Enabling Social Exploration Through Virtual Guidance in Google Expeditions: An Exploratory Study

Antigoni Parmaxi(✉), Kostas Stylianou, and Panayiotis Zaphiris

Cyprus University of Technology, Limassol, Cyprus
{antigoni.parmaxi, kostas.stylianou, panayiotis.zaphiris}@cut.ac.cy

Abstract. This paper reports on an exploratory study on the use of Google Expeditions in the context of an intensive 650-h Greek language course for specific academic purposes. Google Expeditions are collections of linked virtual reality (VR) content and supporting materials that can enable teachers to guide students through virtual trips to places throughout the world including museums, surgical processes, outer space, the ocean etc. Qualitative thematic analysis of instructors' field notes, students' reflections, interviews and focus group was employed aiming at identifying the potential of Google Expeditions as instructional tools that can extend the language course for specific academic purposes in topics related to Nursing. To triangulate the findings, the study also collected data by observing students' behavior in the use of Google Expeditions. The use of Google Expeditions enabled students to extend the borders of the classroom by making virtual walkthroughs in places that would normally be unreachable and trigger social exploration through inter- and extra-VR communication, sharing of ideas, concepts, experiences and artifacts. The outcomes have shown that actions taken by the students and instructor during a virtual trip in nursing-related places reveal results in favor of the use of Google Expeditions in the language classroom. Further implications for practitioners and researchers are also provided.

Keywords: Technology-Enhanced Learning · Google Expeditions
Constructionism · Social constructionism · Wearable · Virtual reality
VR · Low-cost VR

1 Introduction

1.1 Background

The onset of Virtual Reality (VR) technology can be traced to the 1960s in the entertainment industry. Since then, VR has been leveraged to meet the needs of training (e.g. with the use of flight simulators) and curricula in subjects such as mechanics, architecture, art, chemistry, medicine, science and language learning [1–6, 20, 21]. Several studies indicate that these technologies provide fertile ground for visualizing abstract concepts, enhance embodied learning but also give opportunities to visit and

© Springer International Publishing AG, part of Springer Nature 2018
M. E. Auer and T. Tsiatsos (Eds.): IMCL 2017, AISC 725, pp. 397–408, 2018.
https://doi.org/10.1007/978-3-319-75175-7_40

interact with places or object that time or spatial restrictions might limit [1–4], engaging learners in authentic, real-world situations and interactive communication [5, 6, 20].

Virtual Reality is a key concept to understand the effectiveness of experiential and experimental view of learning. According to Schwienhorst [7], as VR uses interface structures, it provides access to authentic resources and tools. VR is a highly interactive, computer-based, multimedia environment in which the user becomes a participant with the computer in a 'virtually real' world (Pantelides, 1993 in [7], p. 200). González et al. [8] defined virtual world as a persistent computer-simulated environment allowing large number of users, who are represented by avatars interacting in real-time with each other at the simulated environment. Learners engagement can be increased through the use of Virtual World, while it develops simulated activities which stimulate active participation [9]. Moreover, VR promisingly provides a wide range of opportunities especially when dealing with sensitive topics or concepts that cannot be easily approached through traditional audiovisual simulations. Ochs and Blache [10], for instance, refer to the European project TARDIS as an example of using virtual recruiters in order to train young people before attending their job interviews. Ochs and Blache [10] specifically examine the use of virtual patients as a training tool for doctors who are obliged to deliver bad news to patients or relatives. Such virtual characters (agents, recruiters, patients etc.) are designed after a deep research on the real behavior of humans in several social contexts and they should coordinate accordingly.

Immersive VR often requires an advanced technology that people hesitate or just do not have the necessary skills to use. As Yang et al. [11] state, nowadays learners have to wear devices such as Head-Mounted Displays (HDM) to experience a virtual world. These devices, are relatively expensive, heavy and easily damaged. On the other hand, desktop VR does not require any special device and regarding the price, it has the lowest cost among the applications used for VR. However, it offers a lower level of immersion compared to other solutions [11, p. 1346].

Even though several researchers have underlined the positive impact of VR in education [9, 11], there is also evidence which shows that teachers and trainers still hesitate to use it extensively. In fact, most teachers make a partial use of VR in classroom as part of a game-based activity or they hesitate to use it because it requires a high level of advanced technology knowledge. Moreover, the high cost of such devices -Yap [12] refers to Oculus VR, Google Glass and Samsung Gear VR- makes it inaccessible to schools, colleges or universities.

1.2 Theoretical Framework and Goals of the Current Research

This study incorporated Virtual Reality cardboard as a low-cost 3D viewer in conjunction with a smartphone in an intensive Greek Language Course for perspective Nursing students. VR Cardboard is a low-cost technology product compared to other VR devices discussed earlier. On 2016, via Google Expeditions, Google has launched a number of virtual environments using videos, 3D images and 360 panoramas aiming at giving teachers and students the opportunity to visit places or environments that are not able to visit ordinarily. Considering that nowadays most of the students own a

smartphone, and also knowing that a VR cardboard can be purchased for less than 20 dollars, VR cardboard along with Google Expeditions is the cheapest solution in the market for creating VR environments. Google Expeditions give instructors the ability to control (using a tablet) what students are viewing and guide them to watch content that is related to the aim of the lesson. Moreover, it includes information and questions related to the 3D environment which can be used by teachers during the VR experience. The fact that all previous VR solutions required a desktop or a computer to view content is another advantage of Google Cardboard. Using a low-cost virtual reality headset in conjunction with a smartphone, Google Expeditions can simulate virtual objects and scenes and has a good record of educational applications in nursing, especially for visualisations of hospital departments, nursing processes and human anatomy.

Incorporating VR in the curricula of health-related professionals, such as nurses, we explored their exposure to a dynamic virtual environment with an eye to fostering social exploration. This study adopts the theoretical framework of constructionism and social constructionism. Constructionism is a theory of learning, teaching, and design, which can be summarized in the conviction that learning occurs more effectively when learners understand the world around them by creating meaningful artifacts that can be probed and shared [13–15]. Building on the notions of constructionism, social constructionism leverages the need for social interactions as well as the need for giving students opportunities to explore a specific topic or theme before proceeding to construction and evaluation of a shareable artifact [16–18].

To capture the use of Google Expeditions through the lens of social constructionism, the process that students adopted and the way technology and context fostered this process were analyzed. This research is unique in that it studies VR through the lens of social constructionism looking at the use of Google Expeditions as an instructional tool that can allow a small group of students to explore, experience and develop expertise in places and objects of their interest. Specifically, the research questions that guide this study are:

1. **How a low-cost VR kit in conjunction with Google Expeditions can facilitate social exploration of authentic, real-life nursing-related situations?** This question aims at studying students' and teachers' use of the VR in terms of their interactions with the content.
2. **What roles does the teacher and students adopt in such an environment?** This question aims at studying the role of students and teachers in a guided VR Google Expedition.

2 Setting

All data related to this study were collected at a public, Greek-speaking university in the Republic of Cyprus. The university accommodates approximately 2500 undergraduate and postgraduate students. The study took place in the context of a course related to Greek as a second language (L2), throughout October 2016 till June 2017. The class met face-to-face every day for five hours, for a total of 650 h. Activities were

held face-to-face and online, whereas outdoor activities allowed students to practice the language in authentic, real-world situations. The course was particularly designed to meet the needs of university students who planned to study Nursing.

2.1 Students

The participants were three male students from Kenya, who came to Cyprus, for five years, on full scholarships. Students enrolled in the Greek course upon their arrival in Cyprus, had sessions every day for five hours. This study's horizon is to go in detail and in depth, despite the small sample, having participants work intensively with VR and collect data rich in detail about their use. The students' age ranged from 19–27 years. All students were fluent English speakers; none of them had any knowledge of Greek upon arrival in Cyprus. Their computer skills were in general at basic to intermediate level. Students had no knowledge of VR.

2.2 Instructors

The class was taught by two instructors with extensive experience in teaching Greek as an L2 (see Table 1). The instructors held weekly meetings for coordinating the progress of the course.

Table 1. Overview of the setting.

Students	Instructors	Scope of the course	Thematic units in Google Expeditions
3 male students Age: 19–27	1 female teacher with nine years of experience for teaching Greek as an L2 1 male teacher with eight years of experience for teaching Greek as an L2	Greek as a second language (L2) – 650 h	- A luxury house - Clinic admissions department - Surgical preparation - Human heart - Human respiratory system - Pregnancy development

2.3 Tools and Materials

Expeditions are group experiences with the instructor acting as a guide leading and the students following along (see Fig. 1). Moreover, it includes information and questions related to the 3D environment being explored. Students used a low-cost virtual reality viewer and Android mobile phones in which they downloaded Google Expeditions application.

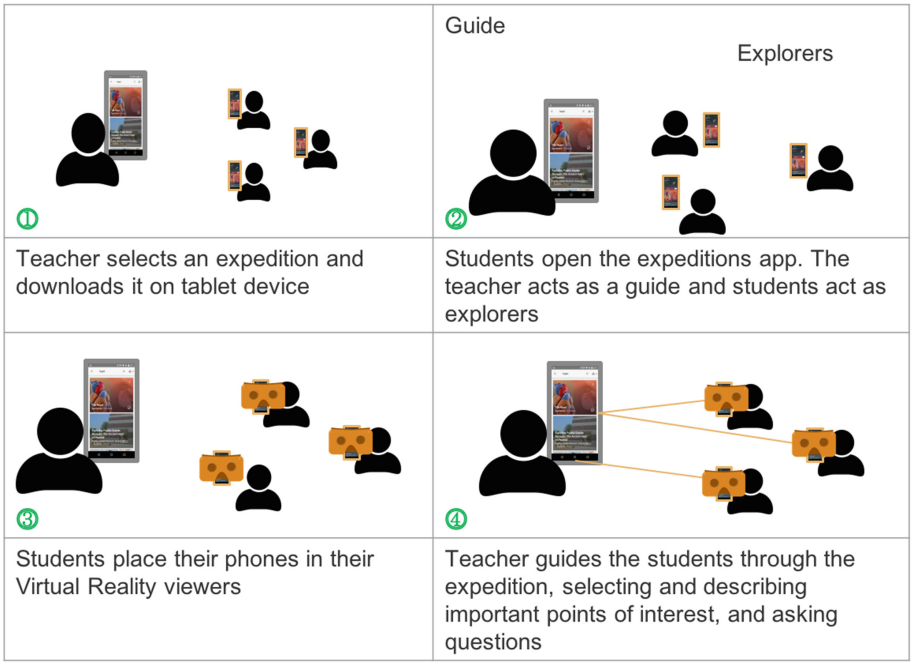

Fig. 1. Setting up Google Expeditions.

The instructors controlled and guided students through Google Expeditions from an Android tablet. Through the tablet the instructor could control what students were viewing and guide them to watch content that is related to the aim of the lesson (see Fig. 2).

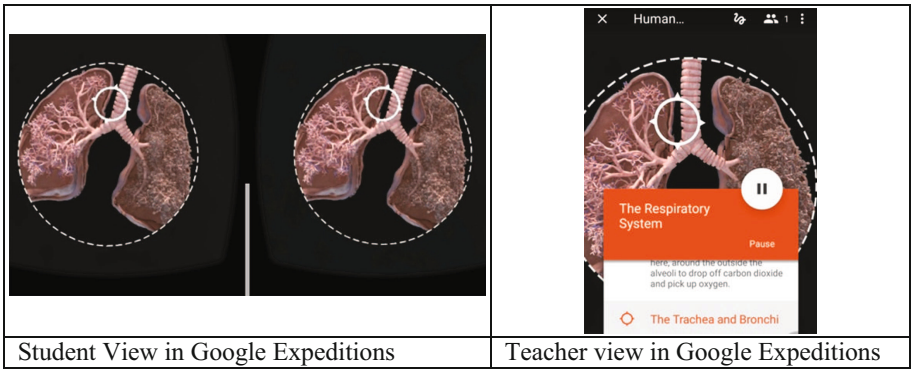

Fig. 2. Student and teacher view in Google Expeditions.

Google Expeditions was incorporated in the existing curriculum of the course, allowing students to explore topics related to their professional needs. Topics explored included general topics (such as a description of a luxury house), as well as specific topics related to health-related professionals (such as clinic admissions department, surgical preparation, human heart, human respiratory system and pregnancy development). These topics were closely linked with students' needs as perspective Nursing professionals and raised their interest in exploring the language for describing them. VR was incorporated as a component of the course, when the topic imposed so for a total of 30 h. Students also owned a wiki where they exposed their work during their Greek course.

3 Methodology

3.1 Data Collection

The data was collected through a questionnaire, in class observations and daily field notes kept throughout the course by the instructor, instructors' and learners' weekly reflective diary. Interviews with each student were also conducted which allowed us to elicit qualitative data about the process that participants followed with the use of VR. An interview protocol was followed to explore students' opinions and overall experiences. The interviews were tape recorded and transcribed verbatim. Finally, students participated in a focus group which lasted approximately 30 min, through which written notes were captured. Table 1 briefly describes the types of data collected (Table 2).

Table 2. Overview of data collected.

Data	Purpose
Questionnaire	Insight into students language and computer literacy
Students' reflections	Self-evaluation of their activities outcomes and process adopted
Instructors' field notes and reflections	Overview of the process adopted and reflections on activities held
Interviews	Reflection on activity process and outcomes
Focus group minutes	Overview of process adopted

3.2 Data Analysis

We analyzed the data set using the Qualitative Research Software Nvivo 11. The content of the utterances was read for meaning to define segment boundaries, thus, consecutive sentences that construct the same meaning are taken as one text unit and coded into a single code [19]. The coding focused on the actions that took place in order to socially explore a specific topic, as well as the affordances of the specific technology.

4 Findings and Discussion

The study identified that a low-cost VR kit in conjunction with Google Expeditions can allow a small group of students to explore, experience and develop expertise in authentic, real-life nursing-related situations, providing opportunities for communication, sharing of ideas, concepts, experiences and artifacts (see Fig. 3). The sections that follow summarize how a low-cost VR kit in conjunction with Google Expeditions can facilitate social exploration of authentic, real-life nursing related situations (RQ1), as well as the roles adopted by the teacher and students in such an environment (RQ2).

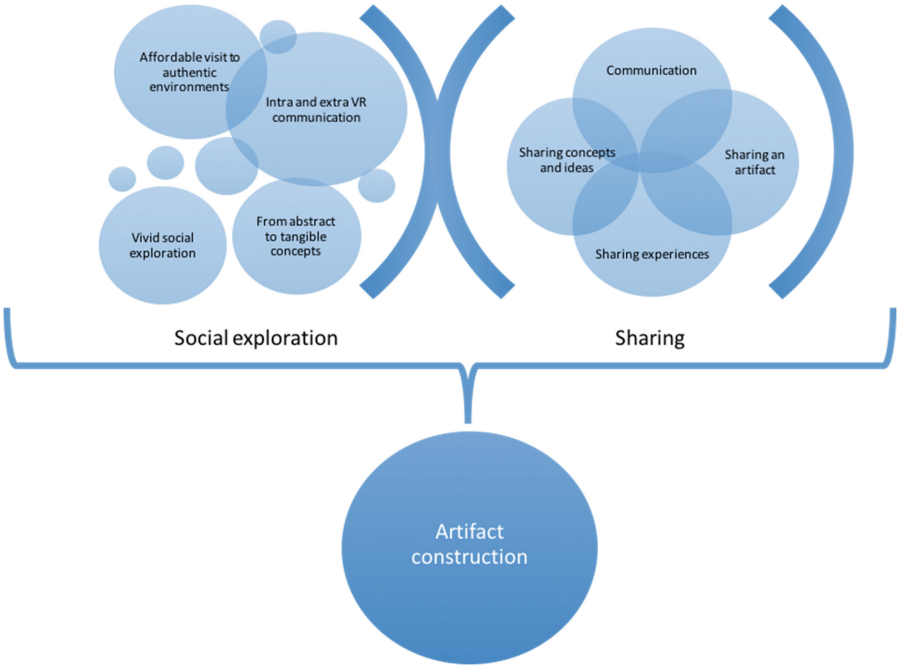

Fig. 3. Elements of social exploration, sharing and artifact construction within VR.

4.1 Intra- and Extra- VR Communication

Google Expeditions can facilitate intra- and extra- VR communication as it allows for (a) instructor to guide students and pose questions for specific important teaching moments given within the application, and (b) students to listen to their instructors' guidance and describe what they could see during the exploration and after the exploration. Intra- and extra- VR communication is particularly important for language learners, as it deals with two fundamental language skills: speaking and listening. Students voiced the importance of being guided by the instructor in practicing their speaking and listening skills, but also noted that being able to visualize information was

of paramount importance for them: *[Not only producing and understanding a language is important] you have to see something… […] For example the heart… you see the heart. The first thing you see, then you have to think what is it* (S2, Interview).

4.2 From Abstract to Tangible Concepts

Guided VR tours within Google Expeditions allow students to explore together with their peers important points of interest. The Expeditions act as a common experience for the whole class making abstract concepts and ideas tangible and vivid. As noted by one student: *I was finding it hard to describe something [that I have not seen]. […] it can take time to imagine but when you are told to describe what you have seen in the glasses, you can easily do it because you have the picture. At the end of the day you create a vivid picture in your mind. So to describe it is just getting some things that are in the picture and try to bring words together* (S3, Interview).

Moreover, as these students come from a culture where health-related habits are different, they encountered difficulties in visualizing, and being in place to describe objects or situations that they have not encountered: *To imagine a student reading something he or she does not get a clue it's hard. How can you stick to reading something you don't know, you don't understand. […] I think it is very important for us for the idea of glasses especially to students who come from outside the Greek environment* (S3, Interview).

4.3 Affordable Visit to Authentic Environments

Google Expeditions provided a gateway for students and instructor to visit places that they would not be able to visit and consequently practice language related to the specific communicative context like '*being in the hospital*' (S2, focus group). As voiced by one student: *We have short time also for the lesson, for the course, and because we have short time, I want to save. […] it will take a day to go there [to the hospital], and the time that it will take for going there will limit the time for learning things* (S3, Interview).

Moreover, the use of Google Expeditions raised students' curiosity and interest for a specific topic. As noted by one student: "*by describing the pictures, the analysis makes learning interesting and sticks in the memory*" (S3, Reflections). Also, as students were exploring the development of pregnancy, they were triggered in proceeding to further research in order to find out more about the development of the child: *I had to go a little bit deeper, doing some kind of research, to get the facts. So I was talking about the curiosity, the curiosity from that made me go a little bit deeper, to collect the facts about what exactly happens in that trimester period* (S3, Interview).

4.4 Vivid Exploration Leading to Artifact Construction

Being guided to a specific environment, students were then tasked to construct an artifact related to the specific environment. More specifically, students were tasked to develop an artifact and share it with the rest of the group (e.g. describe the child development, based on the virtual trip they had experienced; identify the tasks of the

admissions' officer etc.). To facilitate the completion of the task, students were instructed to switch their Google Expedition from explorers to guiders. The specific task allowed students to concretize their progress. As voiced by one student: *I remember when we used to be in school. In high school. Before the beginning of the lesson we were told "by the end of the lesson the learner should have learned a, b, c". So I found this was another type of not telling the student what he should have known at the end of the lesson, but driving the student through curiosity up to reaching a time, he or she will describe. Now it is tiresome to say "at the end of the lesson the learner should", "the learner should", "the learner should" for the whole page. Then the student can be astonished "how will I learn about all these things?". And it's like you are pressuring to know exactly because it is a must to know this and this. But with this [i.e. the glasses], I was driven from "at the end of the lesson I should do, this and this" by looking at it at the end of the day I describe, without that tiresome process of I should do this and this* (S3, Interview).

4.5 Role(s) Adopted by Instructor and Students

Instructor's role within a VR expedition can be marked as a guide and coach. The instructor guides students through a specific virtual environment, pointing out places of interest and addressing relevant questions to students. However, the role of the teacher as guider can deprive from the students the opportunity to construct knowledge. As noted by the instructor: *My main criticism towards this activity has to do with the role of the teacher. I felt like controlling the whole process and that was a disadvantage as students were expecting me to ask before they answer. I think that such activities would have better results if students are let free to present their experiences through the Virtual Environment provided* (Instructors' field notes).

Students act primarily as explorers, being guided by their instructor and describing the environment around them. At the same time, students also act as constructors of vivid artifacts closely related to their virtual experiences. Students are requested to act like "*professionals who are explaining to people what are they looking at*" (Instructors' reflections). Students, are being placed in an authentic environment in which are encouraged to use the language for describing the reality they have in front of them.

5 Conclusion and Future Work

Until recently, the use of VR in the classroom required a high-cost technology and specialized expertise. Currently, the use of Google Expeditions offers a low-cost, easy-to-use VR option, to be used in the classroom. This paper reported on an exploratory study on the use of a low-cost VR kit in conjunction with Google Expeditions in the context of a Greek language course for specific academic purposes. The use of Google Expeditions enabled students and instructors to extend the borders of the classroom by making virtual walkthroughs in places that would normally be unreachable, and trigger social exploration through inter- and extra-VR communication, sharing of ideas, concepts, experiences and artifacts. The outcomes have shown that actions taken by the students, as explorers and constructors, and instructors, as

guiders and coaches, during a virtual trip reveal results in favor of the use of Google Expeditions as an instructional tool for allowing a small group of students to explore, experience and develop expertise in places and objects of their interest.

Traditional language classrooms invest a significant amount of time to bring to the classroom authentic situations that would boost students' need to use the target language. However, these attempts often fail as it is not feasible to bring in class all types of communicative situations that would encourage learners to use the target language. This is especially true when we refer to language teaching for specific academic purposes for perspective health-professionals. VR can facilitate social exploration in places related to health, giving opportunities for social learning. In addition, the classroom is no longer isolated to standardized activities and fill-in-the-gap exercises. Students and instructors can be linked to each other in an active, synchronous exploration. The experience obtained from inter-classroom communication and social exploration through Google Expeditions opens the door to new opportunities. It provides a strategy for connecting instructors and students, and for implementing new forms of engagement, interest and curiosity. Yet, further implications derive in terms of the instructional design of Expeditions. More specifically, more capabilities can be given in allowing students to be members of an Expedition or even in building an Expeditions' community that can provide media-rich constructionist environment for both students and instructors. Taking advantage of the extraordinary power of VR, its low-cost and easy-to-use software, Google Expeditions can support activities that were previously infeasible, making it better positioned to succeed than previous attempts to introduce VR in the classroom.

A low-cost VR kit can open new perspectives in teaching and learning, and its functionalities (in conjunction to Google Expeditions or other VR applications) can foster multiple uses for instructional designs, which remain unexploited until they are embodied and sustained in real-classroom environments. Google Expeditions are currently only available in English, and consequently limit or incommode their use to speakers of other languages. VR holds the potential to release teachers' load in introducing topics, concepts or ideas that are unknown to students. From this perspective, VR is a good mechanism for Technology-Enhanced Learning, especially for introducing ideas and concepts that students cannot understand or visualize from textual sources.

Expeditions are still in the early stage of their development, yet their popularity will most likely continue to increase as companies like Google invest resources into VR to engage and motivate students and teachers. A deeper understanding of the value of this technology can be obtained when different features of this low-cost VR will be incorporated in well-designed, theoretically grounded activities, aligned with the educational needs of the students. Drawing on new forms of teaching, learning and assessment for an interactive world, VR can make fundamental changes in the classroom ecology by leveraging new educational theories and practices such as productive failure, teachback and learning from the crowd [22]. Our working hypothesis is that, as students work closely with their instructors on personally meaningful projects such as virtual reality field trips, they can develop technological fluency, problem-solving skills, social interactions, teamwork skills, and self-confidence on a certain topic that serves them well in the wider spheres of their lives.

References

1. Bellan, J.M., Scheurman, G.: Actual and virtual reality: making the most of field trips. Soc. Educ. **62**(1), 35–40 (1998)
2. Merchant, Z., Goetz, E.T., Cifuentes, L., Keeney-Kennicutt, W., Davis, T.J.: Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: a meta-analysis. Comput. Educ. **70**, 29–40 (2014)
3. Rasheed, F., Onkar, P., Narula, M.: Immersive virtual reality to enhance the spatial awareness of students. In: Proceedings of the 7th International Conference on HCI, IndiaHCI 2015, pp. 154–160. ACM, December 2015
4. Seo, J.H., Smith, B., Cook, M., Pine, M., Malone, E., Leal, S., Suh, J.: Anatomy builder VR: applying a constructive learning method in the virtual reality canine skeletal system. In: 2017 IEEE Virtual Reality (VR), pp. 399–400. IEEE, March 2017
5. Lin, C.-S., Kuo, M.S.: Adaptive networked learning environments using learning objects, learner profiles and inhabited virtual learning worlds. In: Proceedings of IEEE ICALT2005: the 5th International Conference on Advanced Learning Technology, pp. 116–118, Kaohsiung, Taiwan (2005)
6. Chen, Y.L.: The effects of virtual reality learning environment on student cognitive and linguistic development. Asia-Pac. Educ. Res. **25**(4), 637–646 (2016)
7. Schwienhorst, K.: Why virtual, why environments? Implementing virtual reality concepts in computer-assisted language learning. Simul. Gaming **33**(2), 196–209 (2002)
8. González, M.A., Santos, B.S.N., Vargas, A.R., Martín-Gutiérrez, J., Orihuela, A.R.: Virtual worlds. Opportunities and challenges in the 21st century. Procedia Comput. Sci. **25**, 330–337 (2013)
9. Loup, G., Serna, A., Iksal, S., George, S.: Immersion and persistence: improving learners' engagement in authentic learning situations. In: Verbert, K. (ed.) EC-TEL 2016, LNCS, vol. 9891, pp. 410–415. Springer International Publications, Cham (2016). https://doi.org/10.1007/978-3-319-45153-4_35
10. Ochs, M., Blache, P.: Virtual reality for training doctors to break bad news. In: Verbert, K. (ed.) EC-TEL 2016, LNCS, vol. 9891, pp. 466–471. Springer International Publications, Cham (2016). https://doi.org/10.1007/978-3-319-45153-4_44
11. Yang, J.C., Chen, C.H., Jeng, M.C.: Integrating video-capture virtual reality technology into physically interactive learning environment for English learning. Comput. Edu. **55**, 1346–1356 (2010). https://doi.org/10.1016/j.compedu.2010.06.005
12. Yap, M.: Google Cardboard for a K12 Social Studies Module (2016). http://hdl.handle.net/10125/40604
13. Papert, S.: Mindstorms: Children, Computers and Powerful Ideas. Basic Books, New York (1980)
14. Papert, S., Harel, I.: Situating constructionism. In: Constructionism, pp. 193–206. Ablex Publishing Corporation, Westport (1991)
15. Papert, S.: The Children's Machine: Rethinking School in the Age of the Computer. Basic Books, New York (1993)
16. Parmaxi, A., Zaphiris, P., Michailidou, E., Papadima-Sophocleous, S., Ioannou, A.: Introducing new perspectives in the use of social technologies in learning: social constructionism. In: Kotzé, P., et al. (eds.) Proceedings of INTERACT 2013, LNCS, vol. 8118, pp. 554–570. Springer, Heidelberg (2013)
17. Parmaxi, A., Zaphiris, P.: Developing a framework for social technologies in learning via design-based research. Educ. Med. Int. **52**(1), 33–46 (2015). https://doi.org/10.1080/09523987.2015.1005424

18. Parmaxi, A., Zaphiris, P., Ioannou, A.: Enacting artifact-based activities for social technologies in language learning using a design-based research approach. Comput. Hum. Behav. **63**, 556–567 (2016)
19. Chi, M.T.H.: Quantifying qualitative analyses of verbal data: a practical guide. J. Learn. Sci. **6**(3), 271–315 (1997)
20. Brown, A., Green, T.: Virtual reality: low-cost tools and resources for the classroom. TechTrends **60**(5), 517–519 (2016)
21. Lin, C.H., Hsu, P.H.: Integrating procedural modelling process and immersive VR environment for architectural design education. In: MATEC Web of Conferences, vol. 104, p. 03007. EDP Sciences (2017)
22. Sharples, M., de Roock, R., Ferguson, R., Gaved, M., Herodotou, C., Koh, E., Kukulska-Hulme, A., Looi, C.-K., McAndrew, P., Rienties, B., Weller, M., Wong, L.H.: Innovating pedagogy 2016: open university innovation report 5 (2016). https://iet.open.ac.uk/file/innovating_pedagogy_2016.pdf