

Dowthwaite MScR Scholarship 2023/24 entry

DEPARTMENT OF PHYSICS

Principal Supervisor: Dr Pippa Petts

Other Supervisors: Dr Peter Swift (secondary) and other PhES section members as appropriate.

Project Title/Theme: Augmented and virtual reality technologies for teaching physics

Project Description

The field of physics education research (PER) has been growing rapidly in recent years, with a focus on developing new and innovative ways to support undergraduate physics teaching. One such area is the use of augmented and virtual reality (AVR) technology to create immersive and interactive learning experiences for students. This project will investigate the potential use of AVR technology (such as Microsoft HoloLens and Meta Quest headsets), in the development of teaching materials for undergraduate physics in the UK. This project will build on the recent AVR project to develop a virtual optical table by PhES as part of a Collaborative Innovation Grant (CIG) from DCAD. See our [YouTube video](#) for more information on this project.

In recent years, physics pedagogy has moved away from formulaic problem solving focussed on rote memorisation, with a move toward deeper learning processes. However, students can still struggle with grasping some of the more challenging concepts, especially where it requires them to marry physical interpretation with complex mathematical descriptions or when they have limited real world intuition. For example, in areas of electromagnetism students need to combine the mathematics of 3D vector fields or wave equations with core physical laws and interpret the outcome, which is cognitively demanding (Kuo & Wieman, 2016; Yusaf, 2017). Traditional diagrams of these situations are 2D sketches which make it very difficult to build an intuitive understanding. Computer based 3D simulations are arguably better, but tend to be limited in scope and can be clunky to use.

By creating immersive and interactive AVR learning experiences, students are able to engage with complex concepts in a more intuitive and meaningful way. This can lead to improved understanding and retention of key concepts, as well as increased motivation and engagement in the subject. Furthermore, the use of AVR technology can also provide opportunities for students to conduct virtual experiments and simulations, (Radu & Schneider, 2019; Schneider & Radu, 2022).

The main objective of this project is to investigate the potential use of different forms of AVR technology in the development of physics teaching materials for use at Durham. This will involve conducting a detailed analysis of existing AVR-based physics education materials

and designing, piloting and evaluating new materials using AVR technologies. The project will also explore the potential benefits and limitations of using AVR technology in physics education, as well as the challenges and opportunities associated with its implementation.

References

Kuo, E., & Wieman, C. E. (2016). Toward instructional design principles: Inducing Faraday's law with contrasting cases. *Physical Review Physics Education Research*, 12(1), 1–14.

<https://doi.org/10.1103/PhysRevPhysEducRes.12.010128>

Radu, I., & Schneider, B. (2019, May 2). What can we learn from augmented reality (AR)? Benefits and Drawbacks of AR for Inquiry-based Learning of Physics. *Conference on Human Factors in Computing Systems - Proceedings*. <https://doi.org/10.1145/3290605.3300774>

Schneider, B., & Radu, I. (2022). *Augmented Reality in the Learning Sciences*.

Yusaf, F. (2017). Stokes' Theorem: A candidate threshold concept. *Practice and Evidence of the Scholarship of Teaching and Learning in Higher Education*, 12(2), 397–410.

<http://community.dur.ac.uk/pestlhe.learning/index.php/pestlhe/article/view/183/206>

How to apply

You must apply through the University's [applicant portal](#)

You will need to:

- State 'PhES and Augmented and virtual reality technologies for teaching physics in the 'Field of Study' section.
- On the funding tab select 'yes' you are applying for a scholarship, select 'Other' write DOW236 in the name of the scholarship, and select 1st October 2023 as the start date
- attach a covering letter and CV
- attach degree transcripts and certificates and, if English is not your first language, a copy of your English language qualifications.
- provide 2 referee contact details (specifically email addresses) who we will contact directly.

Contact

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