

# *The Use of Virtual Reality Technology in Metaphorical-related Vocabulary Acquisition*

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**Abstract:** English as a Foreign language (EFL) learners often find it difficult to learn English due to the large amounts of idiomatic expressions in English. These idiomatic expressions are difficult to understand since they usually cannot be translated literally. Idiomatic expressions can often be traced back to the same metaphoric theme. Based on previous studies, by classifying different idiomatic expressions into the same category based on the underlying metaphorical theme, students can better understand the meanings of those idiomatic expressions and thus learn better. However, students can be limited by the traditional 2D instruction medium. Therefore, this research proposal intends to investigate first, whether the use of Virtual Reality can enhance students' understanding of the metaphorical theme, and then, to examine whether students could apply the existing knowledge of metaphorical framework to the understanding of novel idiomatic expressions. In the experiment part, a total of 60 seventh graders will be recruited to learn metaphorical-related phrases using a three-step teaching method. The role of medium in learning metaphorical-related phrases will be tested using the scenarios adopted by Thibodeau and Durgin's study.

**Keywords:** foreign language teaching and learning, vocabulary acquisition, metaphorical-related expressions, metaphorical awareness, Virtual Reality.

## 1. Introduction

Virtual reality (VR) is a three-dimensional virtual technology providing users with the feeling of physically existing in a virtual environment. It has been widely used in the language learning field to improve students' motivation and learning outcomes. This paper explores whether VR can help EFL learners understand the metaphorical conceptual framework of English, thus improving their vocabulary acquisition and retention.

## 2. Background

Vocabulary acquisition can be complex for EFL learners since there are large amounts of idiomatic expressions which go beyond the literal meaning in English. These expressions rely heavily on the

metaphorical conceptual framework and are not always transparent in meaning [1]. For example, English has many linguistic metaphors that treat abstract feelings and experiences as discrete entities and substances. In the phrase He shot down all of my argument, people conceptualize verbal conflict as something touchable and can be shot at. According to Lakoff and Johnson, a metaphorical conceptual framework consists of a set of mappings between a linguistic metaphor and a conceptual metaphor [2]. Here, the figurative expressions He shot down all of my argument is the linguistic metaphor derived from conceptual metaphor Argument is war. In general, a metaphorical conceptual framework consists of a set of mappings between a linguistic metaphor and a conceptual metaphor. Native English speakers are generally unaware of the underlying metaphorical framework since it is embedded within their cognitive structure [3]. However, learning those idiomatic expressions can be a great challenge for foreign language learners.

Several studies show that enhancing metaphorical awareness can promote EFL learners' vocabulary acquisition. In the experiment of Boers, two groups of participants received a list of figurative expressions and then were tested to reproduce them [4]. The expressions in the experiment group were categorized based on their metaphoric themes. For example, expressions such as Anger welled up inside me and I was boiling with anger were organized below the metaphoric theme ANGER AS A HOT FLUID IN A CONTAINER. On the contrary, participants in the control group only received the literary explanation of the expressions. The result showed that students receiving metaphorical-related instruction had better learning outcome than students receiving no metaphorical-related instruction. In other words, an enhanced metaphoric awareness facilitates students' vocabulary acquisition.

However, the experiment indicates a problem that this method is not suitable for English beginners since they have a very limited vocabulary in understanding the metaphorical instructions [4]. For example, learners need to comprehend the words fluid and container to recognize the conceptual metaphor ANGER AS A HOT FLUID IN A CONTAINER. If they do not understand the literal meaning of the vocabulary, they are unlikely to comprehend the underlying metaphorical framework. Cognitive linguistics have introduced the approach of conceptual visualization to make the instruction more explicit and easier to understand [5]. In this approach, pictures are used to build the image of the conceptual metaphor to students, so they can understand the instruction better with the visual representation. However, this approach also has its limitations. Firstly, the picture is static, so it can be difficult to illustrate phrasal verbs with dynamic meanings. For example, it cannot illustrate the how water gradually comes up to the ceiling of the container as reflected in the conceptual metaphor ANGER AS A HOT FLUID IN A CONTAINER. As emphasized by Thoms, a clear and explicit vocabulary instruction is the key to language learning [3]. Therefore, it is necessary to break the limitation of 2D static picture and explore new ways of representing metaphorical explanations, thus benefiting students most from an enhanced-metaphorical awareness.

Virtual reality (VR) as a technology-based learning tool has become increasingly popular in recent years [6]. By wearing a pair of computer-connected glasses, users will find themselves immersed in a three-dimensional space where real-time interaction can be achieved [7]. According to Nadan, Alexandrov, Jamieson, and Watson, VR can enhance learning for two main reasons. Firstly, information is illustrated visually and vividly in a physical -based virtual environment, which means it can help students build a mental representation of abstract concepts and lead to a better comprehension [8]. Secondly, VR motivates students to reflect on what they are learning as they can interact with the virtual objects and manipulate from a first-person perspective. This interaction and immersion further enhance memory.

Additionally, Thibodeau and Durgin found that the comprehension of conventional framework can facilitate the comprehension of novel metaphor [9]. Here, novel metaphor means the metaphors that participants have not been exposed to, but they share a same metaphorical framework of the

traditional metaphors. Hence, this study intends to further test whether VR technology could also show its advantage in helping students understand novel metaphors.

### 3. Proposed Study

Based on the advantages of visual illustration and interactive experiences, VR is expected to be an efficient tool in solving the problem of 2D static representation. Therefore, this study aims to address the following research question:

1. To what extent does the use of VR enhance students' retention of the conceptual metaphors in English compared with the traditional teaching method of using pictures?

2. Will the medium of instruction, VR technology and pictured-based materials, make a difference in terms of facilitating the understanding of related novel metaphors? If so, why?

For RQ1, one possible answer is that 3D interactive learning can better facilitate the cognitive processing of abstract concepts, thus enhancing the learning outcomes. Otherwise, it might not necessarily help reduce the cognitive load of the figurative vocabulary acquisition. As for RQ2, based on the study of Thibodeau and Durgin, if the medium of learning conventional metaphoric concepts affects the extent to which the novel metaphors are comprehended, then the students taught by the two approaches will display distinct results in the related novel metaphor understanding [9].

This study will serve as an extension to previous studies by comparing the effectiveness of 2D and 3D approaches of demonstrating metaphoric expressions. The proposed method in the following section will distinguish the potential answers in RQ1 by examining students' knowledge of conceptual metaphors before and after the intervention. To address QR2, the understanding of related novel metaphors will be examined after the whole learning process.

## 4. Methods

### 4.1. Participants

One public school in Shanghai will be selected as the research site, as many secondary schools there take the initiative to implement educational reforms by integrating information technology to enhance learning outcomes. 60 seventh graders in the school who are taught by the same English teacher will be recruited for the experiment voluntarily. 30 participants are needed for each group, which constructs a typical middle school class environment.

All the participants are expected to acquire the basic English grammar and most frequently used vocabulary for primary students as required by The Grade 1–9 Curriculum Guidelines by The Ministry of Education, Republic of China. Those who have visual or auditory deficits will be excluded from the experiment.

### 4.2. Materials

Two instruments will be employed in this study. Before the intervention, participants will complete a vocabulary test of 60 metaphorical words and phrases that match the class content. The purpose of the test is to evaluate students' baseline knowledge of the figurative expressions in order to divide them into two parallel groups. After the intervention, materials from Thibodeau and Durgin's study will be used as stimuli to measure students' comprehension of conventional and related novel metaphors [9].

### 4.3. Procedures

#### 4.3.1. Before Intervention

Students will complete a vocabulary test (as shown in table 1), rating how well they know the target vocabulary on the following scale [10]. Unlike the traditional tests, it provides more options other than what they “know” and “don’t know”, so students’ mastery of each expression can be measured more precisely. The test will be administered one week prior to the intervention, so as to reduce the possibility that the “the effects of the treatment are confounded by testing effects that may arise from completing the test” [11].

For each of the word/phrase please use one of the following numbers to indicate your knowledge and understanding of it. If you choose 3 or 4, please write down the meaning of the word/phrase in the given context.

Table 1: An extract of metaphoric vocabulary test.

Numbers	Words/phrases in context
	My boss <b>barked at</b> me this morning.
	My parents got into fight yesterday, but as usual, it ended up with my mother <b>shooting down all my father’s arguments.</b>

I don’t remember having seen this word/phrase before.

I have seen this word/phrase before, but I don’t know what it means.

I have seen this word/phrase before, and I think it means \_\_\_\_\_.

I know this word/phrase. It means \_\_\_\_\_.

#### 4.3.2. During Intervention

The participants will be divided into experimental and control groups based on their pretest performance to ensure the homogeneity across groups. Formal consent will be obtained from the participants and their parents before any data collection. Both groups will attend the class for 15 days. Each class lasts for 40 minutes. Two groups will be instructed by the same researcher and use the same language-learning materials. To be more specific, a three-step teaching method will be adopted: meaning-focused input, language-focused learning, and meaning-focused output [12].

At the beginning of each class, both groups will first read a short passage containing the target metaphoric expressions to get meaningful input. To make sure the participants understand the article provided, they will be instructed to look up the unfamiliar words in the dictionary. For the second step, the control group will learn the target vocabulary by referring to their handouts, on which the 2D pictures are printed to demonstrate the metaphors embedded in those expressions (as seen in table 2); whereas the experimental group will be provided with an interactive learning environment through the use of VR technology. As for the last step, students in both groups will be required to make up conversations and role play by using the target expressions just learned. In short, except for second step, the teaching procedures in two groups are identical, including the time spent on each part (as seen in table 2).

Table 2: The experimental procedure.

	Control group	Experimental group	Time allocation	
Step 1	Input (passage reading and dictionary)		10 min	40 min
Step 2	2D picture-based material	3D VR technology-based material	15 min	
Step 3	Output (role play)		15 min	

Take the conceptual metaphor ARGUMENT IS WAR as an example. For experimental group, after putting on VR glasses, the students will see a debate scene and a debating topic (e.g. Advertisements should be controlled or encouraged?) in their sight. Then, the students will hear the instructions from the devices to let them express their opinions. When they are speaking, “arrows” will shoot out of their mouths (see Figure 1). These arrows represent their point of view, and they will shoot towards the opponents (see Figure 2) . Following this, students will see a line “Congratulations! You shot down all their arguments!” appears in sight (see Figure 3).

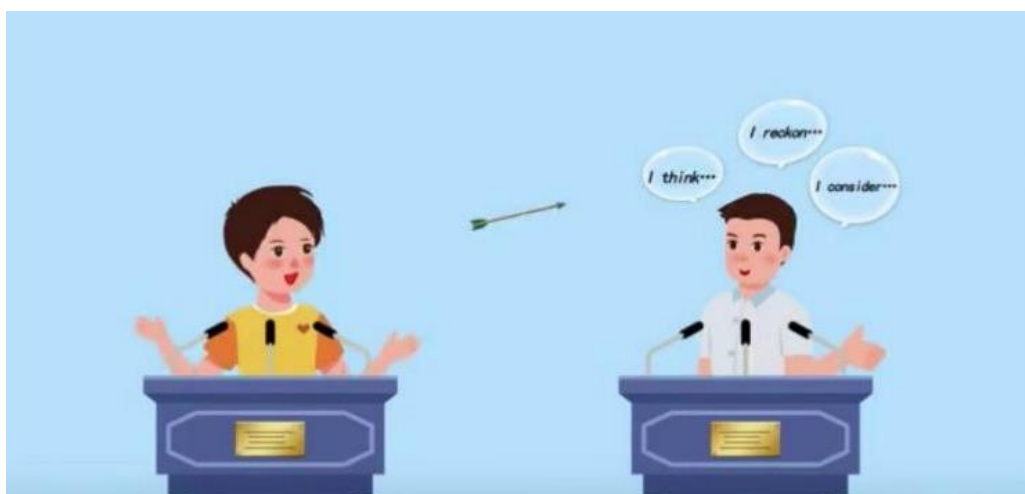


Figure 1: Arrows shot out of the student's mouth.

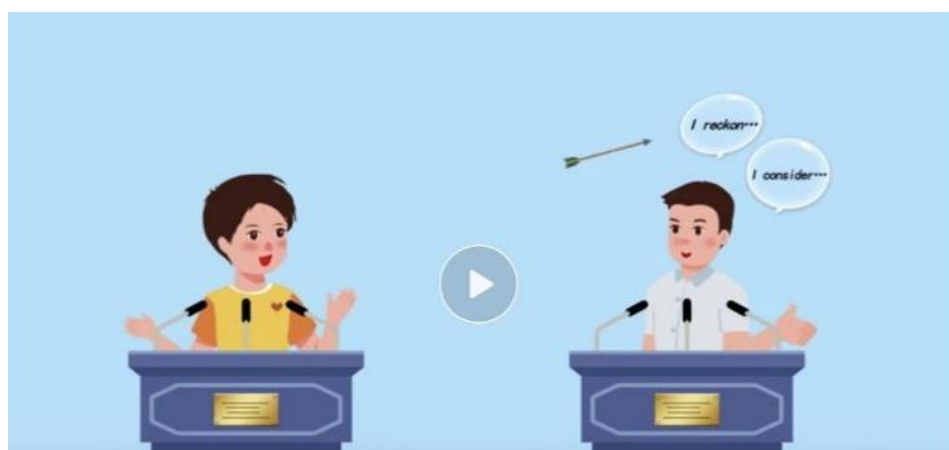


Figure 2: Arrows shot towards the opponents.



Figure 3: Arrows shot down the arguments.

Another metaphor would be that ANGER IS HEAT. After wearing the VR glasses, students will find themselves in a virtual classroom scene. Then, the students will hear the instructions from the devices to ask them to press the trigger button once. After the students press the button, they will start daydreaming and look in all directions. After a while, they are noticed by the teacher. And at this time, the students will see the teacher is very angry with smoke coming from her head. Then, a line of words "The teacher is fuming!" will appear in the student's field of vision. Then, the students will hear the sound from the devices to let them press the button again. Likewise, after pressing the button, the students will start passing notes to their tablemates sneakily and stop paying attention to the lecture. After they are caught on the spot by their teacher, she will ask students and their parents to come to the office after class. At this point, the scene switches to the teacher's office. When the parents arrive, the students will see smoke coming from their heads as well, which means they are angry. Once again, a line of words "Parents are fuming!" will appear in the student's sight.

#### 4.3.3. After Intervention

Participants will be tested on the comprehension of conventional metaphors and related new metaphors that share the same conceptual representation they learn during the treatment session. We will adopt materials from Thibodeau and Durgin's study which provides 12 scenarios that fit both conventional and novel metaphors (see Appendix 1) [1].

Similar to their experiment, each participant will read the scenarios on computer. The sentences in each scenario will be broken into meaningful segments that appear at the center of the screen. If possible, every segment will include a full sentence; otherwise, they will be split into two lines with a reasonable turning point. All participants will be instructed to press "enter" on the keyboard after they finish reading a line. By doing so, the next line will replace the original one. The reading time of each line will be stored automatically by the computer. The metaphorical expressions in the target sentence will not be singled out. Each scenario will be preceded by a message that appears on the screen for one second: "please be ready for the next scenario.". A message "end of scenario" will be displayed after each scenario. Before the formal experiment, three fillers (see Appendix 2) as used by Thibodeau and Durgin will be given to participants for practicing. One of them will include questions [9].

Instead of examining three conditions as Thibodeau and Durgin did, this experiment will concentrate on two conditions of them: (1) conventional metaphors, and (2) novel metaphors. Participants will read two scenarios that include a target sentence of each condition. The scenarios



will be presented randomly [9]. In addition to the two experimental scenarios, each participant will also read two filler items, with one containing a question.

## 5. Results and Discussion

The data generated in the study consist of participants' reading time of conventional and related novel metaphors. Since the two groups are divided based on their test results, we assume that there is no significant difference between them at the onset of the experiment. The learning materials during treatment session heavily rely on the conventional expressions to conceptualize the figurative framework. Therefore, the difference in the reading time of the conventional metaphors between two groups will directly reflect the effectiveness of the medium of teaching conceptual metaphors. If the average reading time of conventional metaphors in experimental group is less than that of the control group, it suggests that the use of VR better enhances metaphorical vocabulary acquisition compared with traditional teaching method. Alternatively, if the control group consume less time, it means that the 3D interactive environment does not reduce the cognitive load for EFL learners to comprehend metaphor-related vocabulary as significantly as 2D images. Another chance is that both groups have similar performance in terms of conventional metaphor reading time, which shows that 2D and 3D have the same impact on figurative vocabulary learning.

Based on the results of reading time of conventional metaphors, the reading time of novel metaphors will show the extent to which different teaching medium, 2D and 3D, facilitates students' knowledge transfer. If the experimental group spend less time in reading both conventional and related novel metaphors, it indicates that 3D interactive environment not only promotes knowledge retention efficiency, but also enhances the comprehension of related metaphoric expressions.

## 6. Conclusion

The proposed study examines the use of VR technology in the arena of English vocabulary teaching and learning. Specifically, a quasi-experimental study is designed to evaluate the effectiveness of VR-based and traditional teaching approaches by comparing the time two groups need to comprehend the sentence with metaphoric-related expressions. Metaphors remain one of the challenges for second language learners. Therefore, this study is among one of the first attempts, trying to test the feasibility of applying VR technology in learning metaphoric expressions. The results of this study will provide suggestions for language teaching practitioners and researchers to better understand technology application in language teaching and learning field.

Although the findings of the research will have significant implications for EFL teaching and learning, there are some potential limitations. First, students may drop out of the experiment during the process due to some unforeseen situations. Second, vocabulary test is self-reported data. The validity of the item "I don't remember this word/phrase" and "I have seen this word/phrase, but I don't remember its meaning" cannot be tested. Third, students' performance in the experimental group might be influenced by their attitudes towards AR devices. Thus, the future research should employ more data collection instruments, such as class observation and interviews to triangulate the findings.

## Appendix

### Appendix 1

#### Scenarios with conventional and novel metaphors

(Adapted from Thibodeau and Durgin,[9])

##### 1. ANGER IS HEAT

Scenario:

My roommate had borrowed my car without asking/and got into an accident. I had to take a moment and let off some steam.

Target sentence:

I was sizzling (Novel).

I was fuming (Conventional).

## 2. ARGUMENT IS WAR

Scenario:

Stan and Jake often get into arguments. But Stan's position is often indefensible.

Target sentence:

As a result, Jake is almost always able to take out Stan's claims (Novel).

As a result, Jake is almost always able to shoot down Stan's claims (Conventional).

3. EMOTIONAL EFFECTS ARE PHYSICAL CONTACT Target sentence: I was black and blue for several days.

Novel: I went to Ed's mother's funeral today. Her tragic death punched everyone in the stomach. It slapped me really hard.

Conventional: I went to Ed's mother's funeral today. Her tragic death bowled everyone over. It hit me really hard.

4. IDEAS ARE FOOD Target sentence: Otherwise, they give him indigestion.

Novel: David has a hard time ingesting new idea. He has to gnaw on them for days.

Conventional: David has a hard time swallowing new ideas.

He has to stew them over for days.

## 5. LIFE IS A GAMBLING GAME

Scenario:

Joan knew that surgery was a very dangerous option. She could lose it all.

Target sentence:

Nevertheless, Joan decided to ante up and have the operation (Novel).

Nevertheless, Joan decided to take her chances and have the operation (Conventional).

## Appendix 2

### Filler questions and answers

(Adapted from Thibodeau and Durgin, [9])

1. Friends are lifesavers. Last week, I got a flat tire on my way to an important meeting and gave up hope of making it to the office by nine. But my friend Julie came and revived me. She offered to lend me her car as a lifeline.

Was Julie compared to a lifeguard? YES

2. Politics is roller-coaster. Ted got on the ride when he decided to campaign for mayor of his small town. After flipping, rolling, and shaking for the public for eight weeks, he finally felt like he was in control. But as he watched the exit polls reported on TV, he plummeted. He had lost in a landslide.

Was the candidate running for mayor in a big city? NO

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