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Student Acceptance of Virtual Bedside Surgical Tutorials During COVID-19: A Randomized Controlled Trial



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ABSTRACT

Background: The social distancing recommendations from the WHO during the pandemic has resulted in a pivot point in the delivery of medical education. With the medical student clinical experience constantly under threat; novel methods to maintain adequate surgical patient exposure and student interaction on a platform amenable to the interactive format required were devised using a virtual platform to compliment current pedagogical approaches.

Methods: A parallel randomized controlled trial evaluated the perceived use of remote learning in place of bedside teaching. Participants were randomized to undergo surgical bedside teaching in person or virtually. Feedback questionnaires and exit interviews carried out following each session. Content analysis of transcripts was performed to evaluate the presence and quality of perceived learning, benefits and limitations to each modality.

Results: Feedback demonstrated greater engagement, satisfaction, involvement and learning ($P < 0.001$) in the bedside teaching group. Content analysis yielded three main themes; Technological, Interpersonal Component, Provision of Content. Participants in the virtual group reported a limited ability to elicit clinically relevant findings in surgical patients. Students however reported the virtual teaching was an acceptable method of learning with 90% satisfaction reported for learning via the virtual platform.

Discussion: The pandemic posed challenges to adequate student-patient exposure. Delivering surgical bedside teaching remotely is a method amenable to learning for students, with advantages including convenience, fewer reports of information fatigue, and decreased perceived pressure identified with this learning modality.

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Background

The current COVID pandemic resulted in a hitherto unprecedented effect on the delivery of healthcare throughout the world,¹ with medical education delivery also disrupted at both postgraduate and undergraduate level.² COVID-19 restrictions induced teaching programs to implement a paradigm shift in modalities of learning and ongoing learning resources for students.³ Modern undergraduate surgical curricula utilize varying components of simulation and apprenticeship models, with teaching in the clinical setting delivered by both consultants and specialty training residents, with the importance of clinical and hands on experience emphasized throughout student rotations.

An increase in clinical workload, redistribution of staff and restricted access resulted in a loss in the conventional method of clinical based teaching.⁴ Precautions taken within clinical learning environments included capped attendee numbers, personal protective gear, and the implementation of pre-session temperature checks to reduce spread,⁵ with a reduction of other nosocomial infections seen with these precautions.⁶⁻⁸ With the rise of multi-drug resistant infections,⁹ and medical students potential vectors for healthcare acquired infections,^{10,11} an argument for the long term integration of measures taken to reduce unnecessary interactions with potentially immunocompromised patients for the purposes of teaching could be made.

Telemedicine is a well-established modality in clinical practice, with a paucity of research demonstrating its integration in undergraduate teaching curricula. Xpert eye is a software supported headset with visual, audio, streaming and photoboard capabilities. Similar models have been used in teleproctoring for peer teaching across surgical specialty centers on both a national and international level.¹² With a myriad of potential benefits derived from the integration of telemedicine into every facet of clinical environments in the wake of the COVID pandemic; this randomized controlled trial aimed to evaluate the perceived benefit of surgical bedside teaching sessions using common surgical conditions on a virtual platform.

Methods

Aims

The primary outcome was to evaluate student acceptance of telementoring during clinical teaching in lieu of conventional surgical bedside teaching.

Study Design

This was a single-blinded randomized controlled parallel group trial in a regional university hospital. Participants were randomized in a 1:1 ratio to undergo either teaching at the bedside with the patient and surgical tutor present, or to receive the session in an alternative location via livestreaming. Informed consent was obtained by patients and participants. Local Institutional Board approval was obtained.

Participants

Subjects were recruited from a pool of medical students in their penultimate and final years while undergoing clinical rotations in a regional university hospital in Ireland. 41 data points from bedside teaching sessions were collected over the course of 6 weeks in 2020, with a total of 21 students eligible to participate. Simple randomization using sealed envelopes technique was utilized, with each envelope containing "Bedside" or "virtual" sheets which were allocated to students just prior to the tutorial each morning.

Control

Usual preparatory tutorial materials were provided to both groups including the tutorial topic to be covered and signposting to lectures given on the relevant pathology the day prior, allowing students to read up and prepare for the tutorial ahead of time. Following randomization, the control group underwent the bedside teaching session in the conventional manner, at the patient bedside with the surgical tutor in attendance.

Intervention

The interventional group received the bedside teaching in an on-site nearby location via a large screen monitor with live feed provided from an Xpert eye headset worn by the surgical tutor. The vantage point of the transmitted video feed was that of the surgical tutor wearing the headset. A 2 way audio system was available for provision of questions and communication between the virtual group and the surgical tutor throughout the session. With the virtual students linked into the tutorial remotely, patients were able to hear the virtual group with no visual connection provided during the tutorial between patient and virtual groups.

Patients selected for bedside teaching had medical conditions which were visible to the eye, to optimize transmission through video. These included leg ulcers, skin malignancies, cholangitis, stomas, and hernias.

Qualitative feedback via exit interviews was collected from both groups following each session. In addition to this, participants were asked to complete a feedback questionnaire regarding individual perspectives on engagement, satisfaction, involvement and perceived learning using a 5 point Likert scale.

Statistical Analysis

Statistical analysis was carried out using the IBM SPSS software (IBM Inc.). Reliability testing by computing Cronbach's Alpha was carried out. Ordinal data was collected and used to assess acceptability of the control and intervention groups across satisfaction, involvement, engagement and perceived learning. Data collected was reported as frequencies, and Mann-Whitney U tests used to analyze differences between groups. A difference in intra-subject and inter-subject findings was considered statistically significant if $P < 0.05$. Feedback was collected from each group in exit interviews by the authors and thematically organized.

Bedside participant feedback

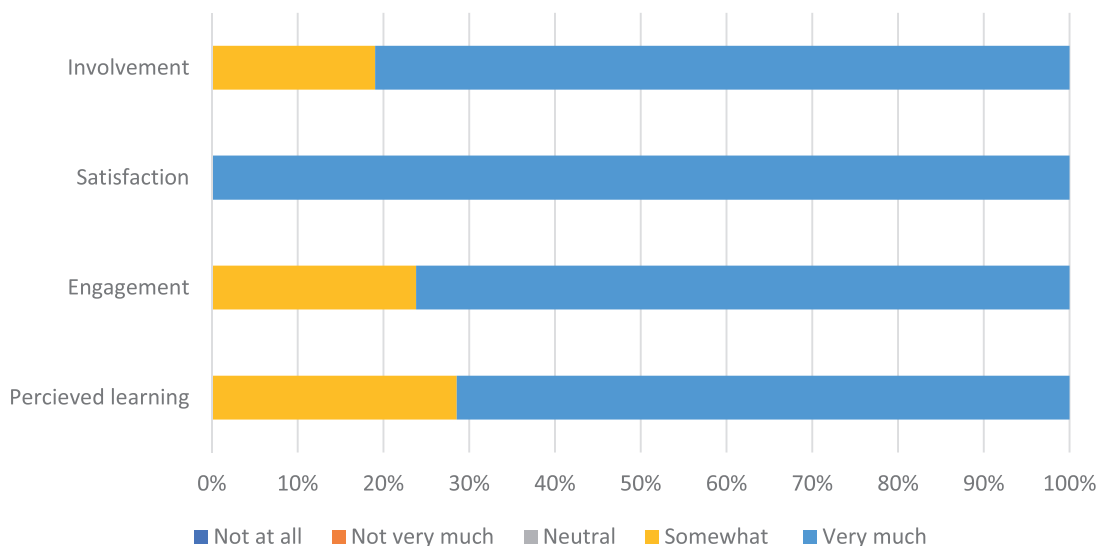


Fig. 1 – Bedside participant feedback.

Virtual participant feedback

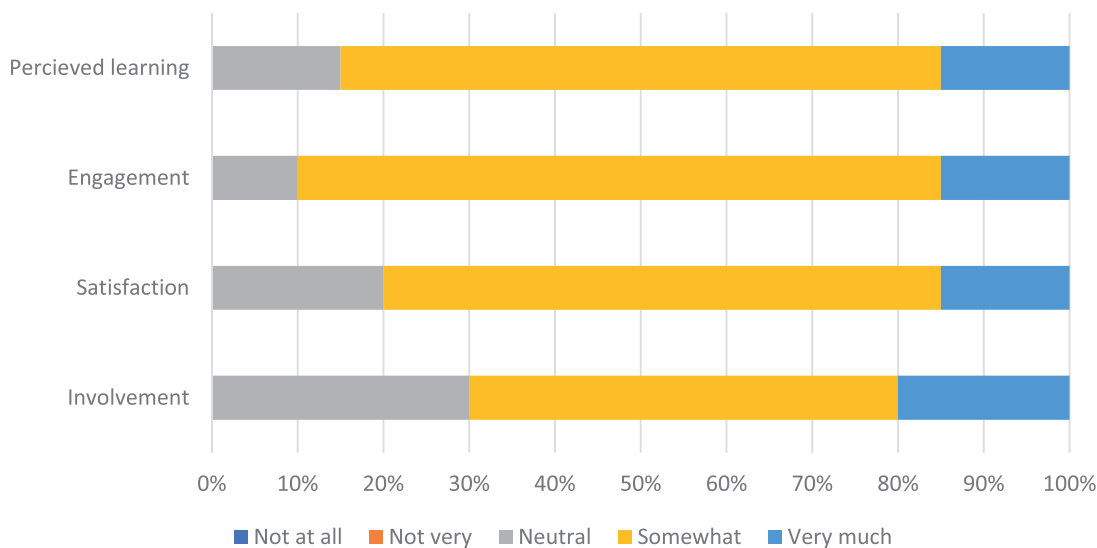


Fig. 2 – Virtual participant feedback.

Results

Feedback from participants demonstrated a significant difference in the groups learning experience, with the bedside teaching group rating higher levels of perceived learning in each teaching session ($P < 0.001$). Similarly, the bedside teaching group reported higher ratings of engagement, satisfaction and involvement in each session ($P < 0.001$) (Fig. 1) (Fig. 2).

Qualitative feedback from participants yielded three main themes: technological, interpersonal, and provision of content.

Technological

The virtual learning group reported frustration with loss of clarity in the video feed as an obstacle to learning. Similarly, some participants in the virtual group reported reduced audio as a barrier to engagement to the teaching session, with reduced satisfaction secondary to this. In contrast to this; several participants in the virtual group felt the virtual learning platform conferred a greater degree of convenience as an advantage during the course of the tutorial, with ready access to notes and supplementary learning resources on hand to enhance their learning during the virtual session.

Interpersonal

Participants in the virtual group reported mixed findings regarding the change in conventional interpersonal interaction with both patient and surgical tutor. The virtual group reported the virtual platform via live telementoring allowed them to formulate clearer answers to questions posed by the surgical tutor during the course of the teaching session due to lack of perceived pressure. This was reported to enhance their learning and retention of teaching content provided. However, some participants felt the lack of direct interaction with the tutor was a barrier to involvement in the clinical discussion. Despite this, no participants in the virtual group cited lack of patient interaction as a barrier to their learning.

The bedside group reported no issues with provision of content, with one participant from the bedside group noting the headset worn by the medical tutor reduced direct eye contact, citing this as a barrier to engagement in the session.

Of note, patients participating in the teaching session indicated no preference regarding the modality in which the session was delivered, via virtual or in-person format.

Provision of content

Participants in the virtual group reported reduced visibility as a result of loss of internet quality an impediment to learning. This issue predominantly arose in teaching sessions involving conditions of the skin; where a reduction in the quality of video over the hospital internet reduced clarity of the condition being visualized. Participants reported conditions with a greater degree of visibility more amenable to the virtual platform, reporting hernias, ulcers, and stomas to be transmitted easily through the remote learning group.

When asked whether they would recommend the method of learning experienced, all participants in the virtual group commended the virtual platform to be a useful learning tool, particularly in a period of reduced clinical access and disrupted teaching.

Discussion

The perceived value of face-to-face teaching has previously been discussed in the literature.¹³ Some participants in the virtual group noted the patient exam was challenging remotely, a finding echoed in recently published data¹⁴ on limitations regarding the use of telemedicine withing our current conventional model of medicine. This issue arose predominantly in cases involving medical conditions where part of the traditional examination involves the use of tactility to differentiate between conditions; and still taught widely in medical school despite the advances in the technological aids introduced into clinical practice. One participant's feedback from the virtual group was that although at the end of the session they were still unsure of some of the answers to the questions, they had a greater idea of what level of knowledge was expected of them following the teaching, and where focus was required for their own individual learning. Despite the challenges noted by the virtual group in viewing the clinical condition, identifying deficits in knowledge is part of the learn-

ing process, with participants in the virtual group consistently reporting the benefits of the visual feedback via the virtual platform and the ability to immediately access supplementary material on hand.

Participants undergoing bedside teaching consistently reported the teaching sessions to be prolonged, with attention deficits occurring as a result. In contrast, no participants from the virtual group found duration of the session to be a barrier to learning. Previous studies have shown that protracted teaching session have reduced benefit due to loss of attention.¹⁵

It is clear that student preference remains with surgical bedside teaching in its traditional setting. However, this study has demonstrated that virtual bedside learning confers a great degree of advantages, and remains a viable alternative for provision of information to medical students, with 82% participants in the virtual group reporting it as acceptable to achieve learning outcomes, with no participants finding the platform unamenable to learning. The virtual group in this study found an increased convenience derived from the virtual platform, in contrast with Mukhtar et. Al,¹⁵ who reported higher levels of inconvenience on the virtual platform. Additionally, although there was a significant difference noted between groups in satisfaction ($P < 0.001$), participants in the virtual group reported 90% satisfaction with teaching received on the virtual platform.

This study does revisit some issues found in recently published data regarding medical teaching in an online forum. Some advantages our study included the provision of 2 way audio allowed for immediate feedback for clarification of concepts, a limitation noted in other teaching manoeuvres.¹⁵ Time commitments have been noted as drawbacks to establishing online learning,¹⁶ which was not found to be an issue in our study. One study¹⁶ also found bandwidth to be an issue, a finding echoed in our study, with participants reporting poor video quality a barrier. Future studies will focus on mitigating issues arising in the current study, including bandwidth; coordination of technological equipment; and a non-concurrent virtual and in-person teaching session study design to remove any potential biases arising from both groups being present in the tutorial.

A limitation of this study is the effect the presence of participants at the bedside had on the participants undergoing the teaching virtually. Although the design of this study in this manner allowed us to directly compare feedback of both groups from the same session, interference from the corresponding group on each participant's perceived learning should be considered. In situations whereby learning takes place on a virtual platform in its entirety, such interference would not occur, thus potentially increasing the perceived engagement over a virtual platform.

Surgical beside teaching in the traditional setting remains the preferred method of provision of information in medical students in this study. However, virtual based case base learning is an acceptable modality of learning, with several advantages including convenience, decreased pressure to learn, and fewer reports of information fatigue in the virtual group. Integration of telemedicine into the student curriculum has been demonstrated to be feasible, and amenable to student learning outcomes.

Author Contributions

Study conception by AF, AC IF and DJH. Tutorials carried out by DJH, interviews and feedback collected by AF and AC. Writing and data analysis carried out by AF and IF. Final manuscript reviewed by AF, IF, AC and DJH.

Disclosure

Authors wish to confirm that there are no known conflicts of interest associated with this publication.

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