

Can Virtual Reality be Used in the L2 for Positive Transfer of Skills from an Intensive English Environment to Reality?

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Abstract

This study meant to add to the literature on virtual reality use in EFL education, examined the feasibility of using virtual reality in an L2 as a tool for positive transfer of skills from virtual reality to a real-world situation. We modeled our research on the methods of Michalski et al. (2019) in their work on the positive transfer of sports skills to practical application. We reinforced the method with ideas from Xie et al. (2021) in their research on common assessment tests and evaluations of positive transfer from virtual reality. Our method was mainly qualitative as it encompasses interpretivism, epistemological orientation, and constructionism as its main driving forces (Bryman, 2006). What we discovered was that the cooking skills taught in the L2 through virtual reality did transfer to a real-world situation. In the short-term skills with detailed knowledge of the process were retained, while in the long term volunteers who were retested retained most of the processes of cooking from virtual reality.

Keywords: Virtual reality, ESL, EFL, Method, Classrooms, Skills Assessment, Positive transfer

Introduction

If there was one word that could be used to theme the entirety of virtual reality and its uses in academics and research, it would have to be “practical”. While we know that virtual reality has been used in multiple other disciplines successfully (Buiu & Gansari, 2014; Wei et al., 2013) it is far less evident in the field of English education that its application has been successful or even practical. What virtual reality is good for is proven and obvious; taking the impractical and making it practical through cost efficiency and simulation of difficult to replicate situations for a

multitude of run-throughs by a user so that in the end they come out the other side with a higher proficiency in what it was designed to teach.

This practicality still comes at a price. Headsets are not cheap, universities do not just hand out money to educators to fill classrooms with VR headsets and even if they did, the discomfort of cybersickness may be too much for a student to endure to become comfortable enough to find out how valuable the technology is (Tacker, 2023).

Compounding this are student perceptions of English education and how their experience previously colors what they

would expect from using virtual reality to learn the English language and skills through class time. Students study English for many reasons not least of which are practicality and academics. Students will often wonder why something is taught in the way it is, and the educator not being transparent makes the purpose difficult to comprehend. Low-level English learners often miss the important points of explanation when the educator gives the reasons why they learn the way they do. In short, a student can have trouble merging the reason or purpose for something with its practicality or use in English language Education. Virtual reality as a tool in the classroom could merge the purpose with the practical.

Thus, using virtual reality to merge the purpose to the practical is the backbone of our question: *Can virtual reality be used in the L2 for the positive transfer of skills from an intensive English environment to Reality?* We wanted to create a tangible method for skill assessment using virtual reality in the EFL classroom. By taking something practical such as cooking, an everyday skill for most people, we can more easily illustrate its purpose or reason for why or how it is done through virtual reality. In this way, learners even at low levels of English can grasp bigger concepts because 1: Most students have previous knowledge of cooking in some form and as such are not starting from zero, and 2: it's far more interactive than a teacher lecturing from a book and giving a homework activity or presenting a demonstration at the front of a class; the students must do it themselves.

To understand if any learning has taken place from the intensive English virtual environment to reality when tested we must look for positive transfer. Positive transfer

is a type of training in which the learning or performance of a task is facilitated or improved because of training on a different but related task. Transfer tends to be positive when the two tasks involve different stimuli and similar responses (Colman, 2009). The differences and similarities between the virtual reality simulation's cook training (American diner/ English) and the Japanese student's experiences of cooking (Japanese cuisine/Japanese) is the reason we chose this for a test of positive transfer. The foods being prepared in virtual reality along with the English vocabulary used and the culture presented in the simulation have different stimuli but similar responses to something that Japanese EFL students would be familiar with.

Method

Participants

Twenty-one students of varying levels of English proficiency from low to high at the Kochi University of Technology participated in our study. Students who volunteered had to accomplish all tasks in an immersive English environment. The instructor would to the best of her knowledge speak only in English to prompt or help students while the virtual reality simulation would be set for English only. In only a few instances were subtitles used with some Japanese but were considered a form of scaffolding (Bacca-Acosta et al., 2021) as these could be taken away or changed to English exclusively when the student no longer needed them. Student participants worked one-on-one with the experimenter on four or five occasions throughout one year or more.

Materials

VR Headset

It was previously mentioned that virtual reality headsets are expensive, and the cheapest mid-range quality headset is the Meta Quest 2 retailing at about 40,000 yen or roughly 400 dollars. It has good resolution for standalone applications at 1832 x 1920 pixels per eye. Since participants would be using the headset one at a time, we only needed a single unit for all twenty-one students (Meta, 2019).

Testing Application (Game)

We chose the game *Job Simulator* by Owlchemy Labs for its section on learning to cook food in an American-style diner. The game's backstory goes like this: it is the distant future and robots have taken over most of the daily functions that humans used to do. The player is a human visiting the museum of ancient occupations and can choose which job to experience while the robots give them tasks in the chosen job.

The other main reason this game was chosen was because of the ease of use by students. Cybersickness becomes a problem when display factors such as frame rate, field of view, and vection (mismatched feeling of motion) are not comfortable. This would mean having at least sixty frames a second with a high field of view (90 to 130 degrees) Finally because the true physical motion of mainly moving only your arms to cook matches the illustrated movement of arms on the avatar in the game inhibits vection thus minimizing or eliminating cybersickness (Weech et al., 2019).

Real-world materials for positive transfer testing

One of the main reasons to use virtual reality for positive transfer is because of

the stated cost efficiency. For our study, it would have been hypocritical and not very cost-efficient to use actual foods with students to cook after learning in virtual reality. To make this cost-efficient we used paper cut-outs of the foods, utensils, and machines that were in the virtual environment. These paper cut-outs were easily identifiable as symbolic as well as inexpensive to make.

Figure 1.

Cut-outs used for practical skills testing of students (Source: Authors)



Assessment

Our assessment of positive transfer from virtual reality to the real-world classroom was based on and inspired by the article *Getting Your Game on: Using Virtual Reality to Improve Real Table Tennis Skills* (Michalski et al., 2019). They used a quantitative scoring method for physical skills in table tennis such as types of hits (backhand/forehand) and serving accuracy with a target game of hitting cans at the end of the table. The skills were scored numerically.

In addition, Michalski et al. (2019) used an “expert” in the field, in their case a table tennis pro to judge the quality of skills which was based on the observation of participants during the tasks. The professional evaluated the improvement in the quality of skills during the observations and gave the improvements a numerical score.

In our research, we were inspired to follow the same logic but using a mixture of both the quantitative and qualitative as we

were not testing for skill improvement but simply for positive transfer from virtual reality to a real-world situation. In this way our research was simpler and did not require so much an expert in the field of cooking, but as it were an expert in the field of English learning, such as the experiment administrator who is herself a proficient English speaker from Japan. Besides administering the testing, she gave the numerical scores for each student's judgment on the skills and whether they transferred.

Our modified method

We first needed as many volunteers as we could and found that the experiment administrator was able to recruit twenty-one students from her classes at Kochi University of Technology. Having had previous experience with the initial stages of cybersickness that some users get from their first time, she suggested and created an orientation warm-up using one of her teaching assistants. This gave volunteers a way to get comfortable with the virtual reality headset and controllers before the actual experiment. After this initial phase, all volunteers were given a pre-test on in game vocabulary, such as the terms for foods and tools used for cooking in English. Next student volunteers played the game through about the first five levels of virtual American diner cooking. Each of these levels had a specific name given to them by the in-game character, for example, the very first level is called "Classic Breakfast". Once the student was finished, they would come back on another day in the near future when they had time and take the skills test using the paper cut-outs while the administrator judged their skills while giving them a numerical score on a rubric we created:

Experts Judgement rubric

1. Speed)

0 - slow	1 - normal	2- fast
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 (*Speed is how quickly the student accomplishes the task*)
2. Accuracy)

0 - none	1 - some	2 - all
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 (*In comparison to the game's instructions how accurate was the student?*)
3. Creative skill use)

0 - none	1 - some	2 - a lot
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 (*How creatively did the student accomplish the tasks?*)
4. Gesturing/thoughtfulness)

0 - none	1 - some	2 - a lot
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 (*Did the student use gestures or reason out loud in English while they accomplish the skills test?*)
5. During the skills test of VR, did they speak in the target language?

0 - none	1 - little	2 - a lot
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 (*How much English did the student speak while working on skills test*)

The final steps of the experiment had the student volunteers re-taking the vocabulary test on foods and tools for cooking as well a final exit survey where they could freely express themselves in Japanese on the experience of using virtual reality to learn skills in an intensive English environment. In our last portion of the experiment, we test for long term positive transfer by bringing as many of the student volunteers back six months to almost a year later to re-test them and judge if they had maintained any of what they had learned in virtual reality.

Results

Skills Test

Figure 2 .

Results of all twenty-one students on the expert's judgment rubric (Source: Authors)

H	I	J	K	L	M	N
Gender	Level of English	Speed	Accuracy	Creative skill use	Gesturing/Thoughtfulness	Use of the target language
M	Intermediate	0	2	1	2	2
F	Intermediate	2	2	1	2	2
F	Advanced	2	2	1	2	2
M	Beginner	0	1	1	2	2
M	Beginner	0	1	1	1	2
F	Beginner	1	2	1	1	1
M	Beginner	1	1	1	1	1
F	Beginner	2	2	1	1	1
F	Beginner	1	1	1	1	1
F	Beginner	1	1	1	1	2
M	Beginner	1	1	0	0	1
M	Intermediate	2	2	2	2	2
F	Intermediate	1	1	1	1	2
M	Advanced	2	2	2	2	2
M	Intermediate	0	2	2	2	2
M	Intermediate	1	2	1	1	2
M	Intermediate	1	1	2	2	2
M	Intermediate	2	2	2	1	2
M	Beginner	2	1	2	1	1
M	Beginner	1	1	1	1	1
M	Beginner	1	1	1	1	2

A. Speed - 17/21 students (80.95%) were able to accomplish the task with a normal speed or better.

(10 students or 47.61% achieved the tasks at a presumably normal speed)

(7 students or 33.33% achieved the tasks at a fast speed)

(4 students or 19.04% achieved the tasks below a presumably normal speed)

This shows that instructions in the English intensive virtual environment were understandable to a degree that replicating the task in a real-world form (paper cut outs) was not hindered by a change in environment.

B. Accuracy - All 21 students accomplished the tasks with some or all accuracy.

11/21 (52.38%) of students had sufficient accuracy in accomplishing the tasks.

10/21 (47.61%) of students had good accuracy in accomplishing the tasks.

This would indicate that the tasks modeled through the game (visual prompts, English speaking, English text) for the students to accomplish during play was to a degree high enough that students could easily replicate the skills learned in the game in the real-world using cut outs.

C. Creative skill use -

14/21 students or (66.66%) accomplished the tasks with some creativity.

6/21 students or (28.57%) accomplished the tasks with a lot of creativity.

1/21 students or (4.76%) accomplished the tasks with no creativity.

This shows that while all skills were accomplished sufficiently by all students regardless of speed, they mainly stuck to replicating the skills on the paper cutout test as nearly as they could to the game,

with very few creative exceptions and one participant that replicated it as exact as possible. The creativity aspect comes from the ability to make foods with various non-traditional ingredients.

D. Gesturing / thoughtfulness-

8 students or (38.09%) used a lot of gesturing and speaking through the tasks while they did the skills test.

12 students or (57.14%) used some gesturing and speaking through the tasks while they did the skills test.

1 student (4.76%) used no gesturing or very little speaking while taking the skills test.

Students continued outside of the intensive English virtual environment during the skills test to use and replicate the English experienced/learned while in the game, leading us to believe that it had a positive impact on English learning.

E. Use of target language (English)

14/21 (66.66%) students spoke a lot of English while working through the skills test.

7/21 (33.33%) students spoke in some English while working through the skills test.

This finally led us to believe that the VR game had a positive impact on the students as it would have been much easier to revert to their native language to speak and work through tasks knowing that the teacher understood what they were saying.

Student Reactions to Virtual Reality and Opinions

On the exit survey given to all twenty-one students who participated, there were two repeated ideas that we hypothesized would be important and unsurprisingly brought up. The first was that of the cultural differences between ways of cooking,

vocabulary, foods, and tools that virtual reality brought to the student's attention. For the question "Did you learn anything from the game?", Some students replied on the survey:

"It's a culture difference from Japan: (the food called crumpets) and boiling water on a grill."

"The difference between foreign words and English. A mixer is called a blender."

"I was especially impressed by the English words for the tools used."

These are reflections on the ideas of what meals are like for foreign people (the robot in game asks for crumpets as a breakfast food) while the virtual environment does not have a hot water pot, students had to deduce that they could boil water on a flat grill to make tea in another level. The student's previous conceptions on what English words were correct, how tools were used was also challenged and the discrepancy created a situation in which they must actively work it out.

The second, and more important aspect we hypothesized was also brought up on the survey under the same question: "Did you learn anything from the game?" It was mentioned by students, the practicality of using virtual reality as a tool for teaching English and skills in a virtual Environment, that immersion in a practical situation created a real sense of purpose because they could understand why they were learning the skills and the accompanying English.

"English vocabulary and the flow of real English conversation"

"What you can understand even if you are a beginner in English and have difficulty with listening."

"I learned the importance of verbs and conjunctions by explaining the cooking"

process in order.”

“It is difficult to force myself to switch to English in my daily life, and my mind moves in Japanese, but this game was strange because it felt realistic, but I felt like I had to think in English. It was very innovative to be able to simulate daily life in English.”

At the conclusion of the survey student's final thoughts were generally positive toward the use of virtual reality and surprisingly accepting of using virtual reality as a tool for learning English and skills. They mention the difficulties of using virtual reality, but more importantly how the practicality of it gives the learning purpose and meaning.

“VR felt more realistic than I expected, and I thought it would be great if I could properly translate some aspects of my life into English. It's difficult to buy a VR device for each person, and it's also difficult to wear it all the time, so I think that's the problem.”

“I think learning English using VR is very good for people who are not good at English. It was nice to be able to learn in a real-life way, not just on paper.”

“I think it's a very good learning method because it's a practical game, so you can not only listen but also feel and memorize English that can be used on a daily basis.”

Discussion

Our study examined the feasibility of using virtual reality in an L2 as a tool for the positive transfer of skills from virtual reality to a real-world situation. We modeled our research on the methods of Michalski et al. (2019) in their work on the positive transfer of sports skills to

practical application. We reinforced the method with ideas from Xie et al. (2021) in their research on common assessment tests and evaluations of positive transfer from virtual reality. Our method was mainly qualitative as it encompasses interpretivism, epistemological orientation, and constructionism. (Bryman, 2006). What we discovered was that the cooking skills taught in the L2 through virtual reality did transfer to a real-world situation. There are some comparisons to be made between our research and that of the Michalski et al. (2019) study on which ours is influenced.

Firstly, Michalski et al. (2019) were looking for skill improvements from virtual reality to reality to indicate significant improvements can be made using VR. Because of this, they had both an experimental group and a control group. They showed that the benefit was at least great enough that it was worthwhile in comparison to no training at all. In essence, they were measuring the strength of the transfer.

Our study on the other hand had only an experiment group. Simply enough to only see if skills transferred meant that we did not need a control group to gauge the strength of the transfer. We only wanted to know if skills learned while immersed in the L2 (English) virtual environment would be applicable outside to the real-world IE, did they learn anything. To have had a control group would have been quite meaningless. If we had one group that was immersed in VR cooking and another that had no interaction in cooking at all, it seems obvious that any amount of training virtual or otherwise would automatically trump the lack of cooking experience.

Secondly, Michalski et al. (2019) stated

that learner characteristics are known to affect training outcomes (Baldwin, 1988). For their study, the participants had previous experience in table tennis at a novice level. They could not determine if such benefits could be reaped for intermediate and advanced table tennis players. In our study, it is believed that the difference in culture created a situation ripe for learning for all students from beginner to advanced. That student's L1 and culture (Japanese) was different enough from the L2 and its cooking culture (English), creating a kind of “gap” that made it much easier to see if skills did transfer. As an example, on the exit survey, a student had remarked on his ability to make a sandwich. It is not that sandwiches do not exist in Japan, but rather that the L2 English virtual reality version of a sandwich is different enough that it created an impactful learning experience. That the two cultures have differences in food names, tools, and processes made seeing the positive transfer much easier.

Our concept of a “gap” between cultures generating positive transfer is well documented and illustrated in a related Cultural Anthropology concept. Michael Agar who wrote *Language Shock: Understanding the Culture of Conversation*, created “rich points” to explain such moments when two cultures, languages, behaviors, or processes come in contact. A rich point is that moment of surprise or break from expectation that defines the difference between the *languaculture* of the source (L1) and the *languaculture* of the target (L2) and creates subsequent learning thereafter (Agar, 2006). Languaculture is the multimodality of a language, such as knowing the culture, behaviors, processes, grammar, and vocabulary (Agar, 1994). In this way, the gap between what was

expected by a Japanese student while cooking was impactfully different enough in the English virtual reality cooking simulation that some positive transfer would occur.

A final comparison to Michalski et al. (2019) is on the validity and reliability of measures in doing a study of this nature. As they point out, they are one of the first studies to investigate transfer from virtual reality to reality. Thus, as detailed and careful as they were in the study, they mention room for improvement. Michalski et al. (2019) had an expert table tennis pro judge the skills of the participants. To that end, it would be different if they had more than one pro giving judgment. With more evaluators, agreement on the assessments might also be problematic. For our study, how different would it have been if multiple fluent English-speaking teachers judged the positive transfer of the students? Or even if the judgments came from a native English speaker who is a short-order cook or chef by profession? It seems likely that the more assessment from experts that you could get the more accurate a study would be. This can hopefully be implemented in future studies of positive transfer from virtual reality.

Conclusion

Our purpose was to find a convenient, cost-efficient way to use virtual reality in a classroom while answering the question: *Can virtual reality be used in the L2 for positive transfer of skills from an intensive English environment to Reality?* To accomplish this and add the literature on virtual reality in education, specifically English as a Foreign Language Education, we took inspiration from Michalski et al. (2019). We created a modified version of their experi-

ment for our own EFL students and had good success with it.

We believe our success comes from a few points brought to light by the research. In virtual reality, instructions were repeatable from VR to reality because tasks were scaffolded with in-game prompts and texts which made understanding by the student volunteers much easier. Also, the game gave creative freedom to make meals within very limited boundaries. Volunteers could make a smoothie with a mixture of cookies, wine, and tomatoes instead of the recommended ingredients but still reward the volunteer with finishing the level. While our students did not take such creative liberties with tasks this would also show that instructions were clear, making replication on the cut-out skills test easy even for beginners of English.

Student volunteers continued to use the target language learned from the intensive virtual environment while taking the cut-out skills test. We believe that the immersion in the intensive virtual environment presented the students with our initial claim of virtual reality use: merging the practical with the purpose, or in this case skills and English language through cooking, thus students could easily retain and recall what they had learned in virtual reality.

Finally, we wanted to know if anything would remain in the long-term considering the skills tests were given in the short term. Would students remember anything six months up to a year later? To our surprise they did. We retested nearly all the students around six to eight months later and found that while the details of the skills tests were not always remembered, the skill processes were mostly retained. This does not seem surprising as the process was the only constantly repeated

action; all other aspects were variable in that choosing which foods to use in most “recipes” were arbitrary but the process by which they made the food in the intensive English virtual environment was always the same.

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