Technologizing the laboratory-based classroom: using augmented reality to enhance the student experience

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Background

Laboratory classes can be quite daunting for science students when they encounter new and complicated equipment for the first time.

- The limited scope for students to make mistakes creates a ‘high-risk’ learning environment that can result in students becoming disheartened and often disengaged during laboratory classes.
- The challenge for tutors is to create a learning environment, both social and physical, that promotes a deep approach to learning and encourages the student to take an active role in learning; increasing motivation for, and engagement in the laboratory activities¹.

Innovative teaching approaches have employed ‘flipping the classroom’² in a range of ways to encourage both active and critical learning in students.

- Approaches range from ‘tutor narrated videos’ prior to class³ to full demonstrations with interactive exercises to complete ⁴.

Research Question

Could we take the ‘flipping’ approach further and not just provide short ‘how to’ videos for students, but create a more immersive experience to foster student engagement and motivation in the laboratory?

Methods

An interpretative approach was adopted for this study; drawing upon aspects of action research⁵ to develop a better understanding of students’ perceptions of laboratory-based learning and the barriers they feel exist around engagement in this environment.

We started with an initial fact-finding stage, drew upon this for the development of ‘immersive interventions’: then ran the laboratory classes with these interventions in place, and finally evaluated the impact of the interventions employed (fig.1).

Fact – finding stage

An initial focus group session was held with five final year undergraduate students to identify:

- the nature of the current situation
- perceptions of barriers to learning and engagement
- experiences of laboratory based classes
- perceptions of the potential role of technology in supporting and enhancing learning

Open coding through the use of simple words or a short sequence of words identified several key themes:

- ‘you are just standing around waiting… and you think ah if someone was available I could have done this a few minutes ago and carried on but...’ (Participant 1)
- ‘if we went over to it and held our phone over it and it actually tells us how it works itself – that would be pretty interesting and really help’ (Participant 2)

‘BEING LOST’

‘JUST-IN-TIME SUPPORT’

‘CONCISE AND RELEVANT’

Intervention Stage

Based upon these findings ‘augmented reality (AR) flips’ were developed:

- short instructional videos
- instructions on equipment (e.g. ‘how to… use a pipette, balance a centrifuge etc)
- COSHH data sheets each linked to ‘trigger images’ using a commercial app and/or ‘quick-response codes’ (QR) (fig 2) embedded within the workbooks.

This provided students with instant access to additional relevant information as and when they required it using a mobile device/laboratory tablet – augmenting the laboratory environment.

Videos were also accessible on the university virtual learning environment without using the trigger images/QR codes.

Findings

A polling app (Socrative) was used to gather free-text responses to a set of questions about the students’ experiences, allowing them to respond anonymously to the questions.

Six key themes were identified from the coding of students’ responses – fig 3.

Discussion

The aim of this study was to address how we could increase student engagement and motivation during laboratory-based classes to support development of the essential skills required by healthcare professionals.

Our findings indicate that ‘augmented flip’ can influence students’ perceptions of their course and skill development by:

- increasing their engagement
- stimulating their interest in the subject matter
- fostering autonomy by providing content at their ‘fingertips’
- providing a sense of independence
- boosting their confidence in activities

Importantly, the technology also provided a way of bridging the gap between school and university for these first-year students – supporting their transition.

The role of AR in providing a way to bypass some of the barriers students encounter when they enter the science laboratory and foster a more inclusive learning environment, supporting development of the essential skills for practice is an important area for further research.

References