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"Less paperwork and more practical approaches": An exploration of stakeholder opinions and priorities for UK postgraduate medical ultrasound education

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ABSTRACT

Introduction: Training in medical ultrasound must adapt to the evolving needs of the healthcare landscape. This study aimed to gain a comprehensive understanding of stakeholders' current opinions and priorities for UK postgraduate medical ultrasound education.
Methods: A UK-wide, online, anonymous survey was open to responses between 7th June and 15th July 2024. To ensure participant convenience, the survey questions were mainly designed as closed or priority ranking questions. Additionally, participants were given the opportunity to elaborate on their answers through free-text response options. Responses to closed questions were analysed using descriptive statistics and integrated within coding clusters generated through qualitative content analysis of free-text responses.
Results: 89 valid responses were received, with an overall average completion rate of 64 %. The largest group of respondents were sonographers (n = 48), from a radiography background (n = 30). Most respondents held a CASE-accredited qualification in medical ultrasound (n = 66). Five coding clusters were developed during data analysis: 1) Teaching and academic assessment; 2) Clinical competency; 3) Educational content, delivery, and faculty structure; 4) Stakeholder development and, 5) Student experience. Key stakeholder priorities included high-quality teaching and standardised assessment processes, maintaining good working relationships between faculty and practice educators, and increased opportunities for professional development to support student learning and personal career advancement.
Conclusion: Although traditional lectures are regarded as core, increased integration of practical approaches, enabled by digital technology is needed to develop critical reasoning and real-world competency. Co-development of curricula with key stakeholders is essential to ensure relevance and suitability of course content and delivery.
Implications for practice: This study highlights important considerations for medical ultrasound education providers to support positive learning experiences for trainee sonographers whilst facilitating professional development opportunities for practice educators.

Introduction

In the United Kingdom (UK), most medical ultrasound training is provided at the postgraduate level within higher education institutions (HEIs).[1,2] Programmes of study are typically competency-based, whereby practical training and competency assessments are integrated within theoretical modules,[3] with students usually completing a Postgraduate Certificate (PGCert), Postgraduate Diploma (PgDip), or a Masters of Science (MSc) in Medical Ultrasound. A tripartite approach is commonly adopted, where an academic institution and clinical department work collaboratively to support trainees whilst navigating the theoretical and practical components required to become a competent practitioner.[3] Effective training in medical ultrasound must be responsive to the

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changing needs of the healthcare landscape, and educational programmes are increasingly adopting blended-learning and hybrid-delivery models,[4,5] simulation-based training,[6] and electronic portfolios[7] to enhance quality, student engagement, accessibility, and standardisation of competency tracking and assessment. However, exactly what constitutes effective training has been difficult to define.[8] Furthermore, UK-based ultrasound training often differs from other countries as reporting competency is also a requirement of UK ultrasound practice.[3]

The Consortium for the Accreditation of Sonographic Education provides clear standards for UK training.[9] These are based on other standards of proficiency in Radiography (e.g., Health and Care Professions Council) and National Occupational Standards, and outline key considerations for medical ultrasound training programmes including core skills, clinical education, science and technology, and professional issues. Although these standards provide fundamental guidance for educators to develop new programmes of study, the extent to which key stakeholders, including clinical partners and students, have contributed to their development is unclear. In addition, current literature related to ultrasound education is largely focused on undergraduate medical students,[10] and research specific to postgraduate education for trainee sonographers and ultrasound practitioners is limited in comparison.

With increasing demand for ultrasound services, and shortages within the sonographic workforce currently estimated at 10–13 %,[1,11] strategies to support sustainability have seen the introduction of undergraduate and direct-entry ultrasound training programmes.[3] However, there is potential for tension in the tripartite relationship if clinical departments desire educational programmes to prioritise technical skills above other components of medical ultrasound training as a means of fast-tracking new staff. Additionally, the provision of healthcare education (especially medical ultrasound) is expensive, and not easily profitable. Indeed, increasing financial pressures within HEIs are seeing the on-going closure of many healthcare courses and subsequent redundancies of academic staff,[12] raising concerns over future shortages and provision of new healthcare professionals.[13] Although no citeable sources exist relating to UK postgraduate medical ultrasound, several training programmes are known to have been suspended in the last 3 years. Gaining a comprehensive understanding of stakeholder perspectives and priorities for training is therefore essential when developing an effective and relevant training programme,[14] to ensure that the taught curriculum aligns with the evolving needs of the sonographic workforce and its service users, and offers inclusive, supportive, and positive learning experiences for trainees to fully prepare them for skilled and competent practice, all whilst navigating the financial constraints of HEIs.

Whilst previous research has explored European trends in ultrasound education,[15] UK-specific studies exploring stakeholder requirements for curriculum development are limited. This study sought to generate empirical data from a range of UK-stakeholders, including prospective trainees, alumni, clinical partners, and academics to help shape curriculum content, teaching, learning, and assessment methods for ultrasound education. Application of findings can be used alongside CASE standards[9] to provide stakeholder input into course design and ensure it meets pedagogic and clinical requirements for the development of safe, effective, ultrasound practitioners.

Methods

Reporting was guided by the CHERRIES checklist.[16] A cross-sectional, open survey was chosen for data collection to enable wide-reach and rapid acquisition of responses. An online, anonymous survey was created, hosted via the secure Qualtrics™ platform.

The survey was divided into four sections: 1) stakeholder roles and qualifications; 2) market insight; 3) opinions and priorities for medical ultrasound education, and 4) respondent characteristics (e.g., geographical location, years of experience, primary place of work). No identifying data were collected. As this survey was jointly conducted for the purposes of informing a new educational programme at City St George's, University of London, responses to some institutional-specific questions asked in section two are not reported.

For convenience in completion, survey questions were mainly closed (e.g., multiple choice, priority ranking), with free-text options for respondents to elaborate on their answers. Survey questions were developed by all authors (expert clinical educators with prior experience in conducting and publishing medical ultrasound research) to ensure relevance to the study aim. Before applying for ethical approval, piloting to evaluate survey accessibility and content validity was undertaken by two volunteers, invited by the research team because of their experience in ultrasound education and online surveys. Minor changes were made to the display logic to enable greater choice in the closed questions to more accurately capture the diversity within stakeholder roles. A snowball sampling strategy was initiated by posting an invitation to complete the survey on social media platforms (e.g., Twitter, LinkedIn) and via email to known stakeholders previously associated with the medical ultrasound programme at City St George's, University of London. Based on previous online surveys of UK sonographers,[17,18] a maximum sample size target of 250 responses was proposed for this survey. This figure included additional capacity for responses from prospective students, academics, industry professionals, and other ultrasound practitioners.

Respondents provided electronic informed consent prior to accessing the survey.[19] Any UK stakeholder (e.g., sonographers/ultrasound practitioners, alumni, prospective students, industry partners, ultrasound academics) was eligible to complete the survey, which was live between 7th June-15th July 2024. Additional advertisements calling for respondents were posted to social media after 2.5 and four weeks of the survey going live. No restrictions were placed on survey completion time, and respondents were given the option to pause and return to an incomplete survey within two weeks (although they were advised to complete it in one session).

Data analysis

Data were downloaded from Qualtrics™ for analysis using Microsoft Excel (version 2008, Microsoft Corporation, USA). Descriptive statistics (e.g., response frequencies) were calculated from closed questions. Free-text responses were imported into NVivo (version 14, QSR International) for qualitative content analysis by ES. An inductive approach was utilised, during which initial codes were generated from the free-text responses, codes were organised into themes, and then themes were further grouped to create coding clusters. These were checked for relevance against the original dataset.[20] Descriptive results from closed questions were integrated into coding clusters to provide deeper insight into respondents' answers. To support trustworthiness of the analysis, provisional findings were reviewed and agreed by the research team, prior to being finalised in the manuscript. Critical analysis of the survey findings is facilitated by the presentation of a combined results and discussion section, in keeping with the exploratory design.[21]

Ethical considerations

Ethical approval was received by the School of Health and Medical Sciences Research Ethics Committee at City St George's, University of London (REF: ETH2324-2107, date: 6th June 2024).

Qualtrics™ ensures respondent anonymity by hiding internet provider addresses. Respondents were informed as part of the informed consent process that as all questionnaire data were anonymous at the point of collection, it was not possible to withdraw their answers once submitted. All respondents gave consent for direct quotations to be used during dissemination. No incentives were offered to respondents on completion of the survey. None of the survey questions were anticipated to cause distress to respondents, however, contact details for the research team were provided in the participant information sheet and embedded into Qualtrics™ in the event that any participant wished to speak to a researcher.

Results and discussion

In total, 89 valid survey responses were received (n = 6 responses received from participants outside of the UK were excluded), with an average completion rate of 64.4 %. Not all respondents answered every question, therefore the frequencies reported are variable.

Respondent characteristics

Most respondents (n = 48, 54.5 %) identified as sonographers or ultrasound practitioners, predominantly from a radiography background (n = 30, 78.9 %) (Table 1). Almost all held an ultrasound qualification (n = 75, 86.2 %), most of which were CASE-accredited (n = 66, 88.0 %). Most reported that they were working in an NHS Trust (n = 37, 92.5 %), and nearly half (n = 18, 45.0 %) were located in London.

Survey findings are presented according to the five coding clusters developed from the qualitative content analysis (Table 2).

Teaching and academic assessment

Across the three core module types typically offered within a postgraduate medical ultrasound programme (physics, professional practice, clinical), respondents consistently rated lectures as the most effective method of teaching (Fig. 1).

Respondents felt that lectures offered students the best opportunity to learn medical ultrasound theory through discussion and understanding in the classroom setting, before consolidating acquired knowledge in practical scenarios:

> *"Students need help to understand theoretical principles, and this needs to be supplemented with practical work to apply these principles to their clinical practice."*
>
> [P88, Ultrasound Educator]

This preference may stem from a familiarity within educational institutions of traditional pedagogical models which emphasise structured delivery of content by subject matter experts.[22] Lectures can be useful for teaching complex theory to a large group of learners; this is easily achieved on-campus, but less feasible in clinical departments. Therefore, this preference could also reflect the alternative teaching approaches which are practiced off-campus. However, the didactic lecture is often questioned in educational literature for its efficacy compared to more active learning strategies;[23] passivity of the traditional lecture is associated with lower knowledge retention and learner engagement compared to more interactive approaches such as problem-based learning or simulation-based training.[6] Indeed, principles of constructive alignment (i.e., supporting learning through appropriately designed activities that are relevant to the learning outcome) favour approaches such as flipped classrooms, case-based discussion, live demonstration,

Table 1
Survey respondent characteristics.

Respondent characteristic	Frequency of responses
Role (n = 88)	Sonographer/ultrasound practitioner = 48
	Ultrasound educator/researcher = 13
	Ultrasound manager = 10
	Supervisor to a current ultrasound trainee = 8
	Prospective ultrasound trainee = 8
	Current ultrasound trainee = 1
Disciplinary background (n = 38)	Radiography = 30
	Nursing and midwifery = 4
	Biomedical and health sciences = 4
Ultrasound qualification (n = 87)	Yes = 75 (CASE accredited = 66)
	No = 12
Post-qualification clinical experience (n = 38)	0–5 years = 5
	6–10 years = 8
	11–15 years = 4
	16–20 years = 8
	21–25 years = 7
	25+ years = 6
Place of work (n = 40)	NHS Trust = 37
	Private practice = 2
	Higher education institution = 1
Geographical location (n = 40)	London = 18
	South East = 11
	East of England = 6
	South West = 3
	North East = 1
	Northern Ireland = 1

Table 2
Final coding clusters and illustrative quotations.

Cluster	Description	Coded themes	Illustrative quotation	Frequency of reference
Teaching and academic assessment	Conventional approaches in lecturing and examinations were consistently reported as most effective for teaching and assessment	Traditional lectures are good for teaching theory	*"Lectures are essential to ensure that students are receiving the most up to date information within the areas of practice from experts in the field"*	47
		Examinations for assessment of theoretical knowledge	*"A combination of OSE and written exam feels like it would fully satisfy the department's requirement that the student can factually recall essential information and not rely on others to help produce an assignment"*	42
Clinical competency	Externally moderated practical assessments and e-portfolios were preferred for evaluating students' clinical competency	Electronic portfolios have improved accessibility and are more efficient	*"Let's all adopt the paperless environment. It will be easier to have all digitally than having to scan lots of papers"*	31
		Assessments in clinical departments are more authentic	*"Since the hospital department is where the students learn most of their clinical skills, it will be best for them to be assessed there, in the clinical environment they're used to, using the departmental protocols and patient cohorts they've learnt with"*	29
Educational content, delivery, and faculty structure	In-person teaching by substantive staff is essential for maintaining standards of teaching quality and providing a supportive student experience	Substantive staff are essential for consistency and student support	*"Guest lecturers bring interesting perspectives; however, substantive staff help to build a confident environment where you are happy to ask questions and build relationships"*	33
		The importance of in-person teaching	*"… the face-to-face aspect of learning is very undervalued. The peer support, interaction, and ability to share ideas is lost remotely"*	25
		Contemporary issues in clinical practice	*"Advanced and consultant practice"* *"An insight into what it's like to be a patient"* *"Sustainability and environment"* *"Health inequalities"* *"Clinical governance"*	18
Stakeholder development	Respondents identified key priorities for personal and professional development	Support to support students	*"Mentor training, guidance on students' difficulties or learning issues"*	33
		Personal development needs	*"Short courses and CPD opportunities for sonographers"*	28
		Professional development needs	*"It would be good for some clinical supervisors to be invited to lecture and be part of the formative or summative external moderators for the university"*	21
Student experience	Respondents highlighted issues that may be detrimental for the postgraduate medical ultrasound student's learning experience	Individual challenges	*"Time management with academic work and practical learning balancing with family life"*	33
		Training challenges	*"Assumptions of dedicated training within host organisations. Busy lists and staff shortages mean that promises surrounding training are often not kept"*	19
		Academic challenges	*"Struggle with academic requirements, some which may not be relevant to practice"*	9

and practical workshops, to better match the practical nature of medical ultrasound and optimise achievement of learning outcomes.[5,24]

Interestingly, practical workshops in the university setting were not rated highly as an effective method of teaching. Despite this, more than half of respondents (52.38 %, n = 22) felt it was still

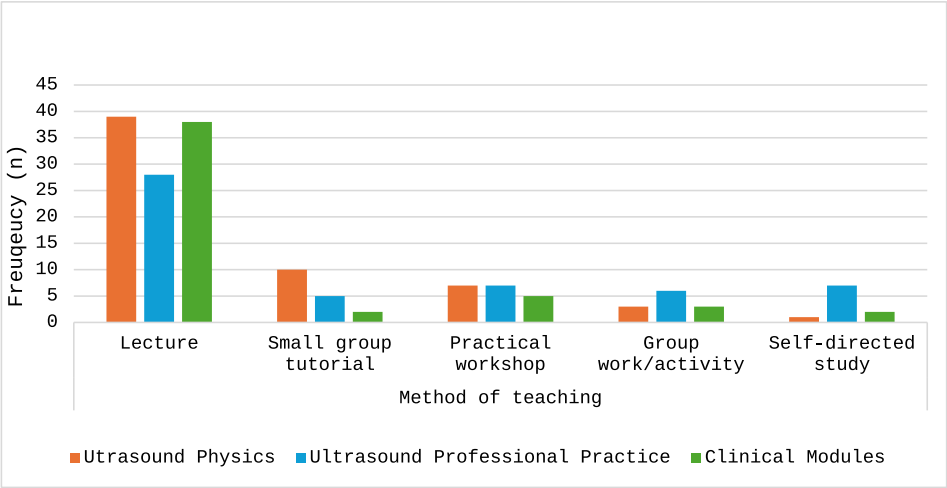

Figure 1. Most effective method of teaching by module type (n = 60).

important to offer practical skills training throughout ultrasound programmes, compared to within the initial 1–3months (39.10 %, n = 16), or 4–6months (7.14 %, n = 3) of training.

Respondent opinions of effective academic assessment methods across the three core module types favoured formal examinations (e.g., objective structured (n = 45) and written (n = 29)) in comparison to coursework or oral assessments (Fig. 2).

Oral viva examinations were consistently rated as the least effective method of academic assessment (n = 8), regardless of module type, reflecting a preference towards objective and standardised methods that can facilitate reliable and consistent evaluation of theoretical knowledge.[25] However, this finding was in contrast to free-text responses which highlighted the benefits of a viva for a more personalised student examination:

> *"A viva would enable the examiners to have a deeper understanding of the students' knowledge, clinical application, and the ability to critically evaluate ultrasound findings."*
>
> [P19, Supervisor]

Clinical competency

Of those who answered the question (n = 42), most (66.6 %) reported their preferred format for assessing clinical competency was for all assessments (formative and summative) to be undertaken in the student's clinical department, with external moderation provided by the University for quality and standardisation:

> *"There can be bias in the department with sonographers lacking in confidence, or not wishing to give negative feedback to students."*
>
> [P18, Supervisor]

The complexity of clinical cases can be highly variable, which may impact both the student experience and subsequent assessment outcome; respondents stressed the importance of external moderation to support equitable and standardised processes. However, external moderation may not provide the solution for fair assessment, as discrepancies may arise due to differences in assessors' expectations and interpretation of competency.[26] Furthermore, external moderators often have little prior

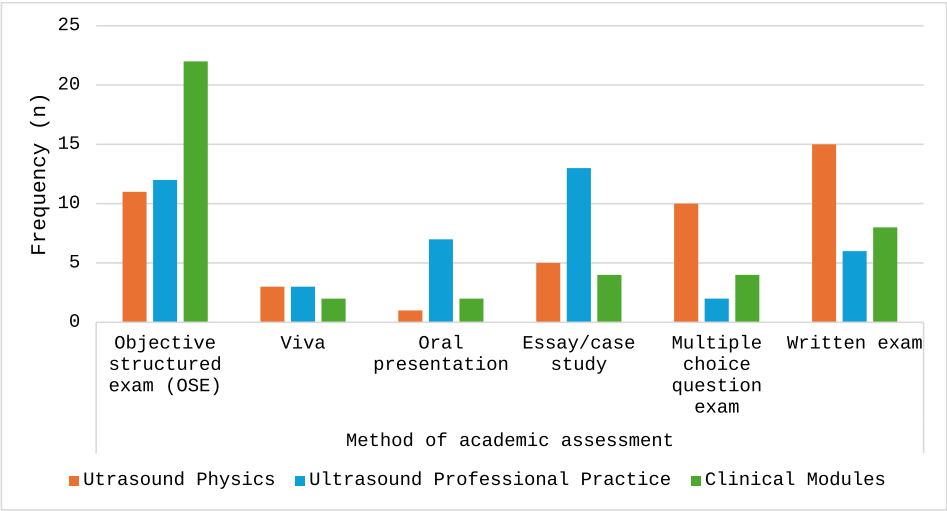

Figure 2. Most effective method of academic assessment by module type (n = 45).

knowledge or experience of a student's overall competency, therefore a single observation of practice as a summative assessment may not provide an accurate reflection of the student's ability.[27] Competency assessments can be further hindered by subjective biases due to close working relationships, and departmental pressures to increase qualified staff numbers, both of which can enable a culture of "failing to fail" whereby underperforming students may still receive a passing grade.[28] To enhance the standard of clinical competency assessments, other considerations such as structured assessment rubrics,[29] multisource feedback mechanisms,[30] and training workshops for practice educators[31] may help to complement external moderation and ensure that assessment criteria are robust, clearly understood, and fairly applied across diverse clinical settings.[26]

With regards to clinical portfolios to capture students' progress and development, respondents highlighted their preference for a completely digital format/e-portfolio (n = 28), citing benefits for accessibility, efficiency, and sustainability compared to an electronic submission of scanned documents (n = 10), or hard-copy submission (n = 4):

"Less paperwork and more practical approaches."

[P71, Sonographer/Ultrasound practitioner]

E-portfolios are now commonplace within health education, with literature suggesting they may promote self-directed learning, reflective practice, and enhanced faculty-student engagement.[32] Yet, they are not without their limitations. Firstly, e-portfolios assume a certain level of digital literacy, and that the user has access to a suitable electronic device to use the portfolio.[33] Secondly, they require careful design to facilitate meaningful learning experiences, and avoid becoming a time-consuming, record-keeping exercise.[33] To support this, clear guidance related to the learning outcomes, required content, and assessment criteria should be developed.[34] Robust training for faculty, students, and clinical practice educators should also be offered to ensure successful implementation.[35]

Educational content, delivery, and faculty structure

'Communication and person-centred care' was highlighted as the most relevant contemporary issue for inclusion in the curriculum, receiving the highest priority ranking from 25 respondents (Fig. 3). This was followed by 'medico-legal aspects', 'ergonomics' and 'protocol development'. Research supports the integration of communication skills training into healthcare curricula, with structured training programmes resulting in measurable improvements for patient satisfaction and mitigating clinician burnout.[36] Despite this, communication skills are often overlooked in favour of technical mastery. Indeed, of the 41 CASE learning outcomes required to reach standards of proficiency in medical ultrasound at Level 7, only one is directly related to communication.[9] This suggests there is still a tendency for educators to design teaching around biomedical models of healthcare, which can be inadvertently reductionist of the patient perspective,[37] although, it should be acknowledged that the CASE standards also include links to mapped HCPC and National Occupational Standards which include extensive reference to communication skills.

The lowest rated issues were 'research skills', 'leadership and management', and 'AI and technological advances' (Fig. 3). This is interesting considering the growing role of AI in ultrasound with applications such as thyroid lesion detection, anaesthetic guidance, and fetal imaging.[38] Furthermore, updates to HCPC standards of proficiency for diagnostic radiographers (of which it is estimated 73 % sonographers are primarily registered)[39] require leadership skills from the outset and now require that all registrants must "demonstrate awareness of the principles of AI and deep learning technology, and its application to practice."[40] Whilst AI-driven technologies have the potential to improve workflow efficiency, enhance diagnostic accuracy, and provide clinical decision support within ultrasound,[41] it should be acknowledged that they are still in their early stages in comparison to more traditional imaging and diagnostic techniques,[42] and perhaps it may be premature to integrate extensive AI training into medical

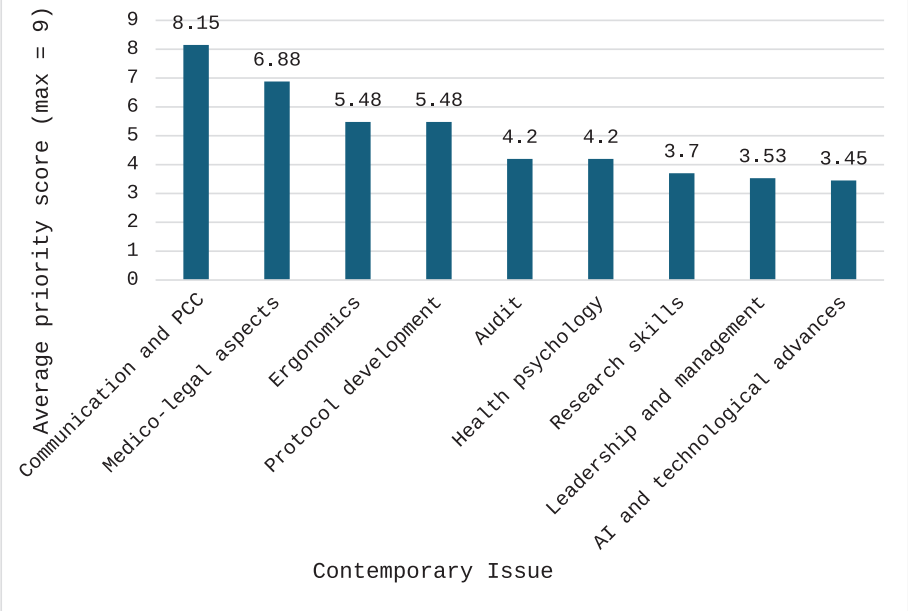

Figure 3. Most relevant contemporary issue in clinical practice (n = 42).

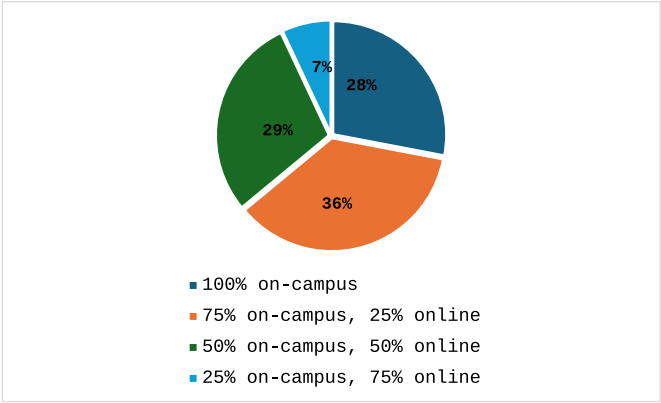

Figure 4. Preferred ratio between in-person/on-campus and online delivery of teaching (n = 42).

ultrasound education at the expense of clinical skills. However, educators must start to introduce AI literacy into curricula to ensure that trainees are adequately prepared for technological advancement and subsequent changes to their future clinical role.[43]

Respondents were asked their opinions on the importance of shared taught modules/interprofessional learning, giving an average score of 3.95/5 (where 1 = extremely unimportant, and 5 = extremely important). Interprofessional learning, whereby "two or more professionals learn about, from, and with each other to enable effective collaboration and improve health outcomes,"[44] aims to promote teamwork, support communication, and facilitate the development of mutual understanding and respect across healthcare disciplines.[45] However, stakeholders also expressed concerns, highlighting potential challenges for scheduling, curricula relevance, and differing professional cultures:[46]

> *"We can learn from other professions in the right instances, but it should be in a measured way not to overshadow the basic clinical skills."*
>
> [P12, Ultrasound manager]

For course delivery, a day-release format was preferred (65.11 %, n = 28) compared to block-release (34.88 %, n = 15). Opinions regarding the optimal ratio between in-person/on-campus and remote delivery of medical ultrasound education were mixed, but most respondents noted a preference which prioritised in-person, face-to-face approaches (Fig. 4).

With regards to faculty, most respondents felt that most teaching should be delivered by substantive staff rather than visiting guest lecturers, with an optimal ratio of 75:25 (52.38 %, n = 22). This was justified by the importance of offering consistent student support. However, others believed the optimal ratio was 50:50 (35.71 %, n = 15). Fewer respondents felt teaching should be delivered solely by substantive staff (7.14 %, n = 3), or predominantly by visiting or guest lecturers with a 25:75 ratio (4.76 %, n = 2):

> *"Having a mix of substantive and guest lecturers would give students opportunities to hear from a range of professionals."*
>
> [P15, Sonographer/Ultrasound practitioner]

Stakeholder development

When asked about their needs for development, many respondents identified priorities related to improving student support through high-quality practice educator training (n = 33) such as mentorship training, access to teaching resources, and more collaboration with institutions to better understand educational content, assessment requirements and deadlines, and better support trainees. This reflects findings from Khine et al.'s study of sonography and radiography students and practice educators.[47] Practice educators play a central role in training, and can contribute to student confidence, professional identity development, and engagement in learning.[48] However, variations in teaching and mentorship styles may affect the students' learning experience, and even their successful completion of a programme of study.[47,49] Others suggested further opportunities for personal development through short courses and CPD activities could be offered by institutions (n = 28). Several (n = 21) expressed interest in gaining formal teaching experience, or studying practice education and/or academic practice modules which could lead to a recognised qualification:

> *"I would welcome the opportunity to become involved in teaching."*
>
> [P15, Sonographer/Ultrasound practitioner]

Training in pedagogical principles such as creative lesson planning, providing effective feedback, and strategies to support learning may be advantageous for increasing standardisation in teaching, creating positive learning environments, and promoting collaborative working practices between clinicians and academics,[50] whilst also expanding the pool of quality educators. There are also benefits for mitigating high levels of occupational burnout in sonographers[18] through role development, variation in work, and increased self-esteem.

Student experience

Respondents identified three main areas that could affect the student experience; individual (n = 33), training (n = 19), and academic factors (n = 9), which collectively captured both personal and professional challenges faced during postgraduate training. Transitioning from undergraduate to postgraduate education requires students to refine skills in critical thinking and self-directed learning,[9] which may degrade if there has been a substantial break between qualifications. Another area that trainees may finding particularly challenging is the application of theoretical knowledge to practice, whereby an individuals' understanding in a classroom setting may not fully translate to their clinical role, e.g., image interpretation, or clinical decision making.[51] Research suggests this can be improved through supportive work-place learning environments,[47,52] however, students' difficulties in applying theory may reflect current challenges experienced in clinical departments for the provision of dedicated training lists:

> *"Limited practical training in hospital environment especially when being pulled out of training lists in order to cover staff sickness."*
>
> [P31, Sonographer/Ultrasound practitioner]

Postgraduate learners are also more likely to have greater personal responsibilities (e.g., care, finances) which must be balanced alongside their clinical roles and academic study.[53] Access to pastoral support services (e.g., personal tutoring programmes, mental health resources, funding advice) which are widely offered in HEIs has been found to be of great importance to help students achieve a manageable work-life balance and succeed in their studies.[54]

Implications for practice and future research

Given the ever-changing clinical landscape, an important consideration for ultrasound educators is how to integrate new content into already full curricula; this survey highlighted the need to emphasise communication and person-centred approaches to care. This could be achieved by more active engagement with individuals who have lived and living experience of relevant health conditions, which has been shown to provide invaluable insight for healthcare professional into patients' perspectives.[55] However, educators must also prepare for the integration of more generalised topics that may not be considered as essential to newly qualified clinical ultrasound practice, e.g., AI, leadership, management, and research skills (as identified in this survey). In these instances, it may be feasible to suggest that interprofessional learning may prove effective in the delivery of some topics where there is relevant overlap with other healthcare disciplines.[45] Given stakeholders' wishes for increased opportunities for practice educator training, future research should focus on the most effective approaches to deliver this. Research post-training could help to identify whether the additional developmental opportunity has any effect on their teaching practices, role satisfaction, and student learning experience.

Strengths and limitations

Study findings are strengthened by the use of an anonymous survey design which may empower respondents to share their opinions more freely.[56] The survey was piloted prior to launch to ensure content validity and usability for all respondents.[57] Finally, the qualitative content analysis provided a systematic analytical strategy.[20] Nonetheless, some limitations must be acknowledged. Firstly, the target sample size of n = 250 was not achieved. Although this did not change the planned analysis (i.e., no inferential statistical analysis was conducted), this may be explained by the affiliation of the study with the research team's ultrasound programme, which might have discouraged some stakeholders with no knowledge of the programme from participating. It should also be acknowledged that some responses may be specific to the affiliated programme, therefore wider generalisation of the findings is limited. It was not possible to extend the data collection period due to the timely need for the data in an institutional report, although it was observed that no new responses were received in the final week of the survey even with circulated reminders. Despite clear inclusion criteria for UK-respondents only, some international respondents completed the survey. Although these data were excluded, this highlights some limitations of using e-consent with self-selecting participants in that individuals can falsify responses to screening questions to gain access to survey material.[19] Finally, most literature cited in this manuscript relates to healthcare disciplines other than sonography, highlighting the paucity of ultrasound-specific research.

Conclusion

Effective postgraduate medical ultrasound education requires a balance between theory, practical skill development, and adaptability to the evolving clinical and technological landscape. This survey highlights some challenges faced by UK trainees, including the lack of standardisation of academic and clinical assessment processes, insufficient communication with education providers, and limited hands-on scanning time in clinical departments, as well as individual student factors. The stakeholder priorities identified in this study are likely to validate the efficacy of many current UK training programmes, but may also help with suggestions to mitigate training challenges. For example, through increased use of digital technologies and simulation-based training on-campus, and creating opportunities for practice educators to further collaborate with HEIs. Future research should seek to identify best practices for practice educator training, including pedagogical principles and mentorship, not only for supporting students' learning, but also to ensure that on-going development of postgraduate medical ultrasound education meets the demands of modern clinical practice.

Ethics approval

Ethical approval for this study was received by (City St George's, University of London, date of approval 6th June 2024). All participants gave informed consent prior to accessing the questionnaire, which included permission to use anonymised quotations for research presentation and publication.

Data availability

A limited dataset will be made available on reasonable request to the institutional research ethics committee (researchethics@citystgeorges.ac.uk).

Authors' contributions

The study was conceptualised by (ES) and (RS). All authors were involved in the study design. (ES) led on the analysis and write-up of the manuscript. All authors reviewed and approved the final manuscript.

Conflict of interest statement

None.

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