

Virtual orthopaedic teaching during COVID-19: Zooming around Scotland

Has e-learning been a resounding success?

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The Conference of Postgraduate Medical Deans states that it is the responsibility of training programme directors to ensure that postgraduate training programmes 'deliver the specialty curriculum, and enable trainees to gain the relevant competences, knowledge, skills, attitudes and experience'.¹ In order to achieve this for orthopaedic trainees, the Joint Committee on Surgical Training recommends that trainees should attend supervised clinics and theatre sessions as well as having access to at least two hours of formal teaching a week, of which they should attend at least 70%.²

E-learning is defined as the delivery of educational content through web-based methods.³ Several orthopaedic studies have reported high levels of trainee satisfaction with e-learning resources^{4,5} and e-learning has played an increasing role in orthopaedic training in recent years.⁶

The COVID-19 pandemic has had a significant impact on the provision and delivery of healthcare. It has also affected the ongoing delivery of essential medical education, creating new pedagogical challenges. Trainees have been redeployed to other specialties, disrupting ability to attend scheduled teaching, and restrictions designed to reduce

viral transmission have limited the ability to hold formal face-to-face teaching sessions. At the time of writing, Scottish government guidelines are that no more than eight people should meet indoors.⁷ These challenges have resulted in an unexpected and dramatic increase in the use of e-learning materials for orthopaedic⁸⁻¹⁰ and surgical^{11,12} teaching around the world.

All four training regions in Scotland (North, East, South East and West) have switched from a face-to-face formal teaching programme to an online teaching programme since the COVID-19 pandemic. The aim of this study was to evaluate the



availability and acceptability of this virtual orthopaedic teaching as perceived by the trainees themselves.

METHODS

A 20-question survey was constructed using an online platform (www.surveylegend.com). The questions were divided into six themes:

1. Demographic data: Trainees were asked their stage of training (grade) on the first day of lockdown as well as in which region they were based.
2. Available teaching opportunities: Trainees were asked how many hours of formal teaching they received on average each week before and during lockdown. They were also asked how many hours of consultant-led teaching they received each week.
3. Teaching logistics: Trainees were asked what time of day teaching usually occurred. For e-learning, they were also asked which software was most commonly used.
4. Teaching attendance: Trainees were asked what percentage of formal teaching they were able to attend. They were also asked whether specific barriers prevented them from attending teaching.
5. Assessment of lockdown teaching: Trainees were asked to rate the quality and relevance of their teaching on a scale of 1–10. They were also asked whether virtual teaching should continue to be part of the delivery of postgraduate education in their region.
6. Preferences for e-learning: Trainees were asked which factors were important for an

online teaching session and the optimum length of these sessions.

The survey was distributed to 129 orthopaedic trainees spread throughout all four training regions in Scotland. Questionnaires were completed anonymously and participants had one week to complete the survey. It was designed so that no questions could be skipped before submitting. The survey was accessible on both mobile devices and personal computers, and it utilised the respondents' IP (internet protocol) address to prevent the survey being filled out by the same participant twice. IP addresses were not recorded or visible to the authors, in accordance with the General Data Protection Regulation (GDPR).

Data analysis

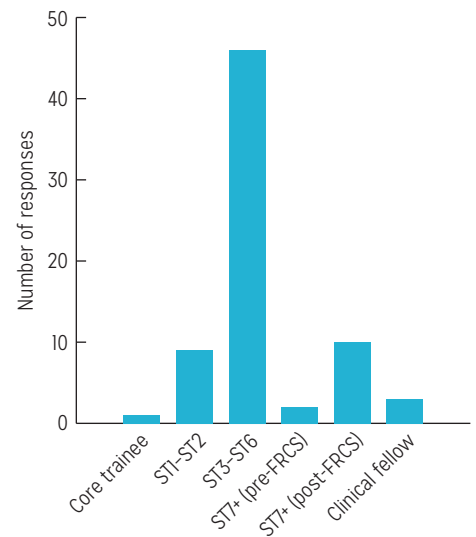
Statistical analysis was performed using SPSS® version 26.0 (IBM, New York, US). Fisher's exact test was used to compare differences in responses before and during the lockdown. A p -value of <0.05 was considered statistically significant. Ethical approval was not required for this study. Data collection was carried out in accordance with General Medical Council guidelines for good clinical practice and adhered to the GDPR. The study was completed without funding.

RESULTS

A total of 80 Scottish orthopaedic trainees (62%) took part the survey. However, nine of these started the survey but did not complete it and so were discounted from the analysis.

Of the 71 complete surveys, 19 were from the North, 12 from the East, 6 from the

Figure 1 Trainee grade on first day of lockdown

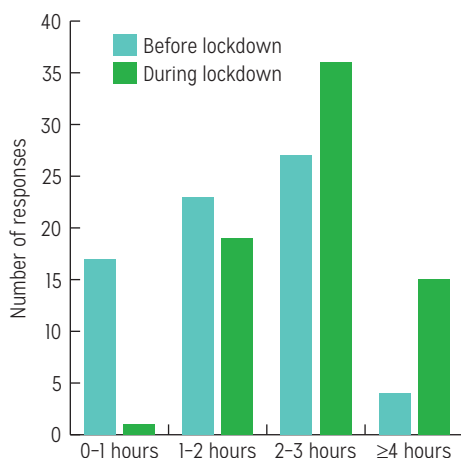
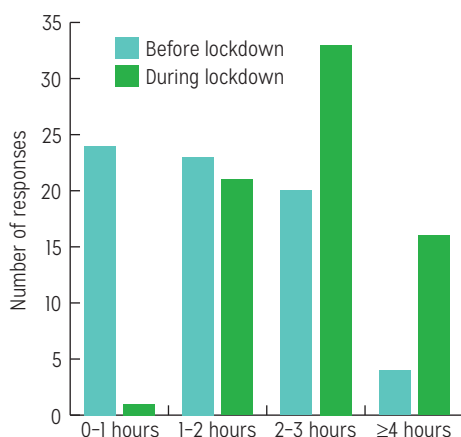


South East and 33 from the West training region. Respondents ranged from core trainees and clinical fellows to specialist orthopaedic trainees in their final year of training. The majority of participants were in years 3–6 of specialty training (Figure 1).

The average amounts of formal teaching available to trainees before and during lockdown are summarised in Figure 2. Significantly more respondents ($p<0.0001$) stated that they received 0–1 hours of formal teaching per week prior to lockdown versus since lockdown. Furthermore, significantly more trainees ($p=0.012$) reported receiving ≥ 4 hours a week during lockdown versus before lockdown.

Figure 3 illustrates the average amounts of consultant-led teaching received before and since lockdown. Significantly more trainees ($p<0.0001$) said they received 0–1 hours of formal consultant-led teaching per week prior to lockdown versus during

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Figure 2 Average hours of formal teaching each week**Figure 3** Average hours of consultant-led teaching each week

lockdown. In addition, significantly more respondents reported having 2–3 hours ($p=0.017$) or ≥ 4 hours ($p<0.0001$) of consultant-led teaching since lockdown versus prior to lockdown.

Only two trainees had access to virtual teaching before lockdown. Prior to lockdown, teaching usually occurred in the afternoons (93%), with some teaching (25%) also taking place in the mornings but only 6% in the evenings. Conversely, during lockdown, most teaching (56%) occurred in the evenings, 52% in the afternoons and 10% in the mornings. All 71 participants reported that e-learning had been delivered using Zoom software (Zoom Video Communications, San Jose, CA, US) and 19 also reported sessions being delivered by Teams software (Microsoft, Redmond, WA, US). No other software use was noted.

The average amounts of teaching that trainees were able to attend before and since lockdown are shown in Figure 4. No significant differences were observed. Prior to lockdown, 47 respondents (66%) had been unable to attend some face-to-face teaching owing to service commitments, 46 (65%) owing to rest days and 45 (63%) owing to shift patterns. During lockdown, 29 (41%) had been unable to attend some online teaching because of other commitments, 23 (32%) because of clashes with other webinars, 20 (28%) because of home distractions, 17 (24%) because of connection problems and 11 (15%) because of technical difficulties with the software.

When asked to rate the quality and relevance of the virtual teaching, the majority of those surveyed gave ratings of 8–10 out of 10 (Figure 5). Only 11 trainees (15%) felt that lockdown had had a negative impact on postgraduate teaching in their region. The vast majority ($n=68$, 96%) stated that online teaching should continue to be a part of the delivery of postgraduate training.

When trainees were asked which factors were important for e-learning, the three most frequently selected factors were quality of presenter ($n=58$, 82%), duration of teaching ($n=39$, 55%) and relevant subject matter ($n=38$, 54%). When asked for the optimum duration for a virtual teaching session, the majority ($n=50$, 70%) selected 45–60 minutes (Figure 6).

DISCUSSION

Our study has demonstrated that the switch from a face-to-face formal orthopaedic teaching programme to an e-learning programme in the Scottish training regions since the COVID-19 lockdown has resulted in an increase in the amount of overall teaching and consultant-led teaching received by orthopaedic trainees. These findings are in contrast to a survey of orthopaedic trainees in Korea.¹³ Although there was a shift to online teaching during the pandemic, Korean trainees reported that they received significantly fewer hours of teaching in this period.

Our results suggest that the transition to virtual teaching for Scottish orthopaedic trainees was associated with changes in the time at which the teaching was delivered. Before lockdown, the majority of teaching occurred in the afternoon but since lockdown, teaching was also often delivered in the evenings. Further discussion with trainees responsible for the organisation of teaching revealed that in the North, East and South East training regions, formal teaching programmes were switched from the afternoons to evenings during lockdown whereas in the West region, formal teaching remained in the afternoons. Zoom was the most commonly used software to deliver teaching and this is mirrored in a survey of orthopaedic trainees in Chile during the pandemic.¹⁴

There was no significant change in the proportion of teaching that Scottish trainees were able to attend. Nevertheless, as the amount of teaching available increased since the lockdown period, it can be concluded that trainees were able to attend more teaching overall. Those surveyed reported that prior to lockdown, the most common barriers to attending teaching were service commitments, annual leave and shift patterns. These have both been consistently noted in the literature as barriers for teaching attendance.^{15,16} However, respondents additionally mentioned clashes with other webinars, home distractions, connection

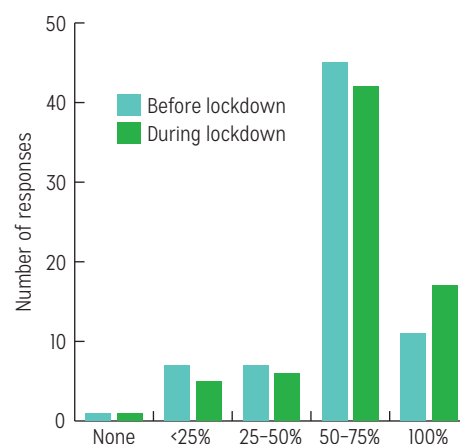
Figure 4 Proportion of teaching that trainees were able to attend

Figure 5 Trainee assessment of quality and relevance of lockdown teaching (1 = lowest quality/relevance, 10 = greatest quality/relevance)

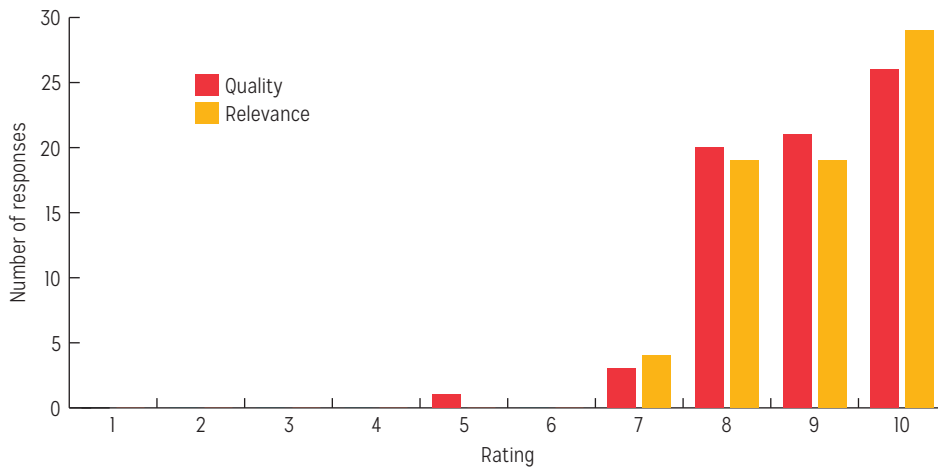
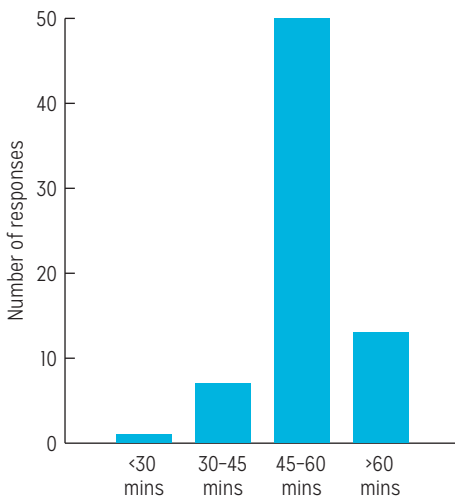


Figure 6 Optimum duration for a virtual teaching session



problems and technical difficulties during lockdown. Chilean orthopaedic trainees also identified these new issues as difficulties of online teaching¹⁴ and technical difficulties are well established in the literature as a barrier to e-learning.^{3,17}

The learners in our study reported high levels of satisfaction with the quality and relevance of the virtual teaching since lockdown. While Chilean trainees were also highly satisfied with their webinars and online presentations,¹⁴ Korean trainees had a significantly lower level of satisfaction with virtual teaching methods in this period than for traditional teaching methods.¹³

Several trainees responding to our survey commented on some aspects that

they particularly liked about the new online teaching in a free text section at the end of the questionnaire. These included the ability to view recorded webinars at a later date for consolidation of learning, the not needing to travel to other hospitals to receive teaching and teaching by specialists from other training regions broadening their experience. No negative comments were made about e-learning in the free comments section. Most markedly, nearly all respondents (96%) said that virtual teaching should continue to be part of the formal teaching programme in their region.

When asked which factors were important for a successful online teaching session, in addition to quality and relevance of the presentation, many trainees were of the opinion that duration of the presentation was important. Although there is no clear consensus in the literature on the optimum duration of webinars,¹⁸ the majority of participants in our survey felt that 45–60 minutes was the best session length. When Chilean orthopaedic trainees were asked about their preferences for online teaching, the possibility of audience participation was noted to be particularly important.¹⁴ In our survey, only 22 respondents (31%) reported that group interaction was important for a good virtual teaching session.

Our national study collected data from orthopaedic trainees across the four different training programmes in Scotland, all of

which had their own e-learning programme during the COVID-19 lockdown. This is a major strength of our study as it gives a generalisable picture of the success and acceptability of online formal teaching for orthopaedic trainees. Like many surgical specialties, trauma and orthopaedics is a highly clinically and practically orientated specialty requiring the delivery of teaching through a variety of media. We feel that the positive impact of this virtual teaching supports its ongoing role in the delivery of postgraduate orthopaedic training but instead of replacing face-to-face teaching, the two should coexist in a blended learning environment.

Blended learning has been widely adopted across higher education with the potential to enhance effectiveness, learner success and learner satisfaction.¹⁹ This modification would promote the flexibility of learning, cognitive effectiveness and learner motivation. The integration of additional e-learning in Scottish orthopaedics would also facilitate a more collaborative approach between the four regions. We have shown that the technology exists for this to occur in its simplest synchronous form. However, the development of more advanced regional e-learning materials and asynchronous access to online content will likely require financial investment in digital infrastructure such as the purchase of a shared learning management system.

Study limitations

Although the use of an online questionnaire allowed for rapid collection of data from a wide geographical area, the use of this tool has inherent limitations. For instance, not all trainees participated in the survey and it may be that those who were motivated enough to complete a web survey on teaching are also those most likely to engage with online teaching, giving our results potential selection bias. Those who did not complete survey may not have such a positive attitude to e-learning.

Furthermore, our study only examined orthopaedic teaching during the initial

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phase of the COVID-19 pandemic and lockdown. During this time, elective clinical and operative responsibilities were greatly reduced, and this has potentially had a positive influence on the availability of consultants to prepare and deliver virtual teaching. Nevertheless, we feel that the changing paradigm created by current circumstances has led to faculty acceptance and engagement in e-learning, providing momentum for a more permanent integration in the curricula.

CONCLUSIONS

Our study has demonstrated that the switch from face-to-face to online formal orthopaedic teaching during the COVID-19 pandemic in Scotland has resulted in an increased availability of formal teaching for trainees. Although there are still barriers to teaching attendance, they are different to those that prevented attendance previously. Scottish trainees have been highly satisfied with virtual teaching since the pandemic started and the vast majority of those surveyed would like to see e-learning continue to be a part of their formal teaching programme. As the COVID-19 pandemic

continues, with the possibility of further waves of infection and restrictions or lockdowns, these findings are encouraging to educators and support the development of a blended learning approach in the delivery of postgraduate education. However, work must continue to maintain this teaching, and to develop new teaching innovations for surgical trainees during the COVID-19 era and the years that follow.

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For more information about SCORE, please visit: www.scoreortho.org.

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