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Use of 360° Video for a Virtual Operating Theatre Orientation for Medical Students

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BACKGROUND: Operating theatres are a unique learning environment that some learners find daunting. By employing orientations some of these fears can be reduced but these require operating theatre space and personnel and are not standardized.

METHODS: We utilized a 360° camera to generate a “virtual” 360° video orientation. It was filmed in first-person perspective to improve engagement and to make it more experiential.

EVALUATION: It was shown to 34 medical students in a tutorial setting before their first operating theatre experience. We analyzed their knowledge gain with use of a questionnaire and change in self-reported confidence using a 7-point Likert scale. The students’ knowledge improved from 38.4% to 78.2% (p < 0.01) as well as self-reported confidence from 4.3 to 6.1 (p < 0.01).

DISCUSSION: The use of 360° video for a virtual operating theatre orientation improved knowledge and confidence of learners which suggests its expanded use in medical education. (J Surg Ed 000:1–3. © 2020 Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery.)

KEY WORDS: 360° video, operating theatre, medical student, virtual reality

COMPETENCIES: Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement

INTRODUCTION

The operating theatre has unique learning opportunities for medical students. However, it has been reported by students that the theatre can be an uncomfortable environment due to their lack of awareness of theatre etiquette as well as little explanation of the role of different staff members.1 To alleviate these feelings studies have shown that students appreciate the concept of a theatre orientation.2 Physical orientations of operating theatres do occur although are rarely formally done for medical students.3 While the benefits are numerous and include seeing the physical space and meeting team members, the nature of clinical environments mean that standardizing these experiences is difficult as theatre space and personnel need to be available. We wanted to see if new technology could generate a theatre orientation which would feel realistic and allow standardization. We found a possible solution with 360° video.

The 360° cameras enable a full 360° view to be filmed in real time. The benefits allow both the depiction of an environment by placing the viewer “within” that environment but also with the use of smartphones allows the viewer to choose where to focus their attention by moving their own screen. This ability to see an environment as if the viewer is placed within it lends itself well to the concept of an orientation as it exposes the viewer to that environment in a virtual way. Additionally, once made it will have the benefit of requiring less resources and allowing a standardized experience. Therefore, we developed a learning resource utilizing this technology with the aim of gaining an insight into students’ receptiveness to this technology and its potential use.

METHODS

Prefilming

We utilized a 360° camera (Ricoh Theta S) already in use in our medical education department. It was chosen for
its ease of use and its limited requirement for post-production editing therefore requiring basic levels of technological knowledge. Other cameras do allow higher resolution images to be attained but are more expensive and often require additional software for editing and therefore greater technological support.

We then identified 5 key learning objectives from our physical operating theatre orientation that we wanted to focus on: the WHO checklist, theatre etiquette, the role of different theatre staff members, the concept of the sterile field and actions to take if feeling unwell. We devised a script covering the above learning objectives and recruited real theatre staff to act in the video.

**Video Production**

To increase engagement, we wanted to film the video using a first-person perspective, through the eyes of our student protagonist. To do this we altered a pre-existing head mount to hold our specific camera onto the head of our student actor. The other actors playing the roles of theatre staff were instructed to talk directly to the camera to recreate the feeling of the theatre orientation “physically” being carried out by the viewer. The scenario was filmed in an empty operating theatre with no patients being used.

We produced a 9-minute video which was uploaded onto a video sharing website (www.youtube.com) to allow easy access and the ability to view it in a 360° angle. Screenshots of the video are shown in Figure 1 and the video web address is https://www.youtube.com/watch?v=O646InNJsic&t.

**Evaluation of the Video**

Thirty-four second-year medical students were recruited at the start of their first clinical placement before they had been allocated time in operating theatres. The video was trialed in three 20-minute tutorials with a maximum of 12 students in each. The students utilized their own smartphones to watch the video directly from the website using a QR code. We evaluated the videos in 2 ways: self-reported confidence using a 7-point Likert scale and factual knowledge change by asking the students to answer the same questions on the 5 key learning objectives listed earlier both before and after watching the video.

**RESULTS**

All 34 students answered the questionnaires. The difference between pre- and postvideo confidence and knowledge gain were evaluated using a paired students’ t test. All the students showed an improvement in knowledge of the theatre environment from a mean score of 38.4% prior to watching the video compared to 78.2% after (p < 0.01). Self-reported confidence improved as well from 4.3/7 to 6.1/7 (p < 0.01). These results are shown in Table 1.

**LIMITATIONS**

One issue is that the video does not allow for specific questions by the students to be answered. We addressed this by using it in a tutorial with a facilitator being able to answer questions. This does require a faculty member and therefore has some resource implications. A possible future solution would be to embed captions or annotations into different parts of the video to expand on specific points. This was not possible with the software used for this video but is available and could be added into future iterations. A limitation of our evaluation was that we gained data only on immediate confidence and knowledge gain. In future studies we would like to evaluate if there are any longer-term benefits for the students.

**TABLE 1.** Change in Factual Knowledge and Self-Reported Confidence Pre- and Postwatching the Video

|                  | Pre Watching Video | Post Watching Video | p Value |
|------------------|--------------------|---------------------|---------|
| Knowledge (% correct) | 38.4               | 78.2                | <0.01   |
| Self-reported confidence (out of 7) | 4.3                | 6.1                 | <0.01   |
DISCUSSION

This study utilized 360° video technology to try and orientate students to the operating theatre and appears to increase knowledge and self-reported confidence amongst viewers.

The 360° video has had limited use in medical education thus far, primarily being used to show surgical procedures where it has shown increased engagement from viewers. However, we feel that by placing the viewer “within” a virtual space a real strength is to utilize it for orientation to new environments. Our results support previous work which has used technology to aid with this issue including operating theatre orientations. Patel et al. utilized a virtual environment of computer-generated images and avatars which along with our study showed an increase in self-reported confidence amongst students in the theatre environment. However, one of the main differences with our study is that the 360° video captures a real environment more like one the students are likely to encounter.

For the institution we have identified 2 additional benefits. First, there was a reduction in time spent on orientation, we were able to carry out orientation for 34 students in 1 hour 15 minutes. This is compared to our traditional physical orientation which would take approximately 3 hours for this number of students. The second benefit is that it allows orientation to take place remotely which in view of the current climate of social distancing imposed by the COVID-19 pandemic may provide a viable alternative to traditional physical orientation.

This study has suggested that 360° videos may have a place in medical education as it can impart knowledge of specific environments through an interactive experience. It is technically easy to produce and once made reduces the resources required to carry out the important process of orientation. This was warmly received by students and the current climate of remote learning and social distancing may lead to an expansion in the use of this technology.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2020.08.014.