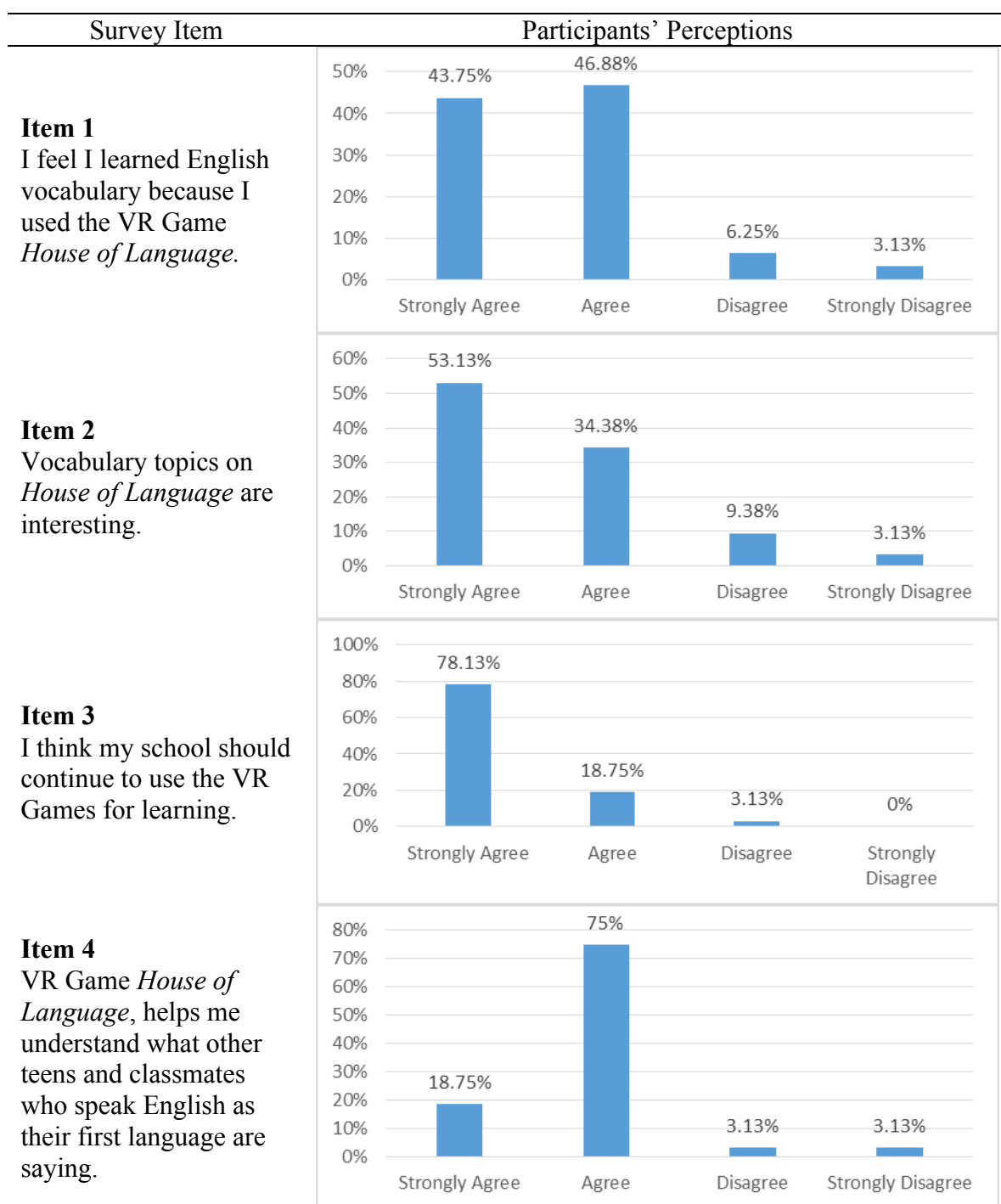


Figure 11. From item 1 to item 4, Participants' perceptions of the usefulness of Virtual Reality.



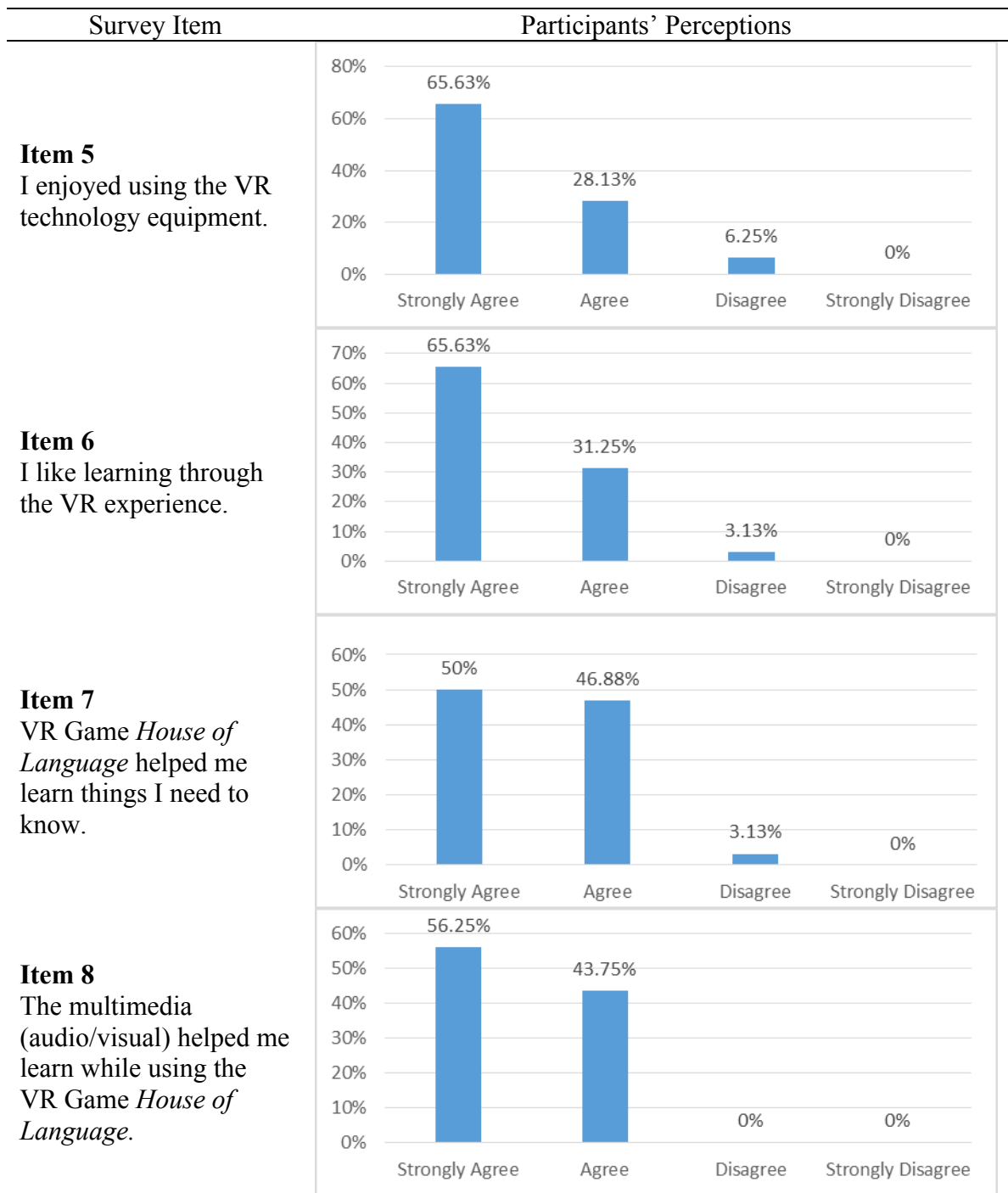


Figure 11. From item 5 to item 8, Participants' perceptions of the usefulness of Virtual Reality.

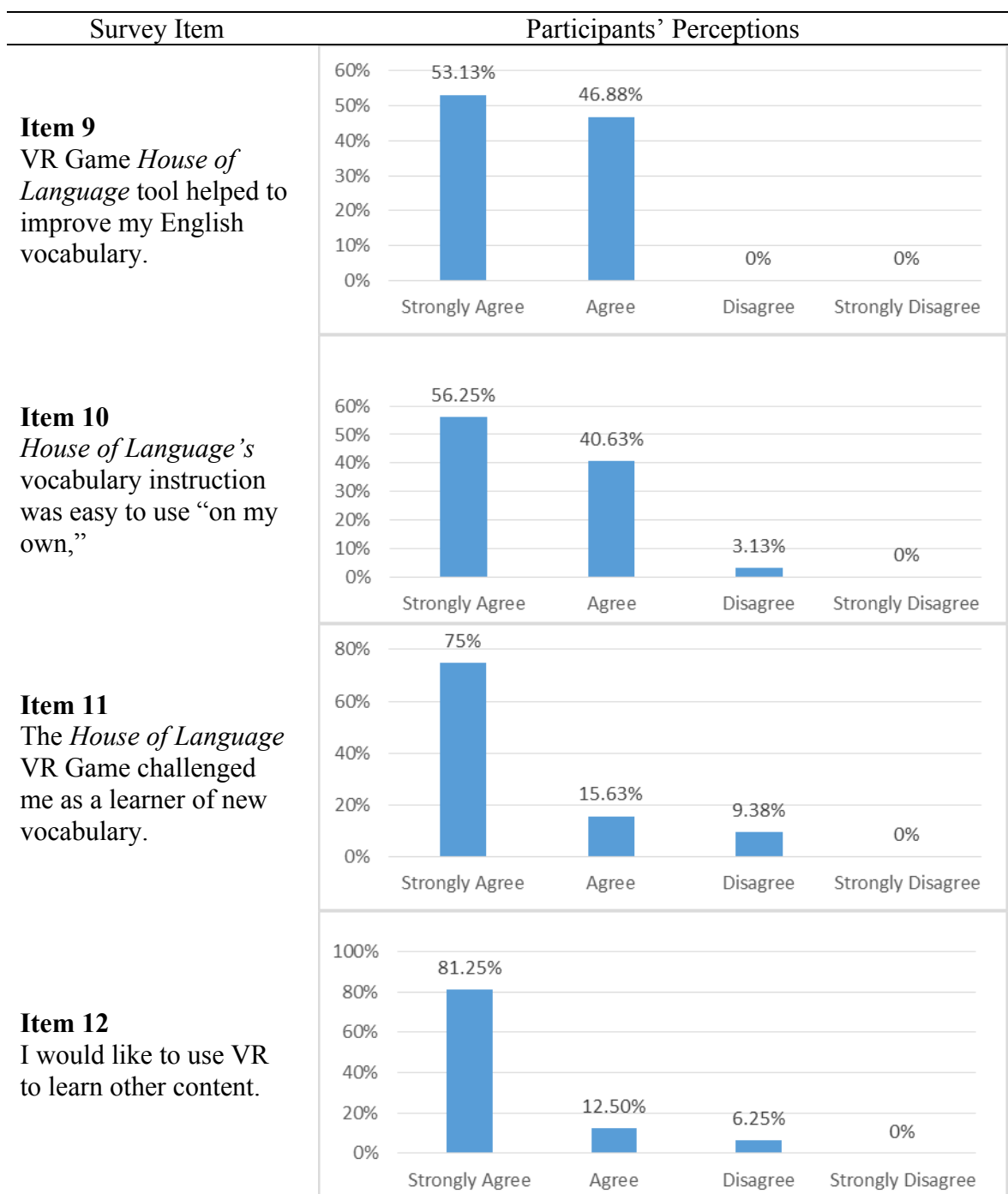


Figure 11. From item 9 to item 12, Participants' perceptions of the usefulness of Virtual Reality.

The majority of students loved learning through the VR experience, as evidenced by their enthusiasm for the technology and eagerness to participate in the lessons, and

indicated that it helped them learn things they needed to know. All the students felt the multimedia (audio/visual) helped them learn while using the VR Game *House of Language*. All students indicated that the VR Game *House of Language* tool helped to improve their English vocabulary. Moreover, about 97% of the students stated the *House of Language*'s vocabulary instruction was easy to use "on their own" while 3% of students stated it was not easy to use "on their own." Approximately 90% of students *strongly agree* or *agree* that the *House of Language* VR Game challenged them as learners of new vocabulary. Finally, about 94% of students *strongly agreed* or *agreed* that they would like to use VR to learn other content.

### **Summary of Finding**

This chapter has presented the reliability and validity of the testing, as well as the analysis underpinning the collected data to answer the study research questions. Exploratory results indicated both the vocabulary test and students' survey demonstrated high reliability, while the teacher survey reliability is not measured because of the limited size of the sample. The expert content reviewers were in 100% agreement that the test was consistent in relation to the content and free of spelling errors and grammatical mistakes. Pictures were removed from the test based on the reviewers' recommendations. Also, the reviewers were in 100% agreement that the survey items were consistent in relation to the VR Game and belonged to at least one of the dimensions that the surveys examined.

The result from the data analyses demonstrated significant results consistent with the research hypotheses. An independent sample t-test analysis indicated that the experimental and control group in the beginning of experimental period had the same

vocabulary level, while at the end of the experimental period students using the VR game *House of Languages* had greater achievement in learning vocabulary than those using the traditional method. Also, the effect size for the difference between the means was medium. The paired sample t-test analysis indicated that students in the experimental and control group scored higher in the post-test compared to their pre-test scores. Here, the effect size for difference between means in each group was large. Finally, the result from the participants' and teacher surveys were positive and supported integrating the virtual reality in the learning process as an effective tool in second language vocabulary acquisition.

## CHAPTER V

### DISCUSSION

The research questions for this study were:

- Q1     Is there a statistically significant difference between vocabulary knowledge of intermediate school students who engage learning with and without use of a virtual reality vocabulary learning game?
  - Q1a.   What is the change in vocabulary acquisition of the experimental group?
  - Q1b.   What is the change in vocabulary acquisition of the control group?
- Q2     What are the perceptions of teachers who integrate a virtual reality vocabulary learning game into their pedagogical practices for teaching vocabulary skills to intermediate school students?
- Q3     What are the perceptions of intermediate school students who use a virtual reality vocabulary learning game as a learning method for developing vocabulary?

The purpose of this study was to determine the degree of ESL vocabulary acquisition achievement of intermediate school students that occurs when the virtual reality game (VRG) *House of Languages* is integrated into the learning process. Before doing this study, there was no published information that determined which instructional method--traditional or VR--was the most effective in ESL vocabulary acquisition. The prior chapter presented the results of the analysis to answer the research questions. This chapter provides a discussion of those results. The findings have contributed information to understanding the implications of instruction that uses VR for vocabulary learning in place of traditional methods.

The results from the previous chapter indicated that

1. Students using the VRG *House of Languages* had greater achievement in learning vocabulary than those using the traditional method in learning vocabulary.
2. Students in the experimental group scored higher in the post-test compared to their pre-test scores.
3. Students in the control group had better post-test scores compared to their pre-test scores.
4. The teacher loved teaching through the VR experience and indicated that it helped him in the students' learning process.
5. Students generally perceived VRG *House of Languages* as learning, challenging and having fun.

Learning by playing is a ubiquitous method for many educators and self-learners. With the rapid development of the technology, it is necessary to integrate these new developments in the learning process. Many educators have not yet adopted the new technology (VR) as a teaching and learning tool to enhance a student's learning experience. This study used VR technology with an interesting and realistic learning environment as an effective method in the learning process, particularly in the field of ESL vocabulary acquisition. The results were positive and supported the study hypotheses.

- Hypothesis 1

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 \neq \mu_2$$

This hypothesis was tested by comparing the post-tests scores mean of control group with post-test scores mean of experimental group. Means of post-tests scores were not equal so, there was a statistically significant difference.

- Hypothesis 2

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 \neq \mu_2$$

This hypothesis was tested by comparing the pre-test scores mean with post-test scores mean of control group for the students. The pre-test scores mean and the post-test scores mean were not equal so, there was a statistically significant difference.

- Hypothesis 3

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 \neq \mu_2$$

This hypothesis was tested by comparing the pre-test scores mean with post-test scores mean of experimental group. The pre-test scores mean and the post-test scores mean were not equal so, there was a statistical significant difference.

## Results

### **Finding 1: Greater Achievement in Learning Vocabulary**

Students in the experimental group showed their ability and enthusiasm to interact with the new learning method that contributed positively to their achievement in learning vocabulary as compared to those using the traditional method of learning vocabulary in the control group. This suggests that the study's main goals of providing and engaging an effective approach to enhance ESL learners' vocabulary acquisition were achieved. This finding is consistent with findings from studies by Tarng, Ou, Yu, Liou, and Liou,

(2015), and Cihak, Wright, and Bell, (2016) showing that the Augmented Reality (AR) technologies is an effectual approach for teaching science vocabulary. Students had greater achievement when they used AR as a learning method when they learned science vocabulary. Virtual reality and AR technologies share many similarities; thus, this study had similarly positive effects on students' learning and experiences.

This study discovered that the VRG *House of Languages* simplified the teaching and learning ESL vocabulary acquisition by placing students directly into field trips. For example, with a dramatic tour of a virtual zoo to see the animals and learn the new vocabulary, students were psychologically transported to that location. The students seemed engaged the whole time as their behaviors and discussion were on task with the expected learning activity, and it is the belief of this researcher the extended engagement with vocabulary through the VR experience was how they remembered the new vocabulary; it was through *learning it by living it*. One explanation is that during the VR set, students maintain eye contact with the VR environment and with the teacher (*Mr. Woo*--raccoon character host) while students cannot make eye contact at all times with a real classroom teacher during the traditional method. Hence, there will be more attentiveness during the VR set more than what happens in the real classroom lecture with more than 32 students. As a result, with increasing the attentiveness, the vocabulary acquisition increased as compared to the traditional learning activity that generated minimal eye contact and engagement with content.

In the digital age, sitting down in the one place (classroom) is confining for students and reflects the efficiency of an earlier era. Most students have seen, particularly through internet use, much more than their parents and grandparents had at the same age



(Buckingham, 2013). It is no surprise that students want the freedom to explore; to go ahead and experience more than what is in the static pages of the now less often used books and lectures. Although the promise of VR appears heightened for certain subject matter such as science and arts, this study found that it can be applied to other fields, and is expected that any subject can be taught in this setting. Facilitating learning processes in ESL vocabulary acquisition was done with the convenience and cost efficiency of VR and reflected positively on the outcome of students' word acquisition. One explanation for this phenomenon is that the excitement for the VR technology for students is higher than for traditional learning method, keeping the students both motivated and engaged. The researcher observed the students' excitement during the experimental period in many accessions. For example, by the end of the first week, five students had bought five VR equipment to use them during the experimental period. Also, students expressed excitement about VR technology through coming to the class during the experimental period without any absence. Every day during the experimental period, at the end of class, students came to the class teacher to ask him to be the first VR user in the next topic. This level of engagement was an exciting ancillary outcome of the project but, from a researcher's perspective, it also introduced a potential for additional time attending to the learning by participants in the experimental group and, thus, could have contributed to the increased growth of vocabulary knowledge. Student participants who purchased their own VR devices were not questioned about their extended use of the tool for vocabulary learning outside the formal learning experience. Another explanation was that interacting with a native English-speaking teacher (*Mr. Woo*--raccoon character host) motivated students to develop their productive vocabulary knowledge of the targeted

words and application in simulated contexts and increased their efficiency in learning, more than interacting with a real but non-native English-speaking classroom teacher.

Last, it seems that this study opened the doors to treat the most complex issue in teaching ESL which is the individual difference factors among students. The VRG *House of Languages* allowed students to learn individually without interrupting the classroom lecture. In other words, each student felt that he had his own individual “teacher” during his opportunity for using the VR technology in a truly interactive learning process. The classroom main teacher confined his role in supporting, guiding, and focusing on students who needed extra effort to increase their understanding of the subject material and achieve the main goal of learning vocabulary in context. Students that needed no help were self-sufficient with the VR instruction. This means, each student felt that all the entire class time was devoted to him to learn. Students with low or poor vocabulary achievement were going to have questions for gaining the understanding, while students with high vocabulary achievement were going to continue their task in advance vocabulary level without losing the entire balance of the class time in repeating what they already have gained. This allowed high-achievers to move faster and deeper into content without being held back, while not neglecting the other minds in the classroom. Low-achievers as well were not pushed through complex tasks to keep pace without taking the time to understand the content. This is different from the traditional classroom mentality of moving as one cohesive unit, often to the detriment of either the high or low achievers (Lah & Hashim, 2014). This traditional paradigm leads to non-meaningful learning for some subset of the class and makes learning harder and inaccessible for some students (Boticki, Baksa, Seow, & Looi, 2015). Overall, the confidence of participants in the new

technology and the fascinating virtual environment may explain how students in the experimental group achieved more than their peers in the control group.

### **Findings 2 and 3: Vocabulary Development Within Each Group**

At the beginning of the experimental period, results of the current level of vocabulary knowledge for both control and experimental groups exhibited similar levels of prior knowledge of the future material presented. Each group was addressed in the study to determine whether there were any significant differences between the two tests scores (pre- and post-test) in each group. The finding from this study has shown both experimental group and control group obtained a significant achievement on the vocabulary acquisition and enhanced learning via two different learning methods. Consistent with Hypothesis 2, students in the experimental group scored higher achievement in the post-test of vocabulary acquisition compared with their achievement in the pre-test conducted at the beginning of the experimental period. Similarly, and consistent with Hypothesis 3, students in the control group scored higher achievement in the post-test of vocabulary acquisition compared with their achievement in the pre-test that conducted at the beginning of the experimental period.

Comparison between the pre- and post-test in each group confirms an improvement in the vocabulary acquisition. At the same time, this does not mean that both groups experienced the same improvement over the period of study, nor would such a difference invalidate or affect the significant and accurate difference between both groups in post-test in students' achievement on vocabulary acquisition in answering the first research question. Overall, the significant result in each group between pre- and

post-test indicated the absence of any potential of systematic bias in the learning process.

Threats to internal validity included the following:

- **Pre-testing.** One of the potential threats to external validity is that the effect of the prior experience (pre-test) can be somewhat expected (Huitt, Hummel, & Kaeck, 1999). This reaction occurs when one of the comparison groups take a pre-test and other does not. This can raise doubts as to the improvement obtained by either group in comparison to one another. This threat was mitigated by giving both groups comparison groups the same test.
- **Interaction.** This threat occurs when the sample subjects are non-random selected (Huitt et al., 1999). This threat was addressed by selecting a quasi-experimental research design where sample subjects were placed into group with as much randomness as possible. The sample could not be fully randomized because the school was a nonrandom convenience sample; however, the subgroups were randomly selected.
- **Multiple Treatments.** This threat occurs when students in the experimental group are exposed to more than one intervention (Huitt et al., 1999). This threat was limited because each group used only one intervention. Also, the learning method in each group did not change during the experimental period.
- **Period of Time.** This threat occurs when the experimental period time is too short or too long. A period that is too short may suffer from not having enough accumulated change to measure regarding the treatment, while a too long period may suffer from an inability to claim the treatment was the direct cause of any change, particularly when the experiment is not completely

controlled. This study use 2 weeks as an experimental period time which is an expected compromise of the two extreme experimental durations.

- Control of After Hours. This threat occurs because the students in both the experimental and control groups are only monitored for the single vocabulary class. After this period, the students were free and without supervision. This can cause issues if students further pursue the vocabulary acquisition beyond the school gate. It was noted that some of the students in the experimental group had purchased their own VR equipment while in the experimental period, suggesting that motivation outside of class may introduce unaccounted for explanations of changes during the experimental period.

#### **Findings 4: Teacher Loved Virtual Reality**

The teacher perception of using VRG *House of Languages*, in term of usefulness as a learning method for developing vocabulary acquisition was positive. All the results of the survey items were rated as *strongly agree*. These results reflected the teacher's personality and general preference for the new technology and of having experienced its use in this environment. The perception of the teacher may be affected by two critical factors; aging and the ability to cope with new technology. Older teachers may not be comfortable with technology if they are not yet acclimated to using it, or see the benefit of using it. Those teachers may need additional support to utilize new technology in the learning process.

The teacher indicated *strongly agree* that the VRG allows teachers to address individual learner differences in one learning activity, likely in part because he has enough time to focus on students who had low vocabulary achievement. The teacher

responses suggested using VR in teaching ESL was more successful for students' vocabulary acquisition over the traditional learning method. It could be because the teacher realized the value of VR as a new way to engage those in his class, and as something different than the tools he used before. Another possible explanation is the limited amounts of technology generally used in the vocabulary field (Ely, Pullen, Kennedy, Hirsch, & Williams, 2014); the introduction of VR does not replace technology as much as it is the first technology to be employed that demonstrates its ability to effectively contribute to raising the level of the students in vocabulary acquisition. Altogether, teachers' acceptance of VR as a successful pedagogical learning method supports the hypothesis of the technology reducing the mental distractibility for student during the studying time. This was one of the expectations of teacher acceptance of the intervention, but the researcher did not attempt to explore the mental distractibility for student during the experimental period in this research. In light of the above, *VRG House of Languages* provides a practical path for the teacher to integrate VR technology in learning process to reach the main goal. This supports the idea that there is a need to advocate for technology to the educators who have not yet understood the usefulness of VR as a teaching and learning tool to enhance a student's learning experience.

#### **Finding5: Learning, Challenging and Having Fun**

A survey of the experimental group student's perceptions using the *VRG House of Languages* as a learning method for developing vocabulary acquisition provided further positive results. Students thought *House of Languages* made the classroom more interesting, made themselves more confident and felt more challenged with the instruction that allowed them to take virtual field trips over different topics. These

positive perceptions demonstrate at least a cognitive difference between the two different learning methods (VR and traditional) as a result of the successful of integrating the VR in the learning process. This finding is consistent with findings from study by Loureiro and Bettencourt (2014), conducted in a physical classroom through the 3D immersive virtual environment confirmed that the learners tend to feel more confident, open, participatory, creative, and understanding, because they are definitely interested in learning.

In this study, there was no particular concern of the handling of the VR equipment in as marked by the students' perception survey nor of intolerance of the *House of Languages* application. One explanation for this acceptance is that the students were fully familiarized on how to deal with the new generation of technology that has becomes part of their life, primarily noted with recent ascent of such technologies in the home market in recent years (Buckingham, 2013). The ability of students to use *House of Language's* vocabulary instruction on their own further suggests VR technology as a valuable tool beyond the school doors. During the course of the experimental period, it became apparent that students would like to use VR to learn other content. This might be attributed to the unique abilities of VR technology to make course topics seem real. The researcher began this study using 10 VR equipment (Samsung phone Devices and VR Goggles). By the end of the first week, five students bought 5 VR equipment and brought their equipment to school to use it during the learning process. These findings further supported the hypothesis that their liking of the program would enhance their learning in content topics. This leads to the conclusion that students who use VR technology on a more regular basis may have achieved differently.

### **Limitations**

As with all quantitative research, this study had some expected limitations. These limitations included the weaknesses that were beyond of researcher's control for different reasons. The limitations included the following:

1. One of the limitations of this study was the small sample size of teacher survey ( $n = 1$ ), limiting external validity, and generalizability. Since the number of subjects in teachers' survey was not large enough, the result did not provide a clear picture of using VR in teaching ESL vocabulary acquisition.
2. Another limitation of this study was the gender limited nature of the study. The school rules did not allow mixing between the genders in one school, so the study results were weak in generalizing the results to all genders.
3. This study was not fully random sample selected, it was a convenience sample--the school was nonrandom selected and the subgroups were randomly selected. So, it might be weak in generalizing the results to those who did not participate in this study.
4. As mentioned, some students pursued purchasing VR equipment on their own during the experimental period. As such, some students have additional time experiencing the intervention at uncontrolled times.

### **Implications**

The study provides a research-based instructional framework for examining how VR technology can be engaged in a learning process to teach ESL vocabulary acquisition for intermediate school students. This study pairs ESL vocabulary with an attractive VR environment where students can access meaningful content topics to facilitate second



language vocabulary acquisition. In spite of the fact that the participants of this study were intermediate school students, the VR technology makes it applicable to a primary school and high school students. So, it is essential to creating awareness among the educators that, the use of the new VR technology as an effective vocabulary acquisition method in learning process should be engaged in all K12 stages not only to improve the vocabulary acquisition but goes beyond that to enhance the degree of achievement. Similarly, while the second language that used in this study was English, the VRG *House of Languages* capable of delivering content in different languages such as German, French, Russian or Spanish to give the same positive result. It might also be applicable to serve the vocabulary acquisition in the first language

This study used Samsung Gear VR, Galaxy S7 edge, and the *House of Languages* application. Other VR systems are not compatible for use with *House of Languages* as it is an exclusive title for the Samsung Gear VR. Nevertheless, many virtual reality vocabulary apps that are well-suited with the others VR systems. While students noted they felt were more comfortable and productive learning vocabulary via the VR method using Samsung equipment, it is possible that other students might not be comfortable with different types of VR systems. There was no risk or negative effect shown during the experimental period from using this equipment. Any foreseeable risk or negative effect effects (such as vertigo, eyestrain, headaches, disorientation) will likely depend on VR system quality and application environment quality. So, there is a need to conduct more empirical studies on the negative effect of using the new VR technology in the long-term.

### **Future Research**

This study was conducted to examine the effects of VR technology in facilitating learning processes in second language vocabulary acquisition for students. Future research is needed in using VR in learning process relevant to 2L vocabulary acquisition because very little research about VR and education exists. For the future research, it would be useful to conduct a similar study taking into account the following considerations

1.      Sample Size. Future research will need to increase the sample size to be at least  $N = 70$  based in the *Gpower* calculation in each group (the experimental and the control group) instead of  $N = 32$  in each group to improve the accuracy and generalization of the outcome.
2.      Sample Size. Increasing the sample size of teacher survey will give a complete picture of using VR technology as a useful teaching tool to better evaluate over a large cross-section. Also, by increasing sample size of teacher survey will be possible for the researcher to measure the survey reliability.
3.      Sample. Using a full random sample will help to generalize the result, instead of using the convenience sample.
4.      Gender. Future research will need to be conducted in the study on both genders (male and female) to improve the accuracy and generalization in the outcome and treat the limitations of the current study. A further consideration is the extent improvement between genders using VR technology.
5.      Age. Applying VR on a wider group of students and people of different ages such as adult or older people might give different results and insight into the

mechanisms of vocabulary acquisition with a VR intervention, taking into account their comfort level with the new technology. Also, future research needs to examine a similar study on college students, such as international students, to see if it generalizes the results across different learning levels and ages.

6. Virtual System. It is recommended for future research to use different VR systems, as it might provide different results in vocabulary acquisition, taking into account the VR system quality and application environment.

7. Research Design. Using true experimental research design (Golden Design) will help to generalize the result and reduce the limitation of the study.

8. Language. This study was conducted on non-native English-speaker students and teacher, and gave a positive result on vocabulary acquisition. Future research will need to examine a similar study in different 2L language such as French or Spanish, to see if it generalizes the result across different languages.

9. Language. One can change the language that is being learned, but a future study may also include more of a question regarding the language of origin (the native language) of the students which was not addressed.

10. Different Aspects of Vocabulary. Since this research was limited in using VR technology to enhance ESL vocabulary acquisition, further research is recommended to address different vocabulary aspects, e.g., memorizing, pronouncing and spelling.

11. Period of time. Since this study has an experimental period of 2 weeks, the students were motivated to use the new VR technology and that reflected positively on their degree of achievement. It would be of interest to examine their level of achievement over an expanded experimental period for more than 8 weeks to see if the degree of

achievement will be maintained or reduced due to the novelty of the technology wearing off from prolonged use.

### **Conclusion**

The outcomes suggest that integrating VR technology in teaching ESL is a promising strategy and more successful than the traditional learning method for vocabulary acquisition. The intention behind conducting this research is establishing a motivating foundation to integrating VR technology in the field of 2L vocabulary acquisition. Today, VR technology is in its empirical phase, but it has incredible potential to improve our lives. Educators and the VR community expect much from this promising technology in the learning process. Five years from now, VR technology may supersede the traditional method due to its quick growth and its low cost, coupled with its current and meteoric rise in popularity. Many consider 2016 as the beginning of educational access to VR. Many prominent companies, e.g., SONY--PlayStation, HTC, Facebook--OCULUS, Microsoft and Samsung remain in competition to release highly-advanced VR headsets due to the rapid growth of the VR technology among end users.

Teachers should benefit from the rapid growth in the technology to develop students' skills in the field of vocabulary. Moreover, they should show a desire to improve their technology skills to be able to deal with the fast changes brought about by this technological innovation. Without having the knowledge, the skills or the support to use more advanced technology, teachers will be unable to keep up with the requirements of the new generation. New generations need to connect deeply with the world surrounding to see, grab and move to explore things instead of sitting down during the classroom lecture to indirectly experience. Thanks to VR, teachers can transport students

to another place and time by wearing the VR headset and looking around to explore and understand. Teachers should push themselves forward and adopt this technology inside the classroom to both empower and inspire students. Finally, the researcher hopes more universities, schools and curriculums designer will collaborate with VR technology companies to realize this full potential.

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**APPENDIX A**  
**VOCABULARY TEST**



## VOCABULARY TEST

The test created to match vocabulary content being taught in classrooms during the experimental period. Researcher will develop the test on Wesche and Paribakht Vocabulary Knowledge Scale (VKS). The basic idea of the scale is to measure progressive degrees of word knowledge. Students have to rate how well they know a word on the following scale:

- I. I don't remember having seen this word before.
- II. I have seen this word before, but I don't know what it means.
- III. I have seen this word before, and I think it means \_\_\_\_\_. (translation in Arabic)
- IV. I know this word. It means \_\_\_\_\_. (translation in Arabic)

**Look at the following list of words and give each one a number rating 1-4 based on how well you know the word.**

Vocabulary word in English	I don't remember having seen this word before	I have seen this word before, but I don't know what it means	I have seen this word before, and I think it means in Arabic	I know this word. It means in Arabic
Jar	1	2	3	4
Raincoat	1	2	3	4
Rain Boots	1	2	3	4
Broom	1	2	3	4
Armchair	1	2	3	4

Vocabulary word in English	I don't remember having seen this word before	I have seen this word before, but I don't know what it means	I have seen this word before, and I think it means in Arabic	I know this word. It means in Arabic
Calendar	1	2	3	4
Houseplant	1	2	3	4
Book	1	2	3	4
Kettle	1	2	3	4
Table	1	2	3	4
Timetable	1	2	3	4
Screen	1	2	3	4
Fizzy Drink	1	2	3	4
Aisle	1	2	3	4
Poster	1	2	3	4
Dog	1	2	3	4
Peacock	1	2	3	4
Parrot	1	2	3	4
Hen	1	2	3	4
Bear	1	2	3	4
Giraffe	1	2	3	4
Lion	1	2	3	4
Costume	1	2	3	4
Statue	1	2	3	4

Vocabulary word in English	I don't remember having seen this word before	I have seen this word before, but I don't know what it means	I have seen this word before, and I think it means in Arabic	I know this word. It means in Arabic
Ship	1	2	3	4
Mask	1	2	3	4
Fountain	1	2	3	4
Landscape Picture	1	2	3	4
Tour Guide	1	2	3	4
Display Case	1	2	3	4

**APPENDIX B**  
**TEACHER SURVEY**



### **Background Information**

What is your age group?

- Under 25
- 25 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- Over 60

What is your ethnic background? (choose as many as apply)

- African American
- Asian/Asian American
- Caucasian/White
- Hispanic
- Native American
- Other

What is your gender?

- Male
- Female

What is your primary language?

- English
- Spanish
- German
- France
- Arabic
- Other

How long have you been working as a K12 teacher?

- Less than one year
- 1 - 2 years
- 3 - 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- More than 20 years

### Teacher Feedback

1. Using of *Virtual Reality Games* in class benefited my teaching.

Strongly agree	Agree	Disagree	Strongly Disagree
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2. It is acceptable for teachers to use *Virtual Reality Games* during class time.

Strongly agree	Agree	Disagree	Strongly Disagree
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3. *Virtual Reality Games* present a meaningful learning activity.

Strongly agree	Agree	Disagree	Strongly Disagree
-------------------	-------	----------	----------------------

4. *Virtual Reality Games* allows teachers to address individual learner differences in one learning activity.

Strongly agree	Agree	Disagree	Strongly Disagree
-------------------	-------	----------	----------------------

**APPENDIX C**  
**STUDENT SURVEY**



Researchers assessed participants' perceptions of the usefulness of Virtual Reality Game *House of languages* using the following 12 statements:

### **Background Information**

What is your age?

- Under 12 years old
- 12 years old
- 13 years old
- 14 years old
- 15 years old
- 16 years or older

What is your ethnic background? (choose as many as apply)

- African American
- Asian/Asian American
- Caucasian/White
- Hispanic
- Native American
- Other

What is your gender?

- Male
- Female
- 

What is your primary language?

- English
- Spanish
- German
- France
- Arabic
- Other



### Student Feedback

1. I feel I learned English vocabulary because I used the Virtual Reality Game *House of languages*.

Strongly agree	Agree	Disagree	Strongly Disagree
----------------	-------	----------	-------------------

2. Vocabulary topics on *House of languages* are interesting,

Strongly agree	Agree	Disagree	Strongly Disagree
----------------	-------	----------	-------------------

3. I think my school should continue to use the Virtual Reality Games for learning.

Strongly agree	Agree	Disagree	Strongly Disagree
----------------	-------	----------	-------------------

4. Virtual Reality Game *House of languages*, helps me understand what other teens and classmates who speak English as their first language are saying.

Strongly agree	Agree	Disagree	Strongly Disagree
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5. I enjoyed using the Virtual Reality technology equipment.

Strongly agree	Agree	Disagree	Strongly Disagree
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6. I like learning through the Virtual Reality experience.

Strongly agree	Agree	Disagree	Strongly Disagree
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7. Virtual Reality Game *House of languages* helped me learn things I need to know.

Strongly agree	Agree	Disagree	Strongly Disagree
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8. The multimedia (audio/visual) helped me learn while using the Virtual Reality Game *House of languages*.

Strongly agree	Agree	Disagree	Strongly Disagree
----------------	-------	----------	-------------------

9. Virtual Reality Game *House of languages* tool helped to improve my English vocabulary.

Strongly agree	Agree	Disagree	Strongly Disagree
----------------	-------	----------	-------------------

10. *House of languages*' vocabulary instruction was easy to use "on my own,"

Strongly agree	Agree	Disagree	Strongly Disagree
----------------	-------	----------	-------------------

11. The *House of languages Virtual Reality Game* challenged me as a learner of new vocabulary.

Strongly agree	Agree	Disagree	Strongly Disagree
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12. I would like to use Virtual Reality to learn other content.

Strongly agree	Agree	Disagree	Strongly Disagree
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## **APPENDIX D**

### **EXAMPLE OF TOPICS AND TARGET VOCABULARY USED IN THE VOCABULARY PRE- AND POST-TEST**

Topic	Words		Topic	Word	
	(English)	(Arabic)		(English)	(Arabic)
FAMILY HOUSE	Brother	أخ	KITCHEN	Houseplant	النبتة المنزلية
	Door	باب		Rain boots	حذاء مطر
	Father	أب		Calendar	تقويم
	Fireplace	مدفأة		Iron	مكواة
	Flower	وردة		Book	كتاب
	Grandfather	جد		Refrigerator	ثلاجة
	Grandmother	جده		Broom	مكنسة
	Lamp	مصباح		Raincoat	معطف مطر
	Mother	أم		Table	طاولة
	Photo	صورة فوتوغرافية		Jar	جرة
	Picture	صورة		Kettle	غلاية
	Sister	أخت		Cup	كوب
	Sofa	أريكة		Armchair	كرسي ذو ذراعين
	Wardrobe	خزانة ملابس		Basket	سلة
	Window	نافذة		Wall clock	ساعة حائط

Topic	Words		Topic	Word	
	(English)	(Arabic)		(English)	(Arabic)
CINEMA	Poster	ملصق اعلان	ZOO	Duck	بطه
	Ice cream	أيس كريم		Horse	حصان
	Seat	مقعد		Giraffe	زرافة
	Popcorn	فشار		Crocodile	تمساح
	Speakers	مكبرات الصوت		Bear	دب
	Movie display	عرض الفيلم		Peacock	طاووس
	Ticket	تذكرة		Cat	قط
	Box office	شباك التذاكر		Dog	كلب
	Aisle	ممر		Lion	أسد
	3D glasses	نظارات 3D		Rabbit	أرنب
	Water	ماء		Pig	خنزير
	Timetable	جدول مواعيد		Parrot	ببغاء
	Screen	شاشة		Elephant	فيل
	Fizzy drink	مشروب غازي		Hen	دجاجة
	Money	نقود		Cow	بقرة

**APPENDIX E**

**CONTENT EXPERT REVIEW FORM:**  
**PARTICIPANTS' SURVEY**

## PARTICIPANTS' SURVEY

**Directions:** The following items were taken from the participants' perceptions of the usefulness of Virtual Reality Game in the learning process survey. Could you please take a look and let me know if:

<b>Item 1</b> I feel I learned English vocabulary because I used the Virtual Reality Game <i>House of languages</i> .		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

<b>Item 2</b> Vocabulary topics on <i>House of languages</i> are interesting.		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

<b>Item 3</b> I think my school should continue to use the Virtual Reality Games for learning.		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 4**

Virtual Reality Game *House of languages*, helps me understand what other teens and classmates who speak English as their first language are saying.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 5**

I enjoyed using the Virtual Reality technology equipment.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 6**

I like learning through the Virtual Reality experience.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 7**

Virtual Reality Game *House of languages* helped me learn things I need to know.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	



**Item 8**

The multimedia (audio/visual) helped me learn while using the Virtual Reality Game *House of languages*.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 9**

Virtual Reality Game *House of languages* tool helped to improve my English vocabulary.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 10**

*House of languages*' vocabulary instruction was easy to use "on my own,"

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 11**

The *House of languages* Virtual Reality Game challenged me as a learner of new vocabulary.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**Item 12**

I would like to use Virtual Reality to learn other content.

Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**APPENDIX F**

**CONTENT EXPERT REVIEW FORM:**  
**TEACHERS' SURVEY**

## TEACHERS' SURVEY

**Directions:** The following items were taken from the teachers' perceptions of the usefulness of Virtual Reality Game in the learning process survey Could you please take a look and let me know if:

<b>Item 1</b> Using of <i>Virtual Reality Games</i> in class benefited my teaching.		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

<b>Item 2</b> It is acceptable for teachers to use <i>Virtual Reality Games</i> during class time.		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

<b>Item 3</b> <i>Virtual Reality Games</i> present a meaningful learning activity.		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

<b>Item 4</b> <i>Virtual Reality Games</i> allows teachers to address individual learner differences in one learning activity.		
Relation to VRG	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
VR Dimension	<input type="checkbox"/> <i>House of languages</i> application	
	<input type="checkbox"/> Virtual Reality	

**APPENDIX G**

**CONTENT EXPERT REVIEW FORM:**  
**PRE-/POST-TEST**

## PRE-/POST-TEST

**Directions:** This test was created to match vocabulary content that being taught in classrooms during the experimental period. Researcher developed the test on Wesche and Paribakht Vocabulary Knowledge Scale (VKS). Please take a look and fill out the following:

Relation to content	<input type="checkbox"/> Consistent	<input type="checkbox"/> Inconsistent
Spelling Errors	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Grammatical Mistakes	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect
Any Recommendation		

**Look at the following list of words and give each one a number rating 1-4 based on how well you know the word.**

Vocabulary word in English	I don't remember having seen this word before	I have seen this word before, but I don't know what it means	I have seen this word before, and I think it means in Arabic	I know this word. It means in Arabic
Jar	1	2	3	4
Raincoat	1	2	3	4
Rain Boots	1	2	3	4
Broom	1	2	3	4
Armchair	1	2	3	4

Vocabulary word in English	I don't remember having seen this word before	I have seen this word before, but I don't know what it means	I have seen this word before, and I think it means in Arabic	I know this word. It means in Arabic
Calendar	1	2	3	4
Houseplant	1	2	3	4
Book	1	2	3	4
Kettle	1	2	3	4
Table	1	2	3	4
Timetable	1	2	3	4
Screen	1	2	3	4
Fizzy Drink	1	2	3	4
Aisle	1	2	3	4
Poster	1	2	3	4
Dog	1	2	3	4
Peacock	1	2	3	4
Parrot	1	2	3	4
Hen	1	2	3	4
Bear	1	2	3	4
Giraffe	1	2	3	4
Lion	1	2	3	4
Costume	1	2	3	4
Statue	1	2	3	4



Vocabulary word in English	I don't remember having seen this word before	I have seen this word before, but I don't know what it means	I have seen this word before, and I think it means in Arabic	I know this word. It means in Arabic
Ship	1	2	3	4
Mask	1	2	3	4
Fountain	1	2	3	4
Landscape Picture	1	2	3	4
Tour Guide	1	2	3	4
Display Case	1	2	3	4

**APPENDIX H****ASSENT FORM FOR HUMAN PARTICIPANTS IN  
RESEARCH: STUDENTS**



method. It will take about 5 minutes for you to answer the survey questions. For each question, I will want you to answer by using agree/disagree style. But, this isn't a test or anything like that. There are no right or wrong answers and there won't be any score or grade for your answers. Your answers will not affect the course grade that you will receive. You are not required to provide personal information. All the information provided will be kept confidential.

I'll ask your teacher for the best time to take the survey so that you don't miss anything too important. You do not require to provide personal information. All the information provided will be kept confidential. Your participation will not be solicited during snack, lunch, or nap times. You will be given the opportunity to ask questions any time.

**Virtual Reality Equipment:** In the Virtual Reality Group you will use Samsung Gear VR, Galaxy S7 edge, and house of Language App. The use of VR equipment can result in negative side effects (such as vertigo, eyestrain, headaches, disorientation). Researcher and your teacher will monitor and mitigate this possibility. You will be monitored vigilantly for these symptoms and if they occur, the affected student will be asked to discontinue use of the equipment. If symptoms persist, the student will be sent to the school nurse.

The participants will be participating voluntarily. No cost or payment for the participation. Your parents have said it's okay for you to participate in this study and take the survey, but you don't have to. It's up to you. Also, if you say "yes" but then change your mind, you can stop any time you want to. Do you have any questions for me about my research? You can ask me any time you want or ask your teacher if you have any questions or concerns about this research.

If you want to be in my research and take my survey about virtual reality technology, sign your name below and write today's date next to it. Thanks!

Student's Signature \_\_\_\_\_ Date \_\_\_\_\_

Researcher's Signature \_\_\_\_\_ Date \_\_\_\_\_

**APPENDIX I**

**CONSENT FORM FOR HUMAN PARTICIPANTS IN**  
**RESEARCH: PARENT**



CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH  
UNIVERSITY OF NORTHERN COLORADO

Research Title: Virtual Reality Game Classroom Implementation: Teacher Perspectives and Student Learning Outcomes

Researchers: Mohammed Alfadil, Doctoral Candidate in Educational Technology under supervision of Mia Kim Williams, Ph.D. Associate Professor of Curriculum Studies and Educational Technology, College of Education and Behavioral Sciences

Phone Numbers: (931)-252-5631 (Alfadil) E-mail: alfa3572@bears.unco.edu  
: (970)-351-2414 (Dr. Williams) E-mail: mia.williams@unco.edu

My name is Mohammed Alfadil and I'm a graduate student at the University of Northern Colorado. I do research on Virtual Reality Technology as a learning tool in the learning process. That means I study the impact of *House of Language* game as a learning tool to try to establish the role of virtual reality game in improving the vocabulary skills of intermediate school students. This is would be one of the first studies in Northern Colorado to test Virtual Reality's efficacy as a vocabulary-learning tool. If you grant permission and if your child indicates to me a willingness to participate, the participants in this study will be divided into two groups, control group and experimental group.

**Traditional Learning Group:** Your child as a participant in this group will depend on the traditional way of learning vocabulary, using book, lecture and worksheets during semester in the learning process. Your child will take a comprehensive vocabulary test to know his/her baseline in the beginning of the experiment period. Your child will take the same test in the end of experiment period to explore the various effects of traditional learning way to students particularly relating to their learning process in vocabulary acquisition. Pre/Post assessments will be collected without names; each participant will take a number. It will take about 10 minutes for your child to answer the comprehensive vocabulary test questions. There are no right or wrong answers and there won't be any score or grade for your child answers. Your decision with regard to your child's participation will not affect the course grade that he/she will receive.

**Virtual Reality Group:** Your child as a participant in this study in the experimental group will depend on only the virtual reality game during the experiment period to meet the requirement of the course. The teacher will use virtual reality technology on two occasions separated by two weeks, for 20-30 minutes of game playing. Your child will take a comprehensive vocabulary test to know his/her baseline in the beginning of the experiment period. Your child will take the same test in the end of experiment period to explore the various effects of virtual reality game to students particularly relating to their learning process in vocabulary acquisition. Pre/Post assessments will be collected without names (each participant will take a number) to explore the various effects of virtual reality game to students particularly relating to their learning process in vocabulary acquisition. It will take about 10 minutes for your child to answer the comprehensive vocabulary test questions. There are no right or wrong answers and there won't be any score or grade for your child answers. Your decision with regard to your child's participation will not affect the course grade that he/she will receive.

**Virtual Reality Equipment:** In the experimental group student will use Samsung Gear VR, Galaxy S7 edge, and house of Language App. There will be no more risk in participating in the study than they encounter as normal students in an academic setting. The only foreseeable risk is inherent in the experimental design: while some students may be more comfortable/productive learning vocabulary via the VR method, it is possible that other students may be more comfortable/productive learning vocabulary via traditional methods—so a foreseeable risk is that for two weeks, the student may be exposed to the method that is less comfortable/productive for that individual. The use of VR equipment can result in negative side effects (such as vertigo, eyestrain, headaches, disorientation). Researcher and teacher will monitor and mitigate this possibility. Students will be monitored vigilantly for these symptoms and if they occur, the affected student will be asked to discontinue use of the equipment. If symptoms persist, the student will be sent to the school nurse.

**Virtual Reality Group - Students Perception Survey:** At the end of the experiment period, after the post test is administered, your child will be asked to answer a survey to measure her/his perception of implementation of virtual reality game in the learning process. There are no right or wrong answers and there won't be any score or grade for his/her answers. Your child's answers will not affect the course grade that (S)he will receive. It will take about 5 minutes for your child to answer the survey questions about virtual reality technology. I'll ask the teacher for the best time to take the survey so that your child doesn't miss anything too important. No obligations to participate in the survey.

Your child does not require to provide personal information. All the information provided will be kept confidential. Your child's participation will not be solicited during snack, lunch, or nap times. Your child will be given the opportunity to ask questions any time. This study will help to establish the role of virtual reality technology in improving the vocabulary skills of intermediate school students. The signed Consent Forms and Assent Forms will be stored on-campus in my research advisor's office for three years, then destroyed, and that any remaining identifiable information will also be destroyed after three years.

The participants will be participating voluntarily. No cost or payment for the participation. You may decide not to allow your child to participate in this study and if (s)he begins 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 your child to participate in this research. If you have any concerns about your child 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 Please feel free to phone me if you have any questions or concerns about this research.

Thank you for assisting me with my research.

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Child's Full Name (please print)

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Child's Birth Date (month/day/year)

---

Parent/Guardian's Signature

---

Date

---

Researcher's Signature

---

Date

**APPENDIX J**

**CONSENT FORM FOR HUMAN PARTICIPANTS IN  
RESEARCH: TEACHER**





CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH  
UNIVERSITY OF NORTHERN COLORADO

Research Title: Virtual Reality Game Classroom Implementation: Teacher Perspectives and Student Learning Outcomes

Researchers: Mohammed Alfadil, Doctoral Candidate in Educational Technology under supervision of Mia Kim Williams, Ph.D. Associate Professor of Curriculum Studies and Educational Technology, College of Education and Behavioral Sciences

Phone Numbers: (931)-252-5631 (Alfadil) E-mail: alfa3572@bears.unco.edu  
: (970)-351-2414 (Dr. Williams) E-mail: mia.williams@unco.edu

My name is Mohammed Alfadil and I'm a graduate student at the University of Northern Colorado. I do research on Virtual Reality Technology as a learning tool in the learning process. That means I study the impact of *House of Language* game as a learning tool to try to establish the role of virtual reality game in improving the vocabulary skills of intermediate school students. I would like to ask the teacher who use the virtual reality as a teaching method about his/her experience of using virtual reality technology during the experimental period.

If you want to participate in the survey, I'll ask you 4 questions about your experience of using virtual reality technology and *House of Language* game as a teaching method during the experimental period. For each question, I will want you to answer by using agree/disagree style. Your decision to participate will not affect your employment status. You are not required to provide personal information. All the information provided will be kept confidential.

It will take about 5 minutes for you to answer the survey questions about virtual reality technology. Taking the survey will help me to establish the role of virtual reality technology in improving the vocabulary skills of intermediate school students. 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. 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.

If you want to be in my research and take my survey about virtual reality technology, sign your name below and write today's date next to it. Thanks!

Teacher Signature \_\_\_\_\_ Date \_\_\_\_\_

Researcher's Signature \_\_\_\_\_ Date \_\_\_\_\_

**APPENDIX K**  
**INSTITUTIONAL REVIEW BOARD APPROVAL**  
**FOR STUDY**



*Institutional Review Board*

DATE: November 23, 2016

TO: Mohammed alfadil, Ph.D  
FROM: University of Northern Colorado (UNCO) IRB

PROJECT TITLE: [978487-4] Virtual Reality Game Classroom Implementation: Teacher Perspectives and Student Learning Outcomes

SUBMISSION TYPE: Amendment/Modification

ACTION: APPROVED

APPROVAL DATE: November 23, 2016

EXPIRATION DATE: November 23, 2017

REVIEW TYPE: Expedited Review

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB has APPROVED your submission. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on applicable federal regulations.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of November 23, 2017.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

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.