Developing and evaluating a virtual laboratory to support medical student oncology education

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Background

Histopathology involves the examination of tissue samples under a microscope.

Genetics is the study of our genes and their functions.

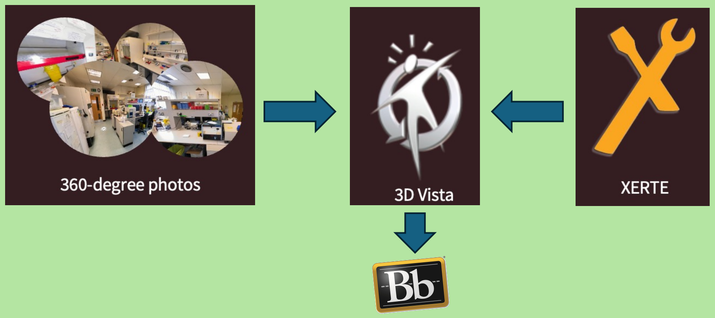
Both disciplines play crucial roles in diagnosing and understanding diseases and are taught to Year 2 Medical students during an oncology case, using a flipped classroom approach,
To support independent self-study, a virtual reality (VR) lab was created for students to use alongside a written Workbook. Their learning was subsequently consolidated during an in-person Q+A session.
Here we describe the initial evaluation of this new mode of delivery using the VR-lab to supplement the self-study component of the teaching.

Methods

1 – The initial storyboard was developed. This included the patient narrative along the diagnosis pathway, laid our where information drops were needed during the story and incorporated questions with model answers that could be developed into interactive questions to promote engagement and interactivity of the resource.

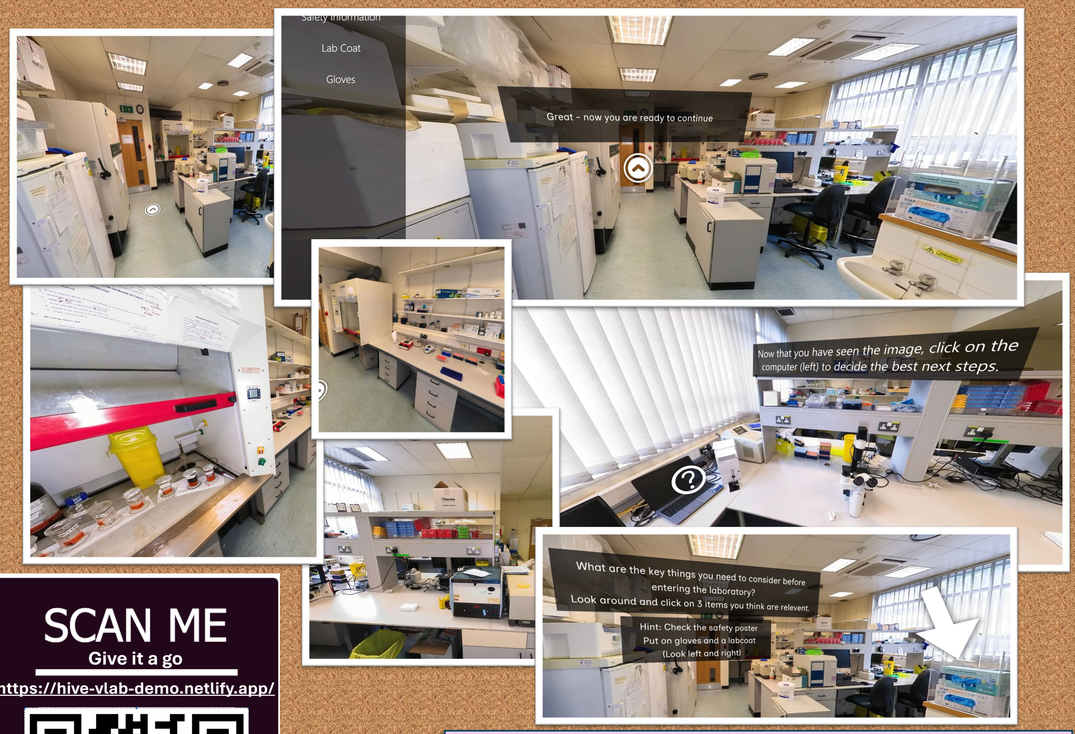
2 - The Photoshoot was scheduled. 360º panorama photos of 3 areas of a molecular biology laboratory within Cardiff University, along with close ups of specific instrumentation, were taken. These images were linked using directional arrows and formed the basis for the VR-lab.

3 - The VR-Lab was built and refined. The VR-Lab was developed as a lightweight, web-based, Desktop-VR experience combining the images from the photoshoot, were inputted into in 3D Vista software for the immersive environment, and the information from the storyboard within XERTE for the interactivity. Both pieces of software are no-code tools, allowing direct updates to the content to be made during the development process.



4 – Resource delivery. The resource was delivered to the entire 2023/24 second year cohort of the Bachelor of Medicine (MBBCh) students (286 medical students), using Blackboard Ultra. Students had allocated, timetabled time to complete the work one week before an in-person Q&A session. Both the VR-lab and a non-interactive word-based workbook were provided to the cohort, with students being given the choice of which resource to use.

5 – Resource evaluation. Microsoft Forms was used to capture anonymous feedback of the student experience of using the independent learning resources.



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https://hive-vlab-demo.netlify.app/

Results 1

Of the cohort of 286 second-year medical students, 242 students (84.6%) engaged with the provided resources prior to the Q&A session.

38 students completed the resource evaluation questionnaire within 4 weeks of the teaching delivery.
- 28 students chose to only use the VR-Lab,
- no student chose to exclusively use the workbook
- 10 students chose to use both (Figure 1).

Free text comments demonstrated that those who used the workbook did so as a means of notetaking and liked its simplicity of the resource.
However, all respondents noted the e-learning resource was more engaging, enjoyable and interactive.

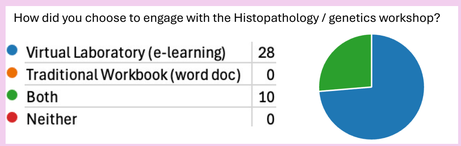

Figure 1 Engagement choice with resource

Results 2

Students rated the VR-Lab resource as user-friendly, engaging and aiding learning, while not being confusing (Figure 2).

Free text feedback responses highlighted:
- the patient narrative supported students putting the learning into context
- the structure and flow of the activity aided engagement with the learning materials
- the provision of model answers provided clarity and aided learning

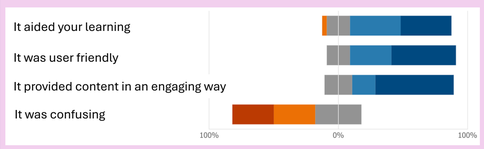

Figure 2 Likert scale rating of the VR-lab

Results 3

The traditional workbook was rated highly as user-friendly and aided learning, but it was not seen as being as engaging as the VR-Lab resource (Figure 3)

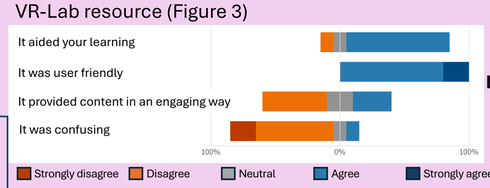

Figure 3 Likert scale rating of Workbook

Areas for improvement

Free text comments provided a clear steer towards features that could be used to further improve the VR-Lab and optimise the learning experience.
- 15.8% asked for a “go back” and/or “save progress” options for easier navigation between sections and to allow recapping of content without having to start over.
- A few students requested the inclusion of video explanations
- Most students encouraged us to develop more resources Akin to the VR-Lab

Conclusion

Here we have described the creation of a VR-Lab to support genetics and histopathology teaching for second year medical students and reviewed the preliminary student feedback.
- Student feedback demonstrated we successfully met our aim of delivering teaching in an engaging way through the VR-Lab, and this has promoted students’ perception of learning.
- While many students only used the e-learning VR-lab resource, the provision of a complementary workbook was beneficial for some. This is an important consideration for future planning of the integration of technology-enhanced learning approaches.
- Integration of technology-enhanced learning approaches, alongside more traditional workbooks, is in keeping with the principles of universal design for learning (UDL), utilizing a variety of strategies to present information to ensure multiple means of engagement, representation and expression.
- The evaluation of this VR-Lab resource highlights the student appetite for, and the benefits of, integrating VR technologies to promote greater interactivity with the learning content.
- Our experience developing this VR-Lab is in accordance with the published literature that has proven VR technologies to be effective teaching tools, although we acknowledge that actual student learning was not assessed here.

Acknowledgements.

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