Virtual reality in astronomy education: reflecting on design principles through a dialogue between researchers and practitioners

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Abstract. This study examines the use of virtual reality (VR) in astronomy education from the joint perspective of educational researchers and education and public outreach (EPO) professionals. Drawing on data from focus group interviews with EPO professionals and scientists from the Australian Research Council Centre of Excellence for Gravitational Wave Discovery (OzGrav), we identify and reflect on design principles focused on immersion, visualisation, facilitation, and collaboration. We argue that these principles can guide astronomy educators in implementing VR in various learning environments while also contributing to our understanding of how to leverage VR technology in astronomy education successfully.

Introduction

VR technologies present many opportunities to transform physics and astronomy education because they offer immersive and embodied learning experiences that make abstract concepts more easily accessible to learners. This study investigates the under-explored perspectives of EPO professionals on the use of VR in astronomy education [1]. While research into the educational impacts of VR is growing, the experiences and motivations of those who develop these VR experiences remain largely unexplored. Acknowledging that the educational value of VR depends on its context-specific implementation [2], we argue that the perspectives of EPO professionals provide valuable insights into design considerations that can inform the successful use and integration of VR in physics and astronomy education.

Research questions and theoretical framework

To shed light on design considerations for VR in astronomy education, we ask:

- What characterises the motivation of EPO professionals to use VR in astronomy education?
- Which opportunities and challenges of VR astronomy education guide the development and facilitation of VR astronomy experiences?
- Reflecting on the findings from the first two questions, what design principles can be formulated to develop and use VR in astronomy education?

Our theoretical framework characterises four features of VR that are particularly relevant in astronomy education: immersion, visualisation, collaboration, and facilitation [3]. Immersion in VR gives learners an active and embodied role in navigating and manipulating scientific concepts, while visualisation features in VR offer opportunities to visualise abstract concepts that would not be accessible otherwise. Besides, collaboration features leverage collective VR experiences, while facilitation encompasses human-led instruction and interactive environment features that guide learners through the virtual environment.

Methods and findings

This study is based on the EPO initiative of OzGrav, a collaboration of science educators, VR developers, digital artists, and astrophysicists utilizing VR technologies in their educational programmes, such as *Bigger Than Big* [3] and *Mission Gravity* [4]. We followed a two-step analytical approach based on a thematic analysis of focus group interviews with EPO professionals and scientists from OzGrav and subsequent reflective dialogues between researchers and practitioners. We framed these dialogues as an act of reflective practice based on Schön's concept, which differentiates between "reflection in action" and "reflection on action" [5]. This approach allowed us to articulate tacit knowledge, ultimately leading to a set of design principles for the use of VR in astronomy education. Key findings demonstrate how EPO professionals use new forms of embodied engagement, visual representations, collaboration, and facilitation across real and virtual spaces to expand and transform astronomy education practices in formal and informal learning spaces. In the presentation, we will explore these opportunities and present selected design principles. Attendees will have the opportunity to experience the OzGrav VR environments first-hand, offering a dynamic perspective on the potential of VR in educational practices. For a comprehensive presentation of our findings, please refer to our full paper [1].

Conclusion

In conclusion, this study contributes empirically and methodologically to VR astronomy education: empirically, we present the perspectives and insights of EPO professionals on how to use VR in physics and astronomy education successfully; methodologically, we champion a reflective-practice approach that synthesises expertise from researchers and practitioners to develop better VR learning experiences.

References

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