Evaluating the Impact of a 2-Week Peer Enhanced E-Placement (PEEP) on Pre-Registration Physiotherapy Students' Attitudes, Self-Perceived Confidence, and Competence in Delivering Telerehabilitation

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Abstract

The COVID-19 pandemic instigated rapid digital transformation of physiotherapy practice and education. We explored whether pre-registration specific teaching and practical experience of telerehabilitation may improve student confidence and competence in delivering telerehabilitation and support its clinical acceptance. A 2-week Peer Enhanced E-Placement (PEEP) was developed and evaluated to explore its impact on third year physiotherapy student attitudes, perceived competence, and confidence in delivering telerehabilitation. Students completed a questionnaire (pre and post PEEP), rating perceived confidence and competence in four areas of telerehabilitation: assessment, intervention, communication, and problem solving. Group discussions explored the impact of the PEEP on their attitudes towards telerehabilitation. Fifty-nine students completed the PEEP, 49 (mean age 25±6.6 years, 41% male) completed both the pre and post placement questionnaire. Fifty-five students participated in group discussions. Compared to pre-PEEP, the questionnaire findings demonstrated more students reported being confident and competent post -PEEP (assessment 14.2% vs 83.6%; delivering interventions 44.9% vs 96%; communication 53.1% vs 93.9%; problem solving 38.8% vs 87.8%). Group discussions identified three core themes: Prior experience and assumptions of telerehabilitation, Opportunities and barriers, and Experience of the PEEP. Participation in a 2-week PEEP positively impacted on physiotherapy student confidence and perceived competence in delivering telerehabilitation. Qualitative data suggested improved student attitudes towards telerehabilitation, with increased acceptance and recognition of its clinical value. Further research is required to understand and evaluate the effectiveness of pre-registration telerehabilitation training in preparing students for practice and supporting sustainability of telerehabilitation in the post-COVID era.

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Background

The World Health Organisation (WHO) has defined telehealth as 'the use of telecommunications and virtual technology to deliver health care outside a traditional health-care facility' (2020). Within current literature this definition is applied interchangeably with a range of terms to include telemedicine, telehealth, telerehabilitation, digital health and technology enabled care services (TECs). Specific to the field of physiotherapy, the term 'telerehabilitation' has been used in much of the literature to date and is defined as 'the delivery of rehabilitation services via information and communication technologies' (Brennan et al., 2010).

Telerehabilitation was first documented in 1959, when interactive video was first used in the delivery of mental health services (McCue et al., 2010). More recently, the global COVID-19 pandemic in 2020 acted as a catalyst for increased usage of remote methods such as telephone and video-based consultations (Buckingham et al., 2022a). Pre-pandemic, uptake of remote physiotherapy service delivery was low, with international studies suggesting that only 17%-23% of physiotherapists utilised telerehabilitation and 74% reporting that they did not use telerehabilitation pre pandemic (Bennell et al., 2021; Bezuidenhout et al., 2022; D'Souza & Rebello, 2021; Reynolds et al., 2021). COVID-19 saw a rapid digital transformation of physiotherapy services to ensure continued delivery of care where face-to-face consultations were suspended (The Chartered Society of Physiotherapy, 2020a)

Recent reviews suggest telerehabilitation to be comparable or better than conventional rehabilitation in some areas (Seron et al., 2021) and suggest acceptance from patients (Alonazi, 2021; Buabbas et al., 2022). Yet Reynolds et al. (2021) found that 40% of physiotherapists within their survey, considered telerehabilitation to be a COVID-19 temporary stop-gap. Therefore, consideration should be given to sustainability of telerehabilitation services. Wade et al. (2014) suggests that clinical acceptance and continuation of telerehabilitation poses challenges, with knowledge, environmental factors, social influences, and beliefs around telerehabilitation commonly cited as barriers to safe and effective implementation (Cottrell & Russell, 2020; Cox et al., 2021).

One way to address these identified barriers, and to potentially sustain the digital gains made during the pandemic, may be through upskilling of the future workforce through embedding specific teaching and practical experience of telerehabilitation within the pre-registration physiotherapy curriculum. However, despite historical evidence supporting the use of telehealth in practice, a scoping review by Hui et al. (2021), identified limited published reports of telehealth curricula within Allied Health Profession (AHP) programs globally. This highlights a clear gap in either relevant curricula development, or in the published literature outlining how AHP education providers are equipping pre-registration students for this growing area of practice.

The COVID-19 pandemic not only brought about rapid and significant transformation of physiotherapy services, but also to physiotherapy education, including rapid translation to remote and online learning and interruption of practice-based learning. Practice-based learning, commonly referred to as clinical placements, are a core component of pre-registration physiotherapy programmes (The Chartered Society of Physiotherapy, 2020b). Clinical placements provide students with the opportunity to apply theoretical knowledge and skills to practice settings, often with service users in clinical settings. During the COVID-19 pandemic, physiotherapy placement capacity was impacted globally due to a range of factors including periods of national lockdown, service reconfiguration and redeployment, social distancing requirements and travel limitations, requiring rapid innovation of alternative approaches to clinical placements (Dario & Simic, 2021; Paraskevopoulos & Papandreou, 2020; The Chartered Society of Physiotherapy, 2020b). The Peer Enhanced E-Placement model (PEEP) (Taylor & Salmon, 2021) was one such

model which was developed to ensure that student progression through programmes was not significantly impacted or delayed.

The need to explore alternative placement provision was the stimulus for designing and implementing a PEEP focused on developing telerehabilitation knowledge and skills. The evaluation, reported in this paper, contributes to filling the current gap in research by describing and evaluating a novel PEEP placement. It aims to stimulate discussion around pre-registration curricula development for telehealth and how this could support clinical acceptance of telerehabilitation in physiotherapy.

The Peer Enhanced E-Placement (PEEP) Telerehabilitation module

The aim of the PEEP telerehabilitation module was to deliver a quality practice-based learning experience that could be presented remotely and still enable students to meet the original placement module learning objectives, which included adherence to professional (Chartered Society of Physiotherapy (CSP)) and regulatory body (Health and Care Professions Council (HCPC)) standards of practice and professionalism (see Figure 1). In addition, the PEEP enabled a specific opportunity to develop students' confidence and competence in the use of telerehabilitation and TECs in preparation for future placements and contemporaneous physiotherapy practice.

Figure 1:

Placement Learning Outcomes

- Communicate effectively and sensitively with service users and members of the health and social care team
- Complete appropriate and effective assessments of service users' problems, identifying and recognising their physical, psychological, and cultural needs.
- Synthesise information gathered from the assessment data to prioritise problems in order to formulate an effective management programme taking into account appropriate contextual factors.
- Consistently apply problem solving and clinical reasoning skills to plan, deliver and evaluate management programmes, adopting a patient centred approach which takes into account the needs of individuals or groups.
- Critically evaluate and reflect on their examination, assessment, clinical reasoning, and patient management skills

The PEEP was delivered remotely over a period of two weeks during November 2020 using the University's Digital Learning Environment (DLE) and a combination of Microsoft Teams and Zoom technology. The student cohort was divided into eight groups of 7-8 students who worked together remotely for the course of the PEEP. Students 'attended' the placement each morning for a briefing session with the academic running the module. During this session, the placement learning objectives and activities for the day, timetable, suggested resources, and the expected daily output were made available on the DLE. The groups used this to guide their placement activity and were provided a virtual 'workspace' using breakout room options to facilitate collaborative working during the PEEP.

Week one of the PEEP focused on introducing students to telerehabilitation and TECs, exploring the relevant drivers, policy, and standards. Practical sessions supported students to adapt their face-to-face skills in preparation for remote assessment, culminating in students undertaking peer simulated telerehabilitation consultations. Week two of the PEEP moved from a focus on assessment to consider the delivery of physiotherapy interventions remotely. This included simulated one-to-one and group-

based interventions, using digital applications (APPS) to support physiotherapy practice, exploration of digital health inequalities and the current evidence base for remotely delivered physiotherapy. Week two culminated with a group debate, and structured reflection activities focused on telerehabilitation and the student's own learning and development needs around the use of technology to enhance their practice. Examples of the PEEP content and activities is provided in Figure 2.

Figure 2:

Examples of telerehabilitation content / activities included within the PEEP

Week 1	Week 2
Develop understanding of TECS, context and drivers – supported by range of online resources. Students required to develop a TECS infographic and summary of policy / drivers.	Delivering group-based interventions. Students participated in an online exercise group for older adults delivered by a local group which moved online during the pandemic. Group reflection on participation and discussion with online-group leaders. Students then designed and delivered group-based interventions for a specific population to their peers online.
Develop awareness of governance and quality issues associated with digital health – review of relevant professional body guidance, policy. Students designed a leaflet aimed at clinicians.	Delivering pain services remotely. Online live session with clinician- presentation of service delivery model and written patient case scenarios to discuss management and clinical reasoning.
Using telephone for triage activity. Pre-reading resources related to triage pathways and criteria for face-to-face versus telephone assessment, Patient case study and pre-recorded telephone triage assessment, live discussion with clinician in practice to discuss findings and process.	Delivering individual interventions. Groups delivered live physiotherapy MSK interventions to simulated patients. Immediate feedback from clinicians and group reflection. Students completed patient paperwork.
Adapting assessment skills for telerehabilitation. Pre-recorded consultations and live discussions with Musculoskeletal (MSK) Respiratory and Neurological clinicians delivering telerehabilitation. Students required to complete patient documentation, discuss findings and plan with clinicians.	Telerehabilitation in private practice and patient experience. Live discussion with Private neurological physiotherapist and two patients with experience of telerehabilitation.
Undertaking remote assessments. Students undertook group-based assessments of simulated MSK and Neurological patients. Students required to complete patient documentation, findings and patient plan. Group reflection activity with facilitator.	Using APPSs in digital health. Exploration of APPS based approaches and application to clinical practice with paper patients and clinician led discussion.
	Digital inequalities, challenges and opportunities. Lecture from CSP professional advisor. Reflective activity. Journal club.

Evaluation of the PEEP

The aim of the evaluation was to determine the impact of the 2-week PEEP on student attitudes, self-perceived confidence and competence in utilising telerehabilitation to deliver remote physiotherapy services. The objectives were to:

   i)   Identify if experience of telerehabilitation via the PEEP increased students' self-perceived confidence and competence in utilising telerehabilitation as part of physiotherapy practice.
   ii)   Explore student perceptions and attitudes towards the use and role of telerehabilitation and technology enabled care in physiotherapy practice following the PEEP.

The placement was evaluated using a pre-post Likert questionnaire and guided group discussions. The questionnaire and discussion schedule were informed by research being undertaken concurrently by our group, exploring the experiences, knowledge, and needs of practitioners relating to telerehabilitation (Buckingham et al., 2022a; Buckingham et al., 2022b; Buckingham et al., 2023).

This placement evaluation was undertaken as part of a service evaluation which involved clinicians, patients, and the potential future workforce. Governance approval was sought from all participating organisations. No breaches of the protocol occurred during the service evaluation. Ethical principles were applied throughout the evaluation process, including informed consent, anonymised responses, and student confidentiality maintained throughout.

Course evaluation questionnaire

The online, customised questionnaire was developed using JISC survey software (https://www.onlinesurveys.ac.uk/). The questionnaire was anonymous but was coded to allow for comparison of pre- and post-questionnaire responses.

The questionnaire comprised both closed and open-ended items using a blend of Likert scale and free-text questions (Appendix 1). Questions were designed to ascertain the student's pre- and post-placement self-perceived levels of confidence and competence in four key areas of remote physiotherapy delivery: assessment, delivering interventions, communicating with service users (e.g., patients and their spouse/carers), and the ability to problem-solve and clinically reason in relation to telerehabilitation. Due to the rapid implementation of the PEEP within the context of the COVID pandemic, the questionnaire was not pilot tested prior to the evaluation, and no formal reliability or validity testing was undertaken.

Quantitative questionnaire responses were analysed using descriptive statistics (SPSS vs 20), and the qualitative free-text responses were analysed thematically in line with guidance from Braun and Clarke (2021). Responses were independently analysed by two researchers before meeting to compare findings. There was high agreement on the themes identified and any minor discrepancies were resolved through discussion and consulting a third person.

Group discussions

On completion of the PEEP, students were invited to participate in eight small group discussions, undertaken via video-conferencing (Zoom) as part of a larger, ethically approved, service evaluation project (Buckingham et al., 2022a). Students were provided with textual information in advance of the discussions (Appendix 2), which clearly informed that participation was optional and how their data would be managed and anonymously reported. These guided discussions were facilitated by two postdoctoral health researchers, experienced in conducting discussion groups, and who were not known to the students nor involved in the delivery of the PEEP. A topic guide was used to facilitate the semi-structured discussions (Appendix 3). Students were informed at the beginning of the discussion that there were no wrong answers, all views were important, and the facilitators encouraged all students to participate by asking the key questions to each individual in turn.

With the students' consent, all discussion groups were recorded. This enabled the researchers to take detailed notes and identify key quotes immediately after the discussions. Thematic analysis was used to identify themes and sub-themes, following the guidance of Braun and Clarke (2021). A combination of inductive (themes arising from the data) and deductive (concepts within the topic guides) analysis was used. As per the free-text responses, two researchers independently analysed the discussion group findings before meeting to compare responses. Both researchers agreed that saturation had been reached with no new themes being identified in the later discussion groups. There was high agreement on the themes identified between researchers, and between the discussion groups and free-text questionnaire responses; minor discrepancies were resolved through discussion and consulting a third person.

Questionnaire Results

Fifty-nine 3rd year BSc (Hons) physiotherapy students completed the 2-week PEEP, of whom 49 (mean age 25±6.6 years, 41% male) completed both the pre- and post-placement evaluation questionnaire (Table 1).

Students' self-perceived confidence and competence increased in all areas assessed, i.e., remotely conducting basic physical assessments, delivering simple interventions, communicating effectively with service users, and applying problem-solving and clinical reasoning to telephone and video consultations. The largest change identified related to remote physical assessment. Pre-PEEP, only 14.2% of students felt confident in this area but post-PEEP, this increased to 83.6%, representing a 69.4% positive change in students' perceived confidence and competence in this domain. The smallest change that was seen, related to student perceived competence and confidence in communicating with patients or service users remotely, however this still saw an increase in agreement from 53.1% pre-PEEP to 93.9% post-PEEP.

Table 1:

Results of the PEEP evaluation questionnaire: Percentage of respondents according to Likert Scale Response

Questionnaire Statement	Prior to PEEP Likert Scale Response			Following PEEP Likert Scale Response		
	Agreed	Disagreed	Undecided	Agreed	Disagreed	Undecided
'I feel confident conducting basic physical assessments of service users via telephone or video-based consultation'	14.2%	47%	38.8%	83.6% (69.4% change pre-to-post*)	2% (45% change pre-to-post*)	14.3% (24.5% change pre-to-post*)
'I feel confident in delivering simple interventions (eg education, exercises) via telephone or video'	44.9%	26.5%	28.5%	96% (51.1% change pre-to-post*)	2% (24.5% change pre-to-post*)	2% (26.5% change pre-to-post*)
'I feel able to communicate effectively with service users and	53.1%	22.5%	24.5%	93.9% (40.8% change	2%	4.1%

their care givers using telephone or video-based methods'				pre-to-post*)	(20.5% change pre-to-post*)	20.4% change pre-to-post*)
'I feel confident in my ability to apply problem-solving and clinical reasoning skills to telephone or video consultations'	38.8%	36.8%	28.6%	87.8% (49% change pre-to-post*)	6.1% (30.7% change pre-to-post*)	6.1% (22.5% change pre-to-post*)

indicates a positive change in students self-perceived confidence and competence

Qualitative results and discussion

The free-text responses to the questionnaire (n=59), and findings from the eight guided discussion groups with 55 students, were reviewed. Core themes were explored in relation to confidence, competence, and attitudes towards telerehabilitation.

Three core themes emerged from the data: Prior experience and assumptions of telerehabilitation, Opportunities and barriers, and Experience of the PEEP (Table 2).

Table 2:

Themes and sub-themes identified in qualitative analysis (in relation to confidence, competence and attitudes towards telerehabilitation)

Theme	Sub-Theme
Theme 1: Prior experience and assumptions of telerehabilitation	Lack of prior experience and anxiety Limited exposure to telerehabilitation Perception of telerehabilitation as a new approach Shifting perceptions after module completion
Theme 2: Opportunities and barriers	Technological challenges Challenges in building rapport Difficulty in transferring face-to-face skills Concerns about the "deskilling" effect Recognition of the value of telerehabilitation

Theme 3: Experience of the PEEP	Mixed student experiences
	Value of simulated patients and peer learning
	Impact of the PEEP on future attitudes towards telerehabilitation
	Influence of the pandemic context and "Zoom fatigue"
	The need to encourage self-management skills through telerehabilitation
	Positive shift in attitudes towards telerehabilitation

Theme 1: Prior experience and assumptions of telerehabilitation

'No prior experience and feeling a little anxious as to how it will go.' (Participant 2)

75.5% of the students reported having had no prior experience of telerehabilitation, and this appeared to directly influence their understanding and perceptions of this approach. The lack of experience was reflected by the relatively high percentage of students who reported a lack of confidence and competence across the domains in the pre-PEEP Likert scale scores.

'Speaking to patients and carers via telephone; explaining exercises, providing advice and finding out patients baseline of patients from carers.' (Participant 44)

Six students reported having had experiences of remote consultations through either previous placement or external clinical roles (e.g., physiotherapy assistant). They reported that these experiences were predominantly telephone based and either from pre-pandemic, based in community teams communicating via telephone with staff in residential home settings, with carers of patients with cognitive impairments, or at the start of the pandemic when based in musculoskeletal outpatient settings undertaking triage or follow-up appointments. During the group discussion, some students reflected on personal experience of being a patient, reporting positive experiences of being able to access healthcare remotely. This aligns with the findings of current research exploring patients' experience of remote healthcare approaches (Buabbas et al., 2022).

Within the group discussions, some students expressed surprise about the extent of telerehabilitation in practice and presence of literature 'stretching back' over time. Again, this lack of knowledge and understanding likely reflects the cohort's limited exposure to telerehabilitation in both practice and as part of their studies. A study by Edirippulige et al. (2018) suggested a perception that undergraduate health care professionals already have adequate knowledge about e-health which may be one of the reasons why limited attention appears to have been paid to teaching e-health. Of note, they identified that in reality students had a low level of knowledge related to e-health. Undertaking this module appeared to enhance the students' confidence in their own knowledge, skills, and beliefs about telerehabilitation, particularly challenging a pre-conception from some students that telerehabilitation is a new approach developed specifically in response to COVID-19. Reynolds et al. (2021) also commented on this perception amongst practicing physiotherapists, with 40% of respondents in their study perceiving telerehabilitation to be a temporary stop-gap during the pandemic.

This theme identified how a lack of prior knowledge and exposure to telerehabilitation influenced students' low levels of perceived confidence and competence pre-PEEP. The importance of clinical exposure on student confidence has been previously identified, with exposure also identified as an important factor in competency development (Lafave & Yeo, 2019). This would suggest that the students

self-reported increase in confidence and competence post PEEP, is likely to have been directly impacted by the period of enhanced exposure to telerehabilitation.

Theme 2: Opportunities and barriers

Students perceived there to be a range of barriers associated with telerehabilitation.

'Issues with technology, especially those with poorer computer literacy.' (Participant 48)

A key barrier identified was related to the use of technology. Students perceived challenges related to internet connection and video quality, patients' digital skills, and their own confidence and competence using technology. A UK wide survey exploring digital confidence, experience, and motivation in 126 physiotherapists identified that respondents rated themselves as having moderate to high levels of confidence in the use of digital devices (Tack, 2020). For our cohort of students, given the prior transition to online learning and the proliferent use of teleconferencing software for delivery of teaching and learning, it was anticipated that they would be confident with the technological aspect of telerehabilitation. However, one student described themselves as "technologically abstinent", which may suggest a purposeful withdrawal from technology in response to the intensity of technology-based learning these students had experienced during this pandemic period.

'You do not get the same rapport building as in person.' (Participant 45)

Students perceived the online nature of telerehabilitation as a barrier to building rapport with service users and that communication would be more challenging than in person. For example, students were concerned that it would be more difficult to establish whether service users had fully understood what they had said, to notice non-verbal cues via video conferencing, or to understand different accents over the telephone. Challenges in communicating with individuals with hearing or visual impairments was also highlighted as a potential barrier.

'Unable to be hands on e.g., to assess how joints feel. Challenging to explain how to do exercises correctly.' (Participant 24)

Students particularly expressed concern about their ability to transfer specific 'face-to-face' skills to suit remote delivery. They perceived the inability to give and receive physical feedback and to undertake objective assessments, particularly related to specific tests that traditionally would require hands-on the patient, as a barrier. There appeared to be a strong pre-conception that remote delivery "just wouldn't work" and that physiotherapy must be delivered face-to-face to be effective. This perception is not unique to students. A study by Malliaras et al. (2021) exploring AHPs' views of telehealth conducted during the pandemic, found many perceived that a lack of physical contact hampered accurate and effective diagnosis. Many clinicians also expressed the view that patients expect them to provide "hands-on" care (Malliaras et al., 2021).

'I'd still like to see patients face-to-face but understand that the patient may have a preference for remote consultations and it's what the patient wants that is important, unless there is a clinical need to see a patient face-to-face of course.' (Participant 18)

Post PEEP module, there appeared to be a shift in this belief, with students generally expressing a recognition of the value, advantages and opportunities offered by telerehabilitation particularly in relation to patient choice. There was recognition that telerehabilitation might be preferable to face-to-face for some service users and circumstances, whilst recognising that some patients, situations, and interventions will always require in-person delivery. This enhanced awareness and recognition of the potential benefits

and when to offer telerehabilitation to patients, is a likely contributing factor to the increase seen in students' confidence in clinical reasoning and problem solving relating to telerehabilitation delivery.

Theme 3: Experience of the 'PEEP'

'TECs has its place and should be included in the undergraduate programme, however it should not be a replacement for [face-to-face] placement.' (Participant 12)

Student experience of the PEEP model was mixed. The PEEP was delivered as a replacement for a traditional face-to-face placement due to COVID placement capacity issues. As a result of this, many students felt they were "missing out" on a traditional placement experience. This may have influenced students' initial attitudes towards both the PEEP and telerehabilitation. However, whilst some students reported post-module that they did not feel the PEEP was reflective of a placement, many said the PEEP was highly valuable in preparing them for future placements / practice.

'More 'live' patient scenarios. Real patients would have been nice.' (Participant 9)

Students described strengths of the PEEP as the simulated patients and the peer learning aspect of the module. Due to time and financial limitations, the simulated patients were local physiotherapists and physiotherapy students from another UK University. Students were unaware that these were simulated patients thus enhancing the fidelity of the experience. Simulation has previously been shown to be effective in supporting the development of clinical skills in physiotherapy students (Mori et al., 2015; Sandoval-Cuellar et al., 2021), as has the value of peer simulation and the role of students in 'role playing' patients (Pritchard et al., 2016, 2020). Together, these experiences support the value of simulation as part of university or clinical based placements related to telerehabilitation within future physiotherapy curricula.

'I would be worried about what my future holds as a physio as I don't want to be sat at a computer all day but I do see its benefits in practice' (Participant 41)

Some students questioned whether they would want to be a physiotherapist if a telerehabilitation approach is "all they were going to do". This highlights a potential misconception by students that telerehabilitation is an 'all or nothing approach' rather than an adjunct to face-to-face service delivery. This is a potential limitation of exposing students to telerehabilitation using the PEEP model, where the delivery was fully online within a university context rather than if they had gained exposure in a clinical placement context.

However, it is important to consider that this trepidation or anxiety related to their future may in part have reflected the context of a global pandemic which was associated with significant societal uncertainty and change (Office for National Statistics, 2020; Xiong et al., 2020). Moreover, it is possible that the remotely delivered nature of this PEEP module reinforced the disparity between their current 'pandemic experience' and a 'normal' clinical placement where they engage with practice educators, service users, peers, and wide-ranging members of the multidisciplinary team. This may have influenced their attitudes and views of telerehabilitation.

'It was difficult to maintain focus and quality of work when you are mentally drained from 9am to 5pm of Zoom calls.' (Participant 43)

It is also important to consider the impact of 'Zoom-Fatigue' – the phenomenon of feeling exhausted and tired attributed to videoconferences or synchronous virtual meetings (Oducado et al., 2021). Both within the questionnaire and group discussions, students reflected on the intensive *'Zoom-heavy'* structure of the PEEP and the impact this had on them physically and mentally. Although the structure and delivery of the module may not accurately reflect the use of telerehabilitation in practice, their experiences may have influenced their feelings about future use of telerehabilitation. Anecdotal reports of physiotherapists in practice also support the fatigue associated with telerehabilitation. Bailenson (2021) proposes non-verbal

overload as a potential cause for this, related to increased and prolonged eye contact leading to physiological arousal and an increased cognitive load because of the effort required to read and deliver non-verbal cues remotely.

'I do think to take away from the core principles of physiotherapy as a hands-on service is a shame.' (Participant 45)

Additionally, within the group discussion, some students expressed concerns that an increase in telerehabilitation would result in *'deskilling'* if they did not use face-to-face skills enough in practice. This appeared to suggest that the students associate skilled physiotherapists as those regularly using skills which need to be delivered in person, for example manual techniques. These concerns contrast with the increasing shift towards the role of the physiotherapist in promoting self-management through 'non-hands on' interventions (e.g., change of lifestyle, education) (Rabey et al., 2017). This highlights a need for physiotherapy educators to encourage students to consider how these self-management skills may be facilitated through telerehabilitation. One student, Participant 48, specifically reflected that telerehabilitation "might empower the patient to take more control of their condition."

'I am sure TEC's will become a part of our future practice so having been able to experience this and already gain some skills is really valuable.' (Participant 45)

Whilst there was still some reticence amongst students about the use of telerehabilitation, most students reflected positively on the potential inclusion of telerehabilitation in their future practice.

'I feel like I have gained a strong insight into technology enabled care and feel confident with undertaking treatments and assessments in this way.' (Participant 42)

Many discussed their increased confidence because of the PEEP experience, which reflected the shift in pre- to post module scores on the Likert survey. Although being a relatively short (2 week) module, students fed back positively about the opportunity for an intensive period of focused learning in an area relevant to their future practice. In contrast, Cox et al. (2021) undertook a 6-week intervention to support telerehabilitation implementation, which comprised of similar elements to our PEEP, found little change in attitudes and perceived barriers pre to post intervention. It is possible that the different intensity of our PEEP intervention (75 hours over two weeks) to that reported by Cox et al. (one hour per week for 6 weeks) may account for this disparity in results. Another factor may be that our student cohort comprised of students who were yet to experience telerehabilitation in practice, which may have made them more amenable to change.

Negative feelings of the PEEP replacing traditional placement activity appeared to be outweighed by the perceived benefits of the training. Timing of the PEEP during their final year and focused training on a growing area of practice, may have increased student feelings of preparedness for practice. Awareness gained during the module that qualified clinicians also have limited experience or training in this area, may have influenced their own perceived confidence and competence post PEEP.

Strengths, limitations and recommendations for future telerehabilitation training.

To our knowledge, this is the first evaluation of a PEEP to support the development of pre-registration physiotherapy student's competence and confidence in delivering telerehabilitation.

Due to the context of the COVID-19 pandemic and the imminent pressures of placement capacity, this PEEP was rapidly developed and implemented. As result, the content of the PEEP was developed and informed based on rapidly available knowledge and resources at that time. Subsequent telerehabilitation educational or training interventions would benefit from mapping training to a core competency

framework (Anil et al., 2023) such as the framework developed by Davies et al., specifically for Physiotherapists undertaking videoconferencing and telephone based care (Davies et al., 2021, 2022).

Using the pre-post Likert scale to evaluate change does pose a limitation of this study, with potential self-reporting bias. The use of the group discussions alongside the Likert evaluation, provided opportunity to explore the reported changes in more detail, however subsequent iterations and training should consider inclusion of a validated outcome measure.

Based on the student evaluation, strengths of the PEEP included the opportunity to work with peers and the direct interaction with clinicians and the simulated patients. Students consistently fed back that they would have liked increased patient contact during the PEEP. Although there was time for reflection on their practice, there was not enough time or sufficient patient opportunities to put lessons learnt back into practice.

The length of the PEEP provided both opportunities and challenges for this study. Two-weeks (75 hours) proved to be labour intensive to deliver and due to the online nature, led to a degree of 'Zoom' fatigue. The full-time delivery with a focus purely on remote consultations during a period when students would have usually been in face-to-face practice, may also have negatively impacted their experience of telerehabilitation and understanding of its role as an adjunct to 'routine' practice. This however was unavoidable because of the COVID-19 pandemic restrictions. Further research is required to better understand the ideal length and mode of delivery for future telerehabilitation training packages.

Conclusions

The use of telerehabilitation in physiotherapy service delivery grew exponentially during the COVID-19 pandemic. As this approach becomes more integrated within service delivery, physiotherapy students and graduates will need to be appropriately prepared for this mode of delivery.

Physiotherapy students within this cohort lacked significant prior experience of remote consultations and did not feel confident or competent in this mode of service delivery. Despite limited experience, many students had strong pre-conceived ideas about remote service delivery, holding 'anti-TECs' views about its potential role, viewing it as a limited and poor substitute for face-to-face delivery, and being used purely as a response to the pandemic.

Following an intensive 2-week PEEP, students' self-perceived confidence and competence in remote assessment, intervention, communication and problem-solving improved. Group discussions and free text questionnaire responses highlighted that despite trepidation about the future of physiotherapy practice, many felt positive and were able to see the potential role and benefit of telerehabilitation as an adjunct to physiotherapy service delivery.

The change seen in students' attitudes and understanding of the potential value of telerehabilitation following a relatively short training intervention, suggest inclusion of telerehabilitation training within Physiotherapy curriculum could have positive implications for integration of telerehabilitation into practice. However, training for pre-registration students alone is unlikely to see sustained or meaningful change in telerehabilitation services imminently. Literature would suggest that training at post-graduate level may also be required to upskill qualified clinicians for remote physiotherapy delivery. Additionally, training may be required at service manager level to influence physiotherapy delivery models to enhance patient care and access to telerehabilitation services where appropriate.

Our evaluation highlights areas for future research, including scoping work to identify current undergraduate physiotherapy student exposure to telerehabilitation approaches within pre-registration programmes – both on placement and within the taught curriculum. It also highlights the scope for further work to design and evaluate a range of resources to support students to develop and practice skills associated with telerehabilitation. Finally, it underlines the need for a better understanding of student and clinician attitudes towards remote physiotherapy service delivery and how this might impact on the profession moving forward.

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Appendix 1 - Pre and Post-PEEP evaluation questionnaire

Part a – Pre-PEEP

Please enter your age in years:

Gender - please choose only one of the following: Male / Female / Other / Prefer not to say

Have you completed a practice placement during the COVID pandemic (i.e., during or after March 2020)? Yes, in person (e.g., in a hospital setting / Yes, virtual (from home) / No

If yes, did you use telephone or video (online) consultations with patients or service users during this placement? Yes, telephone only / Yes, video consultations only / Yes, both telephone and video consultations / No

Please rate your experience of delivering telephone and/or video consultations with patients/service users and their formal or informal caregivers: No experience / Little experience / Some experience / Good experience/ Extensive experience

Please describe your experience of delivering telephone and/or video consultations (e.g., which settings you have worked in, what your role was): (free text response)

Please rate the following statements:

I feel confident in conducting basic physical assessments of patients/service users via telephone or video-based consultations: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

I feel confident in delivering simple interventions (e.g. education, exercises) via telephone or video: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

I feel able to communicate effectively with patients/service users and their caregivers using telephone or video-based methods: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

I feel confident in my ability to apply my problem-solving and clinical reasoning skills to telephone or video consultations: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

What are the main challenges you have encountered (or expect to encounter) in telephone and/or video consultations with patients or service users? (free text response)

What are your main learning objectives for this module? (i.e., what you hope to take away from it) (free text response)

Part b – Post-PEEP

Please rate the following statements:

I feel confident in conducting basic physical assessments of patients/service users via telephone or video-based consultations: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

I feel confident in delivering simple interventions (e.g. education, exercises) via telephone or video: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

I feel able to communicate effectively with patients/service users and their caregivers using telephone or video-based methods: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

I feel confident in my ability to apply my problem-solving and clinical reasoning skills to telephone or video consultations: Strongly agree / Agree / Undecided / Disagree / Strongly disagree

Did the module meet your expectations? Yes / No / to some extent
Please explain why the module did not meet your expectations: (free text response)

Did the module meet your learning objectives? Yes / No / to some extent
Please explain why the module did not meet your learning objectives: (free text response)

Are there any aspects of Technology Enabled Care that you would like more information or training on? Yes / No
If yes, what would you like more information or training on? (free text response)

How will you apply what you have learned to your future work with patients/service users? (free text response)

Do you have any further comments or thoughts about Technology Enabled Care? (free text response)

Any further comments about this module: (free text responses)

Appendix 2 – Discussion groups information provided to students

We would like to talk to you about your experience of telerehabilitation, exploring what you have learnt during this module and how you think you can make best use of this learning in your future careers.

To do this, we will be running a series of focus groups led by a postdoctoral researcher who is currently working on a project exploring telerehabilitation at the University. As well as the researcher asking you questions and guiding a discussion of telerehabilitation, you will also have the opportunity to ask them any questions you might have about the project or working as a researcher.

These focus groups are an <u>optional</u> part of the course but are a useful way to engage in reflexive thought about your preconceptions of telerehabilitation, how they may have changed given your learning during the module, and how you might adapt your practice to reflect your learning. The data from the focus groups will also be used to inform the development of a practical toolkit that will help practitioners adapt to using remote technology, so this is an opportunity for your thoughts and experience to help shape future practice. Any data that is used from the focus groups will be used anonymously. It is also important to remember that anything that is said during the focus groups is confidential and must not be shared outside of the focus group, particularly if anything is of a sensitive nature. Focus group sessions will be recorded so that the researchers can take field notes immediately after the group, but the recordings will not be stored beyond the day they are recorded.

If you have any questions about the focus groups (either before or after) or are concerned about anything, please get in touch with the module lead or the researchers working on this project.

Appendix 3 – Discussion groups topic guide

1. **Introduction – introduce ourselves and the study, check that everyone consents to recording of the session.**
2. **Ask the students to introduce themselves and say what their experience of telerehabilitation has been.**
3. Is telerehabilitation new to you? Or has been on-going throughout your undergraduate education?
4. How much clinical experience have you had with telerehabilitation?
5. How do you think telerehabilitation compares to face-to-face?
6. What do you think are the positives and negatives of telerehabilitation?
7. **What are your learning needs? Key points from the module?**
8. **What have you learnt that you would use in clinical experience? Any knowledge gaps still?**
9. What type of training do you prefer? E-learning? Face-to-face?
10. **What did you learn?**
11. **What's the most important thing you have learnt over the last couple of weeks? What have you taken away from the module?**
12. Have you faced any challenges with patients via telerehabilitation? If not, can you think of any?
13. Have you got any questions you'd like to ask? Telerehabilitation or research more generally.
14. Safety concerns? Governance/safety issues.

Key questions are in **bold**