Virtual reality and foreign language learning

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Abstract

Virtual Reality (VR) refers to a type of simulated reality, constructed using computer systems and digital formats. The construction and visualization of this type of reality requires the use of hardware and software powerful enough to create a realistic and immersive experience (for example, VR helmets or dedicated glasses and 3D software) experienced in first person. Immersive Virtual Reality (IVR) is typically multimodal in nature and provides a sense of immersion in the environment through 360-degree images using a head-mounted-displays (HMD), auditory stimulation using earphones, and the proprioception of the limbs through the control and monitoring instruments. Augmented Reality (Agumented Reality - AR), on the other hand, superimposes synthetic elements such as 3D objects, multimedia content or text information on real-world images, increasing its possibilities of interaction with the user. It is a perceptual enhancement, based on the generation of virtual content by a computer and their overlap with reality. Both Virtual Technologies are no longer limited to specific and circumscribed areas (e.g. aerospace industry), but are currently used in many areas, including education, medicine, psychotherapy, etc. VR has long been studied and described for its potential to revolutionize education as it would provide numerous benefits, including access to limited logistical experiences (such as going to the moon) or access to experiences that are physically impossible (such as being inside a molecule). The use of VR as a pedagogical method, in fact, is not a modern phenomenon and research on its usefulness has been studied for almost half a century. As early as the 1970s, Ellinger and Frankland (1976) discovered that the use of the first computers to teach economic principles produced greater learning outcomes when compared to those obtained through traditional teaching methods (frontal lessons). However, as Jensen & Konradsen (2018) said, it was with the release of Oculus Rift in 2013 that VR became synonymous with head-mounted display-based VR (HMD). This is because HMD has become economically viable for consumers and educational institutions. In the thesis work, the application of VR in language learning has been studied in order to demonstrate how technology can effectively offer effective and innovative teaching strategies. Such strategies, however, could also improve teaching for pupils with Special Educational Needs (BES), starting from a detailed analysis of the subject's specific needs.

Keywords

Virtual Reality, Foreign language, Learning

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1. Introduction

Virtual Reality (VR) is a promising learning tool that allows learners to immerse themselves in three-dimensional environments. It has the capability to enable interactive learning experiences since it can actively involve the learner in the learning process by reacting dynamically to the learner's movements and behavior [1,2]. With this technology, learners can explore and manipulate three-dimensional (3-D) interactive environment. Constructivist learning model has been proposed by Reigeluth [3]. It is a philosophy of learning that believes knowledge is constructed by learners through experience and activity [4, 5]. Constructivist learning is student-centric and focuses on meeting the learners' needs and helping them to construct and build on their own knowledge based on their prior experiences and knowledge [6, 7]. Learners are active, able to control their learning pace and responsible for their learning. Chen and Teh [8] have pointed out how the various technical capabilities of VR technology can support constructivist learning principles, which are congruent with the constructivist educational design principles by Dalgarno [9]. The constructivist learning principles focus on learning and learner control over content, sequence and learning strategy to construct own knowledge; authentic, contextual and discovery activity to encourage diverse ways of thinking; and interesting, appealing and engaging problem representation to provide intrinsic motivation. Though VR could support constructivist learning and research has shown a positive array of learning outcomes with desktop virtual reality, for instance, better learning in geosciences [10]; better understanding in physic concepts [11]; and positive effect on learning driving rules and regulations [12]. Numerous researches show that most students remembered what they saw in virtual reality and concluded that VR is a more significant environment than classroom [13]. The construction of learning situations enhanced by virtual reality presupposes an active teaching that leaves room for the protagonism and creativity of the students, reserving to the teacher the task of structuring the methodological-conceptual framework. The challenge in developing the lesson model enhanced by the use of Virtual Reality was to combine the immersion of VR environments with the logical rigor of Problem based learning. Virtual Reality (VR) can be viewed as an assistive technology, due to its potential to minimize or offset the effects of a disability and provide an alternative mean for an individual to accomplish a particular task [14]. It is a promising avenue to provide children with Special Educational Needs (SENs) opportunities that they otherwise would never experience. VR learning environments can be personalized to allow a child to focus on their unique strengths and abilities, rather than limit their interactive capabilities, and work toward mastery of a task. VR can provide a safe and supportive simulated environment that allows a child to practice or enhance various skills which can be transferred to the real world. Special Education Needs (SEN) refers to particular educational needs that students may manifest even for short periods only: "for biological, physiological, psychological or social reasons, which it is necessary that schools offer adequate and personalized responses (Ministerial Directive of 27/12/2012). The SEN also includes students with problems related to social, economic, emotional, or difficulties due to lack of knowledge of Italian or students with problematic parents (not followed by the family, parents not present, depressed, separated or divorced, etc.). The recent study analysis indicates that the most effective way of learning a foreign language is the method of complete immersion. This statement is relevant for acquiring trendy vocabulary and adequate syntax constructions, for pronunciation adjustment in compliance with geographical or social preconditions. Moreover, improving one's communication skills is one of the most wanted benefits of immersion into interaction with presumable partners because of resemblance of emotions and feelings got by native speakers when communicating with each other within their natural language environment. The aim of this study is to investigate how VR teaching methods could affect learning a foreign language in students.

1.1. Materials and methods

Participants

In this study, we examined 120 subjects from the fifth year of primary school and divided them into two groups of 60 subjects each. All subjects were recruited from 2 primary schools in Caserta (Italy) and were homogeneous in terms of parents' socio-cultural background; family/environmental context was not a factor influencing educational attainment in either group. Therefore, the inclusion criteria were as follows: (a) belonging to the same class level (fifth elementary grade), (b) absence of any kind of diagnosis; (c) a IQ between 95 and 105 assessed through the Raven colored Matrices [15]; (d) medium-high socio-cultural class assessed through the SES scale [16].
After confirming the inclusion criteria of the sample, we divided the subjects into two randomized experimental groups consisting of 60 subjects each. The subjects of both groups had the same inclusion criteria and did not have different sociocultural factors.
In order to assess English academic skills, we assessed an English word list with 300 words. English words were collected in 4 macroareas regarding: house, school, nature, Free time e hobby. Every macroarea had 75 words linked. They were assessed in two times: the first time (T0) was after four months since the beginning of school; the second time (T1) at the end of the school year. The two groups were provided with the two different types of interventions after the first assessment. The interventions lasted 5 months, from January to May for 2 hours once a week. The data were collected and analyzed at the FINDS Neuropsychiatry Outpatient Clinic by licensed psychologists in collaboration with the University of International Studies of Rome (UNINT).

Instruments

SES: Self-administered questionnaire that allows collecting information about the level of education and professional of parents and indicates the position of the person or family within the social system [16].
Raven matrices (CPM-Colored Progressive Matrices): Raven's progressive matrices measure non-verbal intelligence throughout the entire range of intellectual development, from childhood to maturity, regardless of cultural level. They are used within children between the ages of 3 and 11. Our protocol included only matrices A and B, extracted from standard test, with an additional test (AB) of 12 elements. Each sub-test required completing a series of figures with the missing one, comparing them to a model and judging their progress by an increasing degree of difficulty [15].
English word list: A list of 300 words to learn. Words were divided in 4 cluster composed of 75 each regarding 4 macroareas: Home, School, Nature, Free time and hobby.
Procedures
Our intervention started as directed exclusively to children with no diagnosis but could be thought as a general intervention in ordinary and special teaching. Italian school system does not include this type of intervention as ordinary tools underestimating its power to improve and enhance soft skills and metacognitive skills. After unsure all the inclusion criteria we structured the intervention as follow: we divided the sample into 2 groups randomly. The subjects belonging to the control group (GR1) have been subjected to traditional teaching type. The strategies used are those commonly used. This is characterized by frontal lessons with teacher speaking and children listening. The subjects belonging to the experimental group (GR2) were subjected to the an innovative teaching program, with a use of Virtual Reality. This educational approach consisted of a immersive session that enhance the learning in general. The intervention last 5 months, 2 hours once a week. After the interventions, the English wordlist was re-admistered at both groups.

1.1.1. Results

Data analysis was conducted using SPSS 26.0 (2019) statistical data collection software. Significance at the 1% level ($\alpha < 0.001$) was accepted. We compared the two groups (variable between =Gr1 and Gr2) with T0 and T1 (variable within - time) to see if there was any improvement in the number of

words in English language learning (ENGL) after instructional training. We want to check if there is an improvement between T0 and T1, but also between the two groups because they had different apprenticeships. Therefore, we performed ANOVA 2x2 mixed with repeated measurements: within (time) and between (group) factor.
This analysis showed the following results:

- Interaction time*group is significant [F (1,118) = 60.772, p<0.001]. This data indicates that there is a significant interaction between time and the group. More specifically, between the pre and post teaching intervention there is a significant improvement compared to the number of words learned in English, more significant in Gr2 that had carried out a teaching training through VR (table 1 and figure 1).

Table 1
Interaction time*Group

Time	Group	Means	SD	F	p
0	1	161.150	31.89		
	2	159.76	30.88		
1	1	240.90	8.65		
	2	288.08	9.30	60.772	<0.000*

**Statistical significance*

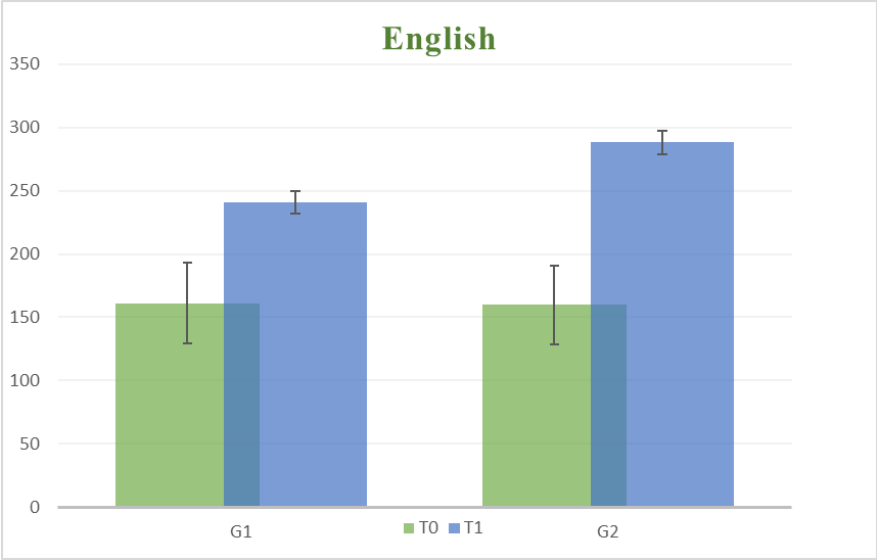

Figure 1: Comparison between the two groups

1.1.2. Discussion

Given that computers are so ubiquitous in schools now that even many schools only have two or three per classroom, it seems reasonable to expect that VR won't be in classrooms for a decade or more. However, VR now has a place in educational institutions such as zoos, science museums, and other similar public spaces. When deploying the system, care should be taken to ensure that the application actually benefits from VR in some way. As hardware prices continue to drop and VR systems become more accessible, this type of application appears to have the greatest utility in the near future. From our research, we observed some key improvements. One obvious result is that students are intrigued by the technology and can't wait to start using it. As computers have become more commonplace in schools and homes, head-mounted displays are still so new that students find excuses to use them. This enthusiasm also keeps students motivated in some of the less exciting parts of the course, such as B. in practical animal observations. We've also seen this enthusiasm from teachers who have followed our

interventions, which is a great example of using VR as a teaching tool because you have to get your students' attention and excitement before you can teach them anything. However, it is clear that the system will need an overhaul before it can be put into general use. Current thinking on how learning occurs emphasizes a constructivist approach, which holds that learners must actively "build" knowledge by drawing it from experiences that are meaningful and meaningful to them [17]. In our study we can see that both groups have had an improvement in terms of learned English words. Furthermore, we can see how better the improvement is in the group that received a training with the use of VR. Moreover, we can assume that the VR techniques applied helped children learn new English words and also use them in a conversation correctly and fluently. We explain our result in terms of number of words learned. In conclusion, we have also seen difference in motivation between groups. Group with VR training did not miss a lesson. Considering the potential improvement of learning using VR, it is clear why researchers, organizations and educators are looking at this technology in recent times, trying to add an extra dimension to the class compared to both teaching and learning.

In conclusion, this study aimed to compare two educational interventions. The interventions provided by traditional teaching strategies have undoubtedly had a positive impact on children's basic learning skills. However, when it comes to learning a foreign language, training with virtual reality is more effective. This benefits metacognitive instructional interventions that take into account individual differences. This strategy is summed up in a constructivist perspective. Finally, as a weakness of this study, we emphasize the importance of follow-up that can verify stability over time.

2. References

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