

Learning in Virtual Reality: Opportunities and challenges for using virtual reality in schools for young autistic people

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Abstract. In this paper I outline the argument for using virtual reality head-mounted displays with autistic groups; especially in schools. While the potential for using VR HMDs with autistic groups is not new (there have been studies addressing this since 1996), the evidence-based remains somewhat limited. There have been few studies that systematically examine the full potential of VR for autistic groups and even fewer that place autistic groups (and their stakeholders) at the centre of research using VR. Therefore this talk (and short paper) will present, examine and discuss some data that we have gathered in schools with autistic groups (and their teachers) to better understand whether VR is a comfortable, wearable technology, for people with sensory concerns, whether VR material is reported as being comfortable and/or useful, and finally if and how VR might be used by autistic groups. Implications for practice will also be presented.

Keywords: Virtual Reality (VR), Head-Mounted Display (HMD), Autism, Classroom

1.1 Introduction

The introduction of virtual reality (VR) technology in schools and higher education began in the early 1990's with projects such as Science Space, Safety World, Global Change, Virtual Gorilla Exhibit, Atom World and Cell Biology [1, 2]. In addition, the potential of VR and head-mounted displays (HMDs) in education has been trialled on the premise that it can “expose learners to challenging or educational situations and allow them to repeatedly practice new skills in an environment that enables correction and non-dangerous failure” [3: p.13]. Within this context, and as Jensen and Konradsen [3] go one to conclude, the educational benefits of VR are mainly connected with: (1) cognitive skills (remembering and understanding spatial and visual information); (2) psychomotor skills (head-movement); and (3) affective skills (emotional responses to difficult/stressful situations). Outside of these areas the authors found limited evidence to support the view that VR HMDs had any advantage over other immersive technologies. This is despite it being noted that VR more broadly has been highlighted as “an effective means of enhance learning outcomes” in schools [2: p.37]. Similarly, other

studies [4] suggest that: “VR and AR [augmented reality] offer the possibility to move safely around dangerous places, learning to cope with our emotions while experimenting the best solutions while far away from the real dangers” [p.1]. Further compounding the debate, Fitzgerald and colleagues [5] undertook a study that compared the effectiveness of video modelling (VM) and virtual reality (VR) for teaching autistic adults where they found the VR method was no more effective than VM in facilitating learning.

These studies [1, 2, 3, 4] provide a confused picture, but also highlight the potential of VR HMDs for learning. They also suggest there is limited and fragmented evidence to suggest how to best use VR in the context of education. This talk will explore the role, potential and user views of VR in autistic classrooms.

1.2 Autism

Autism is a lifelong developmental condition that affects how people perceive, communicate and interact with the world. All autistic people share common areas of difference but as a spectrum condition being autistic will affect individuals in different ways. Some autistic people also have learning disabilities or co-occurring conditions (i.e. ADHD, down syndrome and epilepsy). Around 1 in 59 children have been identified as being on the autism spectrum according to current estimates from CDC’s Autism and Developmental Disabilities Monitoring (ADDM) Network [6]. Within the UK, figures from the Department of Education show the number of children and young people who have autism as their primary SEN need has increased year on year from 66,195 in 2011/12 to 100,010 in 2015/16. This means that children and young people on the autism spectrum accounted for 1.17% of the total school population in England.

1.3 Virtual Reality and Autism

The field of virtual reality and head-mounted displays has been discussed in the context of autism since the 1990’s [7]. Despite some initial positive outcomes, the use of VR HMDs with autistic groups remained under-researched for many years [8]. This, in part, was mainly due to the size, cost, applicability and real-world potential of HMDs during the 1990s and to 2015. More recently (from 2015 – date), there has been renewed interest in the possibilities of VR HMD technology to support the education of people on the autism spectrum. Parsons and Cobb [9], for example, suggest that VR can “offer particular benefits for children on the autism spectrum, chiefly because it can offer simulations of authentic real-world situations in a carefully controlled and safe environment” [p. 355].

However, and despite the possible potential of VR HMDs for autistic populations, very little work exists with younger autistic populations; especially within educational contexts (i.e. schools). Moreover, limited data relate to the types of VR HMDs that are most suitable/preferred by autistic groups, or younger people in schools more broadly. This is especially important for autistic groups as they can have sensory concerns. Therefore, and to elaborate on this, the focus of this presentation is to provide some

insights to the way we have approached working with HMDs and autistic groups, in addition to revealing some findings related to the following:

1. What type of VR HMD device (and experiences therein) are preferred by children on the autism spectrum?
2. How do children on the autism spectrum report the physical experience, enjoyment, and potential of VR HMDs in their classrooms?
3. What would children on the autism spectrum like to use VR in schools for?

2. Results, Thoughts and Discussion

This presentation offers several important and novel insights to the experience of autistic children in both mainstream and SEN settings using VR and HMDs. The need for this work is underlined by a lack of studies and data pertaining to experience of autistic groups using VR HMDs in classrooms.

This view is supported by a review of literature from 1996-2017 undertaken by Fernández-Herrero et al. [10] who suggest that on the one hand, we have seen “an increasing interest in the topic of virtual reality as an educational tool for High Functioning ASD children since 2010” [p.75], while on the other hand: “the scientific production in this field is rather small considering its relatively wide trajectory, mostly concentrated between 2010 and 2017” [p.75]. The work covered by Fernández-Herrero and colleagues covered the role of VR as an “educational tool”, they don’t identify previous work that has sought views, input and co-design of technology for autistic groups. Through their search, limited work, if any, highlights the preferences and choices of autistic groups. This is not a limitation of Fernández-Herrero and colleagues’ work per se, but a wider-spread limitation of work conducted in the field to date; specifically focused on VR HMDs.

Other work [11] found some positive signs, reported by autistic adults, using VR HMDs, and confirmed that negative effects (that is cyber-sickness, feeling dizzy, eye strain) were very limited in the autistic population they worked with. In addition, this study found that wearing the HMD presented very few issues for autistic adults (with associated comorbidities) – there were no sensory concerns reported or observed using an HMD with VR over a short period of time. This coupled with the finding in the current study (that will be presented during this talk) that all children were happy to wear and use a VR experience using a HMD starts to suggest that issues related to negative effects and feeling unduly impacted by HMDs is worthy of further investigation to better tease out whether there is any need to be concerned about this aspect of HMD use.

In addition, further investigation would provide important data as to whom and in what circumstances HMDs are most suited for. This would be important as we strive towards safe and healthy use of HMDs in the future. Notwithstanding, the data presented in this talk (and study) highlights positive responses towards HMD use with 6-16-year olds in the U.K. A level of confidence, willingness and enjoyment using HMDs was reported across the autistic groups. However, we also suggest that as the field grows and develops, providing information and guidance related to health and safety issues (including negative effects) needs to remain central to all research; because in

doing so there will be greater uptake and interest. This is especially important if VR HMDs can in fact provide a safe, ecologically valid, and supportive environment for autistic users to engage with a range of experiences.

We suggest these are important findings, as research examining negative effects (in particular motion sickness) have reported less favourable results. For example, one study [12: p.894] found that “after playing the game for a maximum of 15 min, motion sickness was reported by 22% of participants”. Twenty-two percent in this context refers to n=8 (out of n=36 men and women). This is a finding supported by several other studies [13, 14] and an area that Jensen and Konradsen [3] refer to as: “barriers to the use” in educational contexts. And as some authors suggest [15]: “there are still many unanswered questions about immersive VR’s influence on children’s development” [p.113], pointing towards the need for more considered studies assessing the potential (for positive and /or negative connotations) of VR HMDs used by all children, including those on the autistic children.

This study, and the data presented, should shed some light of the perspectives and views of autistic children (and their teachers). In this context, we have better located the types of HMDs technologies that might be most successful in schools for autistic children. We suggest that based on the feedback (from pupils and teachers) that low-tech options such as cardboard HMDs coupled with a smartphone could be an appropriate first-step into using VR to transport pupils to various environments to augment their learning. In addition, the finding that VR HMDs might be most usefully received as a form of meditation, we also suggest careful thought about using VR in schools for this might provide access to a quick and easy methods to help reduce stress and increase calming feelings for autistic children. This of course needs validating, but the feedback we received in our project seems to suggest that VR could work well in this domain.

2.1 Implications for practice

This talk will conclude with several messages for practice and people wishing to use VR in schools with autistic groups. In terms of research, some messages and areas for further lines of enquiry include:

- The continued need to **collaborate**; sounds obvious, but is something this area can’t grow, scale and have impact without.
- **More evidence**; evaluation of the work ahead is vital.
- The need for **content**; hardware is freely available and can be used in classrooms/centres/the home, but content is lacking.
- **Alignment to evidence**; we need to ensure that content is aligned well to evidence. If VR can be beneficial; how, where, when, what, etc..
- **Autistic** communities and groups (and their caregivers); why would we not?
- **Access**; placing tech in the hands of the users... (funding and scaling).

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