Social VR as a New Collaborative Learning Environment

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Abstract
Collaborative learning is a bedrock of modern education. Following the growing availability and popularisation of virtual reality (VR) technology we witness a substantial increase in numbers of studies exploring various types of learning with use of VR. However, examples of integration of collaborative VR into formal education are still scarce and not conclusive. Thereby, this position paper aims to set a scene for discussion of benefits and challenges, as well as further research direction, for introduction of collaborative virtual reality into formal education.

Author Keywords
Virtual reality, augmented reality, mixed reality, collaborative learning, collaborative virtual environment, computer supported collaborative learning, CSCL.

CSS Concepts
• Human-centered computing → Mixed/augmented reality; Virtual reality; Collaborative interaction;

Introduction
Communication and collaboration have always been essential parts of human activity. Arguably, in modern days their importance is stronger than ever. In our
heavily digitised world today almost everything is connected and we hardly remember times when there were no telecommunication systems.

At the same time, as head-mounted displays (HMD) become more affordable for common users, we see a strong increase in commercial popularity of application that support immersive telecommunication. This leads to an opportunity for immersive telecommunication systems to become an alternative for audio and video communications. Distributed systems, where multiple users meet in an immersive virtual environment that creates a common spatial and social context are called either collaborative virtual environment (CVE)[2] or social virtual reality (Social VR) [8]. The term Social VR is used here further on.

In today mediatised and connected world our youth have tendencies to socialise in groups of more than two and demonstrate enthusiasm for various types of social media networks such as Facebook, Instagram, Twitter, and YouTube [9]. Furthermore, most of workplaces these days also emphasise teamwork and collaboration and require such skills from their recruits [1]. Therefore, quite naturally, collaborative learning draws a lot of attention from all sorts of educators [4, 10, 14]. In addition, literature (e.g. [15, 18]) suggests that collaborative learning with use of social media technology can help students acquire necessary skills and competencies to become active, creative, ethical, and successful members of the modern world. Hence, going forward with the evolution of social media networks, which now include VR [6], we are looking to explore Social VR applications and their use beyond entertainment, such as for collaborative learning.

From TV Broadcasting to Immersive VR
Looking at the history of technology supported education, we can go back to early 1970s, when the Open University for their distant courses started to broadcast lecture-like material during gaps in programming on BBC’s public channels [5]. Then, from 2008, started an era of massive open online courses (MOOCs) [17], where teaching materials are delivered to the learners in 2D video format via specialised online platforms. Later, with the technological progress, delivery of these teaching materials as well as accompanying learning activities tend to become more and more interactive and collaborative [3, 13].

Greenwald et al. highlighted such affordances of VR for learning as “access to remote experts, access to experiences that depend on scarce or access-limited resources (e.g. going to the moon), and access to experiences that are physically impossible (e.g. such as standing inside a molecule), to name a few” and envisioned a potential for VR to revolutionise modern education [7]. Indeed, empirical studies concur with this by showing how virtual learning environments support both physical aspects of learning (e.g. visualization of invisible concepts) [16] and learner’s cognitive processes (e.g. empathy and embodied cognition) [19]. Since contemporary learning theories posit that student collaboration is a key element of effective learning [21], it is logical to start thinking on how collaborative learning can capitalise on the benefits that VR technology provides.

Work of Monahan et al [12] is an early example of investigation of Social VR elements introduction into formal distant learning. Authors designed an online learning environment for delivery of teaching resources
and collaborative learning activities which included a VR system that mimicked a real university (e.g. lecture hall, library rooms, etc). Evaluation of usability of this learning environment provided an optimistic outlook for such technology for e-learning. Overall feedback from students and instructors was very positive, emphasising high level of learners’ motivation maintained throughout the trial. More specifically, study participants noted that immersive 3D learning environment has helped them to feel being part of a group and the environment was an effective means of social interaction.

Li et al. in their study of photo sharing in social virtual reality also concluded that Social VR is capable of closely approximating face to face interaction [11]. Consequently, it seems feasible for Social VR systems to combine and improve upon benefits of face to face collaborative learning and technical affordances of virtual reality.

**System Requirements**

However, if we are going to talk about incorporation of Social VR into regular formal education, both co-located and remote, we need to consider a great number of system requirements and considerations, especially when it concerns younger children. Let us discuss a few of them here.

First of all, educational Social VR systems must be **safe**. Such health issues like tiredness and dizziness from wearing a head-mounted display could be a concern for novice users. Besides, children usually like to move a lot and to move fast. If a collaborative learning task involves physical activity, a wired HDM could cause an entrapment and a hazard of being broken as a result of fall or bump into an object in real world. Further on, prolonged exposure to virtual reality could create a risk of social isolation and other mental health issues.

Second requirement is to be **ethical**. Personal information protection is extremely important when it concerns minors. Loss or misuse of personal data can be harmful and educational organisations are obliged to comply with strict set of rules to secure their students’ information (see, for example, the UK’s Data Protection Act 2018 [20]). Use of VR tools can result in collection of such biometric data as iris and retina scans, voice recognition and other recording of persons’ physical attributes. Protecting such data will be a priority for educators, especially in remote VR communication scenarios when the data has to be transmitted between users via Internet.

Third requirement is the systems have to be **easy** to use for students and for instructors. Initially, instructors, who do not necessarily have skills to design virtual environments will need to create educational content for their courses. Creating from scratch in most cases will be impossible. So, there is a need for template-based systems that would be modifiable in order to be populated with necessary teaching materials and learning instructions. Then, such systems have to be intuitive for the students. They have to be easy to learn and to use in order to maximise effectiveness in the classroom.

Next requirement - to be **adaptable**. Consider an example of an elementary school teacher who delivers several different subjects to his or her students. If this teacher decides to use Social VR to teach some of the
subjects, e.g. mathematics, science, and art, the chosen VR system would need to be flexible in order to fit for different study purposes and contexts. So, that the teacher would not need to acquire and learn to use more than one system or set of tools.

Finally, a feature that would also need to be considered is how scalable is the system. While gaining popularity and becoming affordable for many users, VR technologies are still niche as commercial products. Presently, most of HMD are still bulky and require power cables, thus have limited mobility; they are still expensive to be expendable for everyday use by children. In addition, enabling low-latency interactions in VR requires processing of a massive amount of data, and network lags may prevent smooth experience of a collaborative activity.

**Further Thoughts**

In addition to discussion of the abovementioned requirements, it would be also interesting to explore the following questions during the workshop and as potential future studies:

- How ethical concerns can limit introduction of Social VR into formal education?
- Is there a difference in impact on learning with use of high-fidelity or low-fidelity Social VR?
- How much can Social VR scale for co-located and remote collaborative learning?
- What are the challenges of asynchronous immersive collaborative learning and how can they be addressed?
- Are there any possible health concerns that may arise when Social VR is used for a prolonged time and by children?

**References**


