

Virtual Reality in the EFL Classroom: Educational Affordances and Students' Perceptions in Cyprus

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Abstract

Virtual reality has attracted the interest of the research community due to the endless possibilities it offers in the educational arena. Although a wide range of applications already exists, further research is required to establish effective practices for a fruitful classroom implementation. This quantitative research of a sample of 37 primary school students explores the educational affordances and students' perceptions of virtual reality systems as supportive tools for teaching English as a foreign language. To address the objective of the study, an evaluation test and a questionnaire were administered to the participants. The results showed a positive outcome on students' performance, since it motivated them to visualize abstract knowledge within the virtual world without having to leave the comfort zone of their classroom. The current work revealed the growing potential of VR in the teaching and learning practices and can serve as a reference point for studies to follow. The vision of further agenda on the dynamics of virtual reality in the field of foreign language education is highlighted. Finally, implications for the implementation of VR in the educational system in Cyprus are discussed.

Keywords: virtual reality (VR), educational technology, primary education, students, Google Cardboard, Google Expeditions, English as a Foreign Language (EFL), constructivism

Introduction

There are several definitions that have been proposed in an attempt to clarify what virtual reality (VR) is. According to Sanchez, Lumbers and Silva,³ it is a computer-based technology that introduces its user to a non-real world, using audiovisual and touch stimuli to create a sensation immersion in the virtual world. Although VR systems were initially developed for entertainment,⁴ they are also used for demanding

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 - 3 J. Sánchez, M. Lumbreras and J. Silva, 'Virtual Reality and Learning: Trends and Issues', in *Proceedings of the 14th International Conference on Technology and Education*, Oslo, 10-13 August 1997 (1999).
 - 4 C. Stein, 'Virtual Reality Design: How Head-Mounted Displays Change Design Paradigms of Virtual Reality Worlds'. *Media Tropes*, Vol. 6, No. 1 (2016).

training environments in industries that require effective simulations, such as medicine, military, aviation and engineering.⁵

Theorists and educators now seek to integrate VR into the classroom as they believe that it has the means to completely transform the teaching method, taking into account its multiple benefits, as it seems to follow the theory of constructivism, according to which students build essential knowledge from their personal experiences and authentic situations.⁶

Various technological tools, although not originally developed as a means of promoting education, are now being used to enhance teaching and to facilitate learner engagement and knowledge retention. Therefore, there is a need for continuous diversification of the teaching methods based on the evolutionary course of the digital media. Virtual reality (VR) is the new great achievement that requires the reformulation of teaching to keep up with current trends.⁷

Given these statements, the Cyprus Educational system lacks virtual reality technological readiness; hence, digital education initiatives should be present in the Cypriot educational context. VR integration in primary school curriculum clearly creates a challenge that must be addressed today, since both students and teachers need to become members of a digital citizenry and responsible users of digital technologies. The global community is now endeavouring to develop students into digital citizens, capable of finding solutions for the world's greatest technological advances.⁸

Henceforth, this research was conducted to examine the potential benefits and drawbacks of the implementation of VR technology into the classroom and to investigate students' perceptions of this medium.

Theoretical Background

Recent studies exemplified the possible benefits of virtual reality in subjects that demand authentic situations, such as foreign language learning.⁹ Phenomena and situations that may be inaccessible or too difficult to perform in the physical world can

5 J Rong Yang, et al., 'Classroom Education Using Animation and Virtual Reality of the Great Wall of China in Jinshanling'. *The ASEE Annual Conference & Exposition* (2017).

6 Bouras and Tsiatsos, 2006; Huang, Rauch & Liaw, 2010; X. Chen and M. Chen, 'The Application of Virtual Reality Technology in EFL Learning Environment in China'. 2016 *International Conference on Sensor Network and Computer Engineering*, eds Liu Weigu, C, Guiran, Z. Huiyu (Paris: Atlantic Press, 2016).

7 Chen and Chen, 'The Application of Virtual Reality Technology'.

8 Logan (2016).

9 Chen and Chen, 'The Application of Virtual Reality Technology'; D. Liu, et al., 'The Potentials and Trends of Virtual Reality in Education'. In *Virtual, Augmented, and Mixed Realities in Education*, eds D. Liu, C. Dede, R. Huang, J. Richards (Singapore: Springer, 2017),

now be created securely in the digital environment, allowing students to experience realistic interactions.¹⁰

Constructivist Approach

According to various researchers' VR follows the constructivist theory of learning.¹¹ The lack of external stimuli achieves a high degree of immersion in the digital world, as the user unconsciously builds primary patterns of learning that lead to the subliminal capture.¹² The obstruction of external visual and acoustic stimuli minimizes student disorientation and assists the connection with the learning material.¹³ The user and median interaction that takes place leads to the argument that a VR system is an experiential learning environment, which, according to constructivists, will trigger the establishment of new knowledge as the person learns through actions.¹⁴ Inside the virtual world, the user interacts freely with the virtual objects, receiving immediate feedback, which leads to the assumption that VR promotes discovery learning, enriching even more the user's experience.¹⁵ The introduction of practical knowledge into the classroom is achieved as students, instead of just listening to the teacher, acquire real experience through the virtual environment, becoming able to recall the associated information more easily for later use, which is a practice which the theory

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- 10 C. Christou, *Virtual reality in education. Affective, interactive and cognitive methods for e-learning design*, eds A. Tzanavari and N. Tsapatsoulis (Hershey, PA: IGI Global, 2010); W. S. Alhalabi, 'Virtual reality systems enhance students' achievements in engineering education'. *Behaviour & Information Technology*, Vol. 35, No. 11 (2016); J. Rong Yang et al., 'Classroom Education Using Animation'; C. W. Shen, et al., 'Behavioral intention of using virtual reality in learning'. In *Proceedings of WWW '17 26th International World Wide Web Conference* (Geneva: International World Wide Web Conferences Steering Committee, April 2017), 129-137.
- 11 L. Jensen and F. Konradsen, 'A review of the use of virtual reality head-mounted displays in education and training'. *Education And Information Technologies*, Vol. 23, No. 4 (2018), 1515. DOI:10.1007/s10639-017-9676-0; J. Martín-Gutiérrez, et al., 'Virtual Technologies Trends in Education'. *Eurasia Journal of Mathematics, Science and Technology Education*, Vol. 13, No. 2 (2017).
- 12 K. Tsolakidis and M. Fokidis, 'Virtual reality in education: An initial reflection'. *Modern Education* (2004).
- 13 R. Gadelha, 'Revolutionizing Education: The promise of virtual reality'. *Childhood Education*, Vol. 94, No. 1, (2018), 40-43.
- 14 Y. Chen, 'The Effects of Virtual Reality Learning Environment on Student Cognitive and Linguistic Development'. *The Asia-Pacific Education Researcher*, Vol. 25, No. 4, (2016); Liu et al., 'The Potentials and Trends of Virtual Reality'; Greenwald et al., 'Technology and applications for collaborative learning in virtual reality'. In *Making a Difference: Prioritizing Equity and Access in CSCL, 12th International Conference on Computer Supported Collaborative Learning (CSCL)*, Vol. 1, eds B. K. Smith et al., (Philadelphia, PA: International Society of the Learning Sciences, 2017), 719-276.
- 15 Martín-Gutiérrez et al., 'Virtual Technologies Trends in Education' *EURASIA Journal of Mathematics Science and Technology Education*, Vol. 13, No. 2 (2017).

of constructivism encourages as the most appropriate way of learning.¹⁶ The user is transformed from a passive observer into an active explorer, learning through one's own actions and experiences.¹⁷ This systematic process of exploration and discovery will ultimately enable the cultivation of imagination and the promotion of user creativity.¹⁸

Enhanced Learning Experience

An increased level of motivation is also achieved since learning becomes easy and fun with the use of VR systems in the classroom.¹⁹ The fun nature of VR will definitely enhance student's interest, thus leading to higher engagement.²⁰

Researchers stated that the strongest attribute of VR is the fact that it assists the user to visualize situations and abstract ideas that other mediums fail to do so.²¹ The visualization of objects and processes from different angles in a 3D perspective is the main reason behind this unique characteristic of VR.²² Consequently, visualization not only makes the understanding of new concepts possible, but also allows better knowledge retention for students.²³ Eventually this will influence students' performance

16 S. Minocha, 'The State of Virtual Reality in Education – Shape of Things to Come', *International Journal of Engineering Research*, Vol. 4, No. 11 (2015).

17 Christou, 'Virtual Reality in Education'; E. Barilli, 'Virtual Reality Technology as a Didactical and Pedagogical Resource in Distance Education for Professional Training', in *Distance Education*, ed. P. Muyinda (London: IntechOpen, 2013); M. Dávideková et al., 'Utilization of Virtual Reality in Education of Employees in Slovakia'. *Procedia Computer Science*, Vol. 113 (2017).

18 Chen, 'The Effects of Virtual Reality Learning Environment'; J. Tempchin, 'How Virtual Reality Will Democratize Learning'. *ReadWrite.com* (2016, March 23); Dávideková et al., 'Utilization of Virtual Reality in Education'; Parmaxi et al., 'Enabling Social Exploration Through Virtual Guidance in Google Expeditions: An Exploratory Study', in *Interactive Mobile Communication Technologies and Learning: Proceedings of the 11th IMCL 2017*, eds M. Auer and T. Tsiatsos (Basel: Springer, 2018).

19 Minocha, 'The State of Virtual Reality in Education'; S.H. Lee, et al., 'Assessing Google Cardboard virtual reality as a content delivery system in business classrooms'. *Journal of Education for Business*, Vol. 92, No. 4 (2017); B. Ozkan, 'The Reflections of English as a Foreign Language Teachers' on the Use of Virtual Reality in Classroom Practice (International Black Sea University Case). *Journal of Education in Black Sea Region*, Vol. 2, No. 2 (2017).

20 Chen and Chen, 'The Application of Virtual Reality Technology'.

21 Chen, 'The Effects of Virtual Reality Learning Environment'; Parmaxi et al., 'Enabling Social Exploration Through Virtual Guidance'; G. Yildirim, et al., 'Analysis of Use of Virtual Reality Technologies in History Education: A Case Study.' *Asian Journal of Education and Training*, Vol. 4, No. 2 (2018), 62-69.

22 J. Rong Yang et al., 'Classroom Education Using Animation'.

23 T. G. Moesgaard et al., 'Implicit and Explicit Information Mediation in a Virtual Reality Museum Installation and its Effects on Retention and Learning Outcomes', in *Proceedings of The 9th European Conference on Games-Based Learning: ECGBL 2015*, eds R. Munkvold, & L. Kolás (Reading, United Kingdom: Academic Conferences and Publishing International, 2015); I. Stojšić, et al., 'Possible application of virtual reality in geography teaching'. *Journal of Subject Didactics*, Vol. 1, No. 2 (2017).

and bolster learning.²⁴

Despite the high expectations and popularity of educational VR,²⁵ few researches have defined the necessary elements allowing its integration in the classroom, as its merits are based mainly on assumptions and theories.²⁶ Besides, most of those works focus on adults instead of underage students, which leads to the assumption that there is a need for further investigation. Therefore, the current research study aims to examine the integration of VR into the EFL (English as a foreign language) classroom for A1 and pre-A2 language learners, by exploring students' attitudes and its educational affordances.

Google Cardboard and Expeditions

The learning affordances of the VR systems affordances in the classroom were not fully exploit up until 2014. This was due to the fact that those systems not only were expensive but also required extremely costly equipment to operate, making their acquirement almost impossible.²⁷ The appearance of Google Cardboard reversed that situation since it was cheaper to obtain and at the same time it did not require any state-of-the-art hardware besides a smartphone.²⁸ Google Cardboard is an HMD (Head Mounted Display) that adapts to the user's head and is responsible for immersing the user in the simulated world through the digital representations projected by the smartphone. Inside the Cardboard, two optical lenses exist, creating the necessary sense of depth, and two magnets are responsible for triggering the phone's touch sensors, enabling a form of interactivity.²⁹ In an HMD, the main controller is the human head instead of the hand since it is equipped with built-in sensors that detect the person's movement.³⁰

Undoubtedly, Cardboard suffers from a few drawbacks, too. Some VR applications

24 Alhalabi, Virtual reality systems enhance students' achievements in engineering education.; Ozkan, 'The Reflections of English as a Foreign Language Teachers'.

25 Schaffhauser, D., 'VR and AR Come of AGE'. *THE Journal*, Vol. 44, No. 3 (2017); Gadelha 'Revolutionizing Education'.

26 Jensen and Konradson, 'A review of the use of virtual reality head-mounted displays'.

27 Dávideková, et al., Utilization of Virtual Reality in Education'; A. Gronstedt, 'The Immersive Reality Revolution', *TD: Talent Development* Vol. 72, No. 2 (2018), 32.

28 M. Hussein and C. Natterdal, 'The benefits of virtual reality in education: A comparison study', Bachelor's thesis (University of Gothenburg, Göteborg, Sweden, 2015); E Mann Levesque, 'Is virtual reality ready for school?' *Brookings.edu* (2016); M. Yap, *Google Cardboard for a K12 Social Studies Module*, (Honolulu: ScholarSpace, 2016).

29 Hussein and Natterdal, 'The benefits of virtual reality in education' 2015; D. Vergara et al., (2017) 'On the Design of Virtual Reality Learning Environments in Engineering'. *Multimodal Technologies and Interaction*, Vol. 1, No. 2 (2017).

30 Alhalabi, 'Virtual reality systems enhance students' achievements in engineering education'; Stein, Virtual Reality Design; C. Woodford, 'Virtual reality'. *Explainthatstuff.com* (2017, March 14).

require specialized controls for proper navigation and interaction, functions that cannot be executed by the simplistic magnetic trigger which is incorporated inside the Cardboard.³¹ Another issue is that its motion sensors take advantage of the smartphone's accelerometer, possibly leading to headaches or a feeling of nausea for the user during prolonged periods of time.³² Finally, dependence on the smartphone results in the lack of plausibility offered by other HMDs that are connected to personal computers.³³ Despite the aforesaid disadvantages, Google Cardboard provides an opportunity for classroom integration given the widespread of smartphones and its promising characteristics,³⁴ focusing in particular on its low cost compared to other VR systems.³⁵

In 2015 Google launched 'Expeditions', an Android application for Cardboard, perceiving its possibilities in the learning process.³⁶ This app provides students the opportunity to embark on expeditions which consist of different scenes that immerse the viewer in a visual experience. At the moment over 500 expeditions are included, varying from historical places and museums to outer space.³⁷ A portable device is used by the teacher to control the expedition assuming the role of the guide, while a number of useful features exist to support the teaching of the student-explorers, such as detailed information of the various scenes.³⁸

Methodology

A quantitative approach was followed to clarify the learning outcomes resulting from the use of virtual reality in the EFL classroom. An evaluation test and a questionnaire were administered to measure VR educational affordances and determine learners' attitudes.

31 Stojšić et al., 'Possible application of virtual reality in geography teaching'.

32 Hussein and Natterdal, 'The benefits of virtual reality in education'.

33 Jensen and Konradsen, 'A review of the use of virtual reality head-mounted displays'; Martín-Gutiérrez et al., 'Virtual Technologies Trends in Education'.

34 A. Brown and T. Green, 'Virtual reality: Low-cost tools and resources for the classroom'. *TechTrends*, Vol. 60, No. 5 (2016); B.-W. Lee et al., 2017b, (2017, May) 'Educational Virtual Reality implementation on English for Tourism Purpose using knowledge-based engineering', in *Proceedings of the 2017 IEEE International Conference on Applied System Innovation* (Piscataway, NJ: IEEE, 2017), 792-795; Stojšić et al., 'Possible application of virtual reality in geography teaching'.

35 A. DeNisco, 'Wearable tech expands new horizons'. *District Administration*, Vol. 51, No. 11 (2015); F. Rasheed et al., 'Immersive virtual reality to enhance the spatial awareness of students', in *Proceedings of the 7th International Conference on HCI, India HCI 2015* (NY, NY: ACM 2015, December); Yap, Google Cardboard for a K12 Social Studies Module.

36 Stojšić, et al., 'Possible application of virtual reality in geography teaching'.

37 Yap, Google Cardboard for a K12 Social Studies Module.

38 Brown and Green, 'Virtual reality'; Parmaxi, et al., 'Enabling Social Exploration Through Virtual Guidance'.

Participants

The research sample consisted of 37 learners studying in four different classes of a language school during the academic year 2018-19. Their level of the English language ranged from A1 to pre-A2, according to the CEFR (Common European Framework for Languages), as determined by their scores in a language test that took place about six months before the end of the data collection. Half of the classes were randomly assigned to the experimental group, while the other two were assigned to the control group. For data collection purposes, the post-experimental design of two equivalent groups was chosen to explore the relationship between the research variables.

Material

The questionnaire of the control group explored students' attitudes towards static pictures as a tool for supporting English language learning, while the questionnaire of the experimental group aimed to find out students' attitudes towards VR as a supportive tool for learning English. The design of the two questionnaires was based on Davis' Technology Acceptance Model (TAM), which is a conceptual model developed to examine users' acceptance of technological innovations.³⁹ TAM is used by many researchers to capture and predict the behaviour of the individual against various information systems and applications.⁴⁰ The primary source for the development of the questionnaire was the survey of Huang, Rauch and Liaw,⁴¹ which examined pupils' attitudes towards the VR systems in a constructivist approach, and the case study by Yildirim, Elban and Yildirim⁴² who sought the influence of VR systems when teaching history to higher education students. Also, in order to formulate the factors alleged to be related to student opinions, the questionnaire of Shen, Ho, Kuo and Luong⁴³ was taken into consideration, which examined students' intentions towards educational VR. The questionnaire was made up of three categories that recorded students' demographics, their attitudes towards educational VR and the impact of VR to their learning. All 23 items besides the two demographic questions were measured on a 5-point Likert-type scale with responses ranging from 1 (disagree) to 5 (agree).

39 F. D. Davis, 'Perceived usefulness, perceived ease of use, and user acceptance of information technology'. *MIS Quarterly* (1989), 319-340.

40 H. Huang and S. Liaw, 'An Analysis of Learners' Intentions toward Virtual Reality Learning Based on Constructivist and Technology Acceptance Approaches', *International Review of Research in Open and Distributed Learning*, Vol. 19, No. 1 (2018).

41 H. M. Huang, U. Rauch and S. S. Liaw, 'Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach'. *Computers & Education*, Vol. 55, No. 3 (2010).

42 Yildirim, et al., 'Analysis of Use of Virtual Reality Technologies in History Education'.

43 Shen, 'Behavioral intention of using virtual reality in learning'.

To compile and create the evaluation test that measured students' knowledge acquisition and retention, a survey by Yang, Chen and Jeng⁴⁴ (2010) was used, which examined the educational outcome of VR technology, as well as a questionnaire by Mark Lee et al.⁴⁵ that explored the potential of Google Cardboard in the classroom as a means of transferring new knowledge. In addition, an evaluation test, developed by Moesgaard et al.,⁴⁶ that investigated the cognitive impact of simulation systems in a historical museum on Danish high school students was also used. Finally, to further inspect the learning effects of VR technology, the test of this research was also based on Shih's test,⁴⁷ which measured the probable acquisition of cultural knowledge within a modified virtual environment.

Setting

The course was divided into two parts. The first part was common for both groups. The students learnt about famous sights of the city of London by listening to an English-speaking narrator. In the second part, teaching the control group was supported using the conventional method of a sequence of static images depicting famous city-sights, followed by a verbal description of each picture in English. On the other hand, the subjects of the experimental group were exposed to the effect of the experimental variable, namely the use of the VR system. Each experimental group was given six Google Cardboards and six Android smartphones that were preconnected to the school's Wi-Fi. Since both of those groups had more than six participants, ten and seven respectively, students were asked to often swap their HMDs with their peers' to ensure that all participants would spend enough time immersed in the virtual world. The application employed was Google Expeditions, which was controlled by the instructor, who was also responsible for providing the necessary verbal information regarding each scene. Subsequently, the control and the experimental groups were asked to sit a test and a questionnaire in order to extract the necessary data.

Data analysis

Quantitative data analysis was conducted via SPSS 19.0, which consisted of two separate steps. First, descriptive statistics were calculated in order to examine the

44 Yang, Chen and Jeng, 'Integrating video-capture virtual reality technology into a physically interactive learning environment for English learning'. *Computers & Education*, Vol. 55, No. 3 (2010), 1346-1356.

45 Lee et al., 'Assessing Google Cardboard virtual reality'.

46 Moesgaard et al., 'Implicit and Explicit Information Mediation in a Virtual Reality Museum Installation'.

47 H. Y. Shih, 'A virtual walk through London: culture learning through a cultural immersion experience.' *Computer Assisted Language Learning*, Vol. 28, No. 5 (2015).

variables of the questionnaires. Then an independent sample T-test was executed to determine whether there was a statistically significant difference between the test scores of the two groups.

Results

Participants' descriptive statistics are reported in tabular form in Table 1. Cronbach's alpha was calculated to assess the level of internal consistency reliability of all variables of interest. The reliability coefficient (Cronbach's alpha) showed high consistency across the items of the tools: (experimental group, $\alpha = .916$), (control group, $\alpha = .809$). To determine whether the differences in the two teaching modes are statistically significant, the test of independent samples was used. It was found that there is no statistical difference between the scores of the evaluation test extracted from the experimental group ($M = 7.59$, $SD = 1.23$, $N=17$) and the scores of the control group ($M= 6.95$, $SD= 2.09$, $N=20$); $t= (35) =1.11$, $p>.05$.

Table 1: Descriptive Statistics

	Group	N	Mean	Std. Deviation
Total Test Score	Experimental	17	7.59	1.23
	Control	20	6.95	2.09

The summary of the results from both questionnaires on students' perceptions is illustrated in Figure 1. The experimental group showed increased means in all but two questions, which were related to the perceived usefulness of VR, as it was found that the control group showed a more positive stance regarding the traditional method of teaching (Q12, Q19). Besides the experimental group showed decreased ability to maintain focus while using the media compared to the control group which demonstrated marginally higher level of dedication (Q8). Finally, it was pinpointed that students of the experimental group found it harder to interact with the tutor while being immersed in the virtual world (Q4).

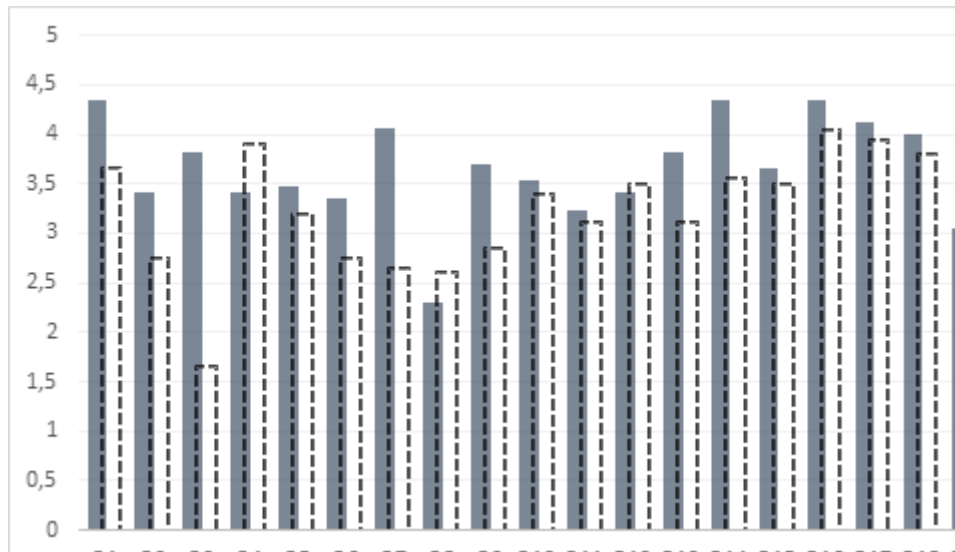


Figure 1: Mean differences between VR system (experimental group) and Static Images (control group)

Discussion

In this research the potential of virtual reality in the EFL classroom was investigated. Results' analysis showed that Google Cardboard was found to have a higher level of perceived usefulness compared to the sequence of images that was used. This can also be presumed by the highest score achieved by the students taught with the help of the virtual reality system, although it was not as great as other scholars have recorded.⁴⁸ With the help of a VR system, the user is able to better understand abstract concepts and complicated processes.⁴⁹ This visualization of information is seen as an essential advantage of simulation systems as recalling knowledge becomes easier.⁵⁰ On the other hand, it should be noted that according to students' beliefs, there was no substantial difference in terms of knowledge retention, learning new information, and understanding between the two methods.

48 Alhalabi, 'Virtual reality systems enhance students' achievements in engineering education'.

49 D. Janßen, C. Tummel, A S. Richert, and I. Isenhardt, 'Towards Measuring User Experience, Activation and Task Performance in Immersive Virtual Learning Environments for Students', in *Immersive Learning Research Network: Second International Conference, iLRN 2016 Santa Barbara, CA, USA, June 27 – July 1, 2016 Proceedings*. ed. C. Allison et al. (Switzerland: Springer, 2016), 45-58.

50 Yap, Google Cardboard for a K12 Social Studies Module.

Despite the fact that students found the VR system to be more interactive compared to the sequence of images, the degree of interactivity was low for both methods of teaching. The lack of substantial interaction largely degrades the usability of the VR system, as through this method, a user's attention deviates over longer periods of time while the margin for learning by personal experience is reduced.⁵¹ Such a conclusion has already been drawn by Chen and Chen,⁵² who consider interactivity essential for the users, empowering them to modify the objects of the virtual world as they wish. In the digital world of the current research, students were unable to use the objects they viewed, as Google Expeditions did not provide a satisfying degree of object manipulation.

Besides, according to students' beliefs, the depth of achieved immersion was not formidable. Based on related literature, one of the negatives that can be attributed to Google Cardboard is the low immersion which is created for the person involved.⁵³ Although the users found the digital representations realistic and qualitative, they failed to maintain their focus in the virtual world. The experimental process may have influenced this outcome, as students were occasionally called to withdraw from the virtual world by removing the HMD due to the lack of the necessary number of Cardboards. The main problem behind this is that, in order for a VR system to be as realistic as possible, it has to immerse one's mind and body to a high degree,⁵⁴ a situation which was not achieved in the study.

The reduced immersion may also have been caused by some technical problems that had occurred in the process. Although the combination of HMD and the Expeditions application was excellent and no technical issues arose, the students reported they were physically inconvenient to use. Physical discomforts such as nausea were reported because of the smartphone's accelerometer. This issue was also present in other researches which identified physical discomforts from the prolonged use of Google Cardboard.⁵⁵

It is beyond a doubt, however, that the learners were greatly entertained by the use of VR during the EFL lesson, and wished it would be adopted by other school subjects. These responses are fully justified, as it was found during the literature review that one of the main advantages that VR offers is the reinforced motivation to engage in the

51 A. B. Ray and S. Deb, (2016, December) 'Smartphone Based Virtual Reality Systems in Classroom Teaching – A Study on the Effects of Learning Outcome'. In *Technology for Education (T4E)*, 2016 IEEE Eighth International Conference on IEEE (2016), 68-71.

52 Chen and Chen, 'The Application of Virtual Reality Technology' (2016).

53 Martín-Gutiérrez et al., 'Virtual Technologies Trends in Education'.

54 Woodford, 'Virtual reality'.

55 Hussein and Natterdal, 'The benefits of virtual reality in education'.

subject being taught.⁵⁶ This positive attitude of students will help their learning since people tend to learn efficiently when dealing with situations that draw their interest⁵⁷.

Implications for Practice

The uses of virtual reality in education are impressively vast. This paper offers important educational and theoretical significance for teachers and policy makers in Cyprus in regard to the uses of virtual reality in primary education. Specifically, the great potential of integrating VR as a teaching and learning tool in EFL classes was revealed, promoting research in the field of virtual reality-based education. VR-based education can improve teaching and learning practices, providing new ways for students to interact and gain hands-on experience. In modern multicultural societies, students who would like to study abroad need to gain an in-depth knowledge and comprehension of a foreign language to fully understand the teaching material. To this extent, VR allows built-in translations, which promote students' conceptual understanding and help them accomplish their educational goals in a more efficient and engaging way.

Given the increased digital skills required by the job market in Cyprus and abroad, educational policy-makers should grasp the aforementioned benefits of VR in the classroom and suggest implications for curriculum reform at the primary level in Cyprus. Henceforth, the revised curriculum needs to (a) encourage primary teachers to use experiments and hands-on activities when teaching abstract concepts and complicated processes to students; (b) provide opportunities for students to use VR applications to understand and recall abstract and complicated concepts through the visualization of information; and (c) teachers and students should be prepared for the implementation of VR technology in education through continuous professional development and training.

Conclusion and Future Directions

Virtual reality has been subject to intense discussion and reflection by the teaching community with regards to the educational affordances it offers. Being physically present in the safe classroom environment enables students to travel to a digital world, experiencing a new way of learning. In relation to the cognitive effects of this medium, there was a marginal improvement in students' performance taught with the aid of

56 L. Freina and M. Ott, 'A literature review on immersive virtual reality in education: state of the art and perspectives'. In *The International Scientific Conference eLearning and Software for Education*, Vol. 1 (2015, January), 133; Yap, Google Cardboard for a K12 Social Studies Module.

57 Tsolakidis and Fokidis, 'Virtual reality in education'.

VR, as opposed to those taught without it, confirming that it has the elements to stand out as a beneficial learning tool. VR allowed students to visualize new information and helped them to construct the necessary subconscious patterns required to turn theory into substantive knowledge. At the same time, this teaching approach led students to a higher level of engagement with the English language since considerable motivation was achieved. The small financial burden of purchasing the Google Cardboard system, along with the widespread use of mobile phones, assisted the introduction of VR in the EFL classroom. However, due to this dependence on mobile phones, user experience was affected. It should be stressed that the restrictions posed by the HMD that was used, influenced user-experience, as the levels of immersion and interactivity were far lower than the ones found from more expensive VR systems.

To conclude, Google Cardboard offers great potential to be utilized in education as students are given the opportunity to explore places and situations through a completely new perspective, while incorporating the element of entertainment. On the contrary, this technology suffers from a number of constraints which may affect the growing potential of VR in learning. The evolution of technology will lead to the improvement of both Cardboard and Expeditions, as well as other educational applications, guaranteeing that Virtual Reality will shape learning in the near future.

Further studies should investigate how this technology affects students' motivation when they are immersed in virtual worlds in the long-run. The current research can also be the reference point for further exploration of the dynamics of virtual reality in the field of foreign language education. Upcoming studies can suggest a teachers' guide on how to integrate VR in the curriculum that will support and enhance students' twenty-first century skills. Besides, future application designers need to take into consideration the issues that have been explored with the use of Google Expeditions, and develop their applications in a way that fosters interactivity and ensures enhanced feedback.

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