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# Self-assessed head and neck ultrasound skills before and after a DEGUM-certified basic course: a pre-post questionnaire study

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## Abstract

# Background

Ultrasound is an essential diagnostic technique in otorhinolaryngology and related head and neck specialties. Its diagnostic value depends strongly on the examiner's training, experience and adherence to structured examination standards. In Germany, head and neck ultrasound is commonly learned during specialist training and can be supplemented by courses certified by the German Society for Ultrasound in Medicine (DEGUM). This study evaluated participants' self-assessed ultrasound skills and their appraisal of a DEGUM-certified basic head and neck ultrasound course.

# Methods

We conducted a single-centre pre-post questionnaire study among 25 participants of a DEGUM-certified basic course in head and neck ultrasound at a tertiary university department. Questionnaires administered before and after the course assessed professional background, prior ultrasound experience, perceived training opportunities, course relevance and self-assessed ultrasound skills on a 10-point visual analogue scale. Descriptive statistics were calculated for all available responses. Changes in self-assessed skills were analysed using complete paired cases and the Wilcoxon signed-rank test.

# Results

Most participants had limited professional and ultrasound experience: 19 of 25 participants (76%) reported 1–3 years of professional experience, and 16 of 25 (64%) had performed 50–500 ultrasound examinations. Structured ultrasound teaching in routine clinical practice was uncommon. Before the course, 24 of 25 participants (96.0%) rated the curriculum topics as clinically relevant; after the course, 21 of 23 respondents (91.3%) did so. In complete paired cases (n = 20), self-assessed ultrasound skills increased from a mean of 2.8 ± 2.2 before the course to 3.9 ± 2.0 after the course (median 2 [IQR 1-3.25] vs. 3 [IQR 2–6]; Wilcoxon signed-rank test, p = 0.002).

# Conclusions

Participants considered the DEGUM basic curriculum clinically relevant, and attendance was associated with a statistically significant improvement in self-assessed head and neck ultrasound skills. Because the study measured self-assessment rather than objective competence and included a small, self-selected sample, future studies should combine participant-reported outcomes with standardized practical assessments and follow-up measurements.

## Background

Ultrasound has become an important diagnostic modality in otorhinolaryngology, oral and maxillofacial surgery and other head and neck specialties. It is widely available, repeatable, relatively inexpensive and free of ionizing radiation. In experienced hands, ultrasound contributes to the evaluation of cervical lymph nodes, salivary glands, soft-tissue lesions, thyroid disease and vascular structures, and it supports clinical decision-making in traumatology, oncology and preoperative diagnostics [1–4].

The diagnostic performance of ultrasound is highly operator-dependent. Examination quality is influenced by knowledge of anatomy and pathology, technical handling of the transducer, standardized image acquisition and documentation, and the examiner's ability to integrate sonographic findings into clinical reasoning [5, 6]. Consequently, ultrasound education is not merely a technical skill but a core component of competency-based clinical training.

In Germany, ultrasound competence in otorhinolaryngology is acquired during specialist training, and the current training framework specifies defined ultrasound experience requirements for the specialty [7]. However, ultrasound teaching in everyday clinical practice often depends on local resources, individual supervisors and opportunities for bedside teaching. Structured external courses may therefore complement workplace-based learning by offering a standardized curriculum, protected practice time and direct expert feedback.

The German Society for Ultrasound in Medicine (Deutsche Gesellschaft für Ultraschall in der Medizin, DEGUM) certifies structured ultrasound courses that include theoretical instruction and practical hands-on components. Recent work on head and neck ultrasound education in Germany has highlighted the diversity of course formats and the need for standardized approaches to competence assessment [8]. Against this background, this study aimed to evaluate participants' baseline experience, perceived clinical relevance of the course curriculum and changes in self-assessed ultrasound skills before and after a DEGUM-certified basic course in head and neck ultrasound.

## Methods

# Study design and setting

This was a single-centre pre-post questionnaire study conducted during a DEGUM-certified basic course in head and neck ultrasound at the Department of Otorhinolaryngology, Head and Neck Surgery, University Hospital Marburg, Germany. The course followed the DEGUM basic-course curriculum and combined theoretical teaching with supervised practical exercises.

The study was designed as an evaluation of a continuing medical education intervention. All participants attending the course were invited to complete anonymous questionnaires before and after the course.

## Participants

Twenty-five course participants completed at least one questionnaire. The target group consisted predominantly of physicians in specialist training in otorhinolaryngology or oral and maxillofacial surgery. Participation in the questionnaire was voluntary. No patient data were collected.

## Ethics, consent and anonymisation

The questionnaire survey was conducted as an anonymous educational course evaluation in accordance with the Declaration of Helsinki and applicable professional ethical standards. Participants were informed orally that their questionnaire responses could be analysed and published in anonymised, aggregated form; completion and return of the questionnaire were taken to indicate consent. No directly identifying personal information or patient data were collected. Formal prospective approval by an ethics committee was not sought. Following an inquiry about the need for ethics review, the Ethics Committee of the Faculty of Medicine at Philipps-Universität Marburg (Ethikkommission des Fachbereichs Medizin der Philipps-Universität Marburg, Germany) provided a written determination dated 12 May 2026 (AZ 26–162 Anf.). Referring to Section 15 of the Professional Code of Conduct for Physicians in Hesse (Berufsordnung für die Ärztinnen und Ärzte in Hessen), the committee stated that submission for ethics review was not mandatory for this project provided that data were irreversibly anonymised at the time of collection.

## Questionnaires and outcome measures

The pre-course questionnaire assessed professional experience, prior ultrasound experience, previous ultrasound-guided procedures, perceived value of ultrasound examinations and availability of ultrasound teaching in everyday clinical practice. Before and after the course, participants assessed the relevance of the curriculum topics for clinical practice. After the course, additional questions addressed the perceived usefulness of the course for future ultrasound examinations and diagnostics and whether important topics were missing.

The primary outcome for the pre-post analysis was self-assessed ultrasound skill measured on a visual analogue scale (VAS) from 0 to 10, where 0 indicated beginner-level skills and 10 indicated expert-level skills. VAS responses were measured manually using a ruler and rounded to the nearest whole number for analysis.

# Statistical analysis

Descriptive statistics were calculated as counts and percentages for categorical variables and as mean ± standard deviation (SD), median, interquartile range (IQR), minimum and maximum for VAS scores. Percentages were calculated using the number of valid responses for the respective item as denominator.

For the analysis of change in self-assessed ultrasound skills, only participants with both pre-course and post-course VAS scores were included. Because the VAS data were ordinal and paired, the Wilcoxon signed-rank test was used for the pre-post comparison. Statistical significance was set at $p < 0.05$. Analyses were performed using Microsoft Excel and R/RStudio.

## Results

# Participant characteristics and prior ultrasound experience

All 25 participants completed the questionnaires, although not all items were answered by every participant. Nineteen participants (76%) reported 1–3 years of professional experience, five (20%) reported 3–6 years and one (4%) reported more than 6 years. Twenty-four participants (96%) were in specialist training in otorhinolaryngology or oral and maxillofacial surgery, and 17 participants (68%) were working in a hospital or clinical setting. Participant background and prior ultrasound experience are summarised in Table 1. [Table 1 should be placed here.]

Prior ultrasound experience was limited to moderate in most participants. Five participants (20%) had performed 0–50 ultrasound examinations, 16 (64%) had performed 50–500 examinations and four (16%) had performed more than 500 examinations. Twenty-one participants (84%) had performed no more than 10 ultrasound-guided punctures or related interventional procedures.

Table 1
Participant background and prior ultrasound experience

| Variable | Category | n | % |
|---|---|---|---|
| Professional experience | 1–3 years | 19 | 76 |
| | 3–6 years | 5 | 20 |
| | > 6 years | 1 | 4 |
| Ultrasound examinations performed | 0–50 | 5 | 20 |
| | 50–500 | 16 | 64 |
| | > 500 | 4 | 16 |
| Ultrasound-guided punctures/procedures | ≤ 10 | 21 | 84 |
| | > 10 | 4 | 16 |
| Clinical work setting | Hospital/clinical setting | 17 | 68 |

Percentages are based on n = 25 valid responses unless otherwise stated.

## Perceived value of ultrasound and workplace-based training opportunities

Thirteen participants (52%) described ultrasound as a safe and simple examination method. Fourteen participants (56%) stated that ultrasound can answer relevant clinical questions, and 16 participants (64%) emphasized that ultrasound assessment and diagnostic accuracy depend on the examiner's skill.

Participants reported limited structured ultrasound teaching in routine clinical practice. Eighteen participants (72%) reported occasional bedside teaching, whereas five (20%) reported a complete lack of structured ultrasound teaching. Twenty participants (80%) stated that they only occasionally had opportunities for ultrasound training in routine practice.

# Evaluation of curriculum relevance and course usefulness

Before the course, 24 of 25 participants (96.0%) rated the course topics as relevant to everyday clinical practice and one participant (4.0%) rated them as partly relevant. After the course, 21 of 23 respondents (91.3%) rated the topics as relevant and two of 23 (8.7%) as partly relevant (Fig. 1). No respondent rated the topics as not relevant.

Twenty-two participants (88%) stated that no important topics were missing from the basic course. One participant suggested greater emphasis on ultrasound-guided puncture and punch biopsy. All participants agreed that the balance between theoretical and practical teaching was appropriate. Twenty-three participants (92%) stated that the course would help with future ultrasound examinations, and 24 participants (96%) felt that it would support future ultrasound diagnostics.

# Self-assessed ultrasound skills before and after the course

In all available responses, mean self-assessed ultrasound skill was 2.9 ± 2.2 before the course (n = 23) and 3.7 ± 2.0 after the course (n = 21). For the paired pre-post analysis, 20 participants had complete VAS data. In these complete paired cases, mean VAS scores increased from 2.8 ± 2.2 before the course to 3.9 ± 2.0 after the course. The median increased from 2 (IQR 1-3.25) to 3 (IQR 2–6). The mean paired change was 1.1 ± 1.2 points; 13 participants improved, six remained unchanged and one reported a lower score after the course. The increase was statistically significant (Wilcoxon signed-rank test, p = 0.002; Fig. 2). Detailed VAS results are presented in Table 2. [Table 2 should be placed here.]

Table 2
Self-assessed ultrasound skills on a 0–10 visual analogue scale

| Analysis | n | Mean ± SD | Median | IQR | Minimum | Maximum | p value |
|---|---|---|---|---|---|---|---|
| All available pre-course scores | 23 | 2.9 ± 2.2 | 2 | 1-3.5 | 0 | 7 | |
| All available post-course scores | 21 | 3.7 ± 2.0 | 3 | 2–6 | 1 | 7 | |
| Paired pre-course scores | 20 | 2.8 ± 2.2 | 2 | 1-3.25 | 0 | 7 | |
| Paired post-course scores | 20 | 3.9 ± 2.0 | 3 | 2–6 | 1 | 7 | 0.002 |
| Paired change | 20 | 1.1 ± 1.2 | 1 | 0–2 | -1 | 4 | |

IQR, interquartile range; SD, standard deviation. The p value refers to the paired pre-post comparison using the Wilcoxon signed-rank test.

# Figures

## Discussion

This pre-post questionnaire study found that participants in a DEGUM-certified basic head and neck ultrasound course had predominantly early-career clinical backgrounds and limited prior ultrasound experience. Participants rated the course curriculum as highly relevant to clinical practice, and the course was associated with a statistically significant increase in self-assessed ultrasound skills.

The baseline findings are educationally relevant. Although ultrasound is a central diagnostic method in head and neck specialties, the majority of participants reported only occasional ultrasound teaching in routine clinical practice. This suggests that workplace-based exposure alone may not reliably provide structured feedback, supervised repetition and standardized content for all trainees. A certified course can therefore function as a complementary learning environment in which participants can consolidate technical, anatomical and diagnostic knowledge outside the time pressure of routine clinical work.

The observed increase in self-assessed skill should be interpreted as an improvement in perceived competence rather than proof of objective skill acquisition. Nevertheless, self-assessment is an important educational outcome because confidence, perceived preparedness and awareness of one's limitations may influence whether trainees seek supervision, perform examinations systematically and engage in further practice. The magnitude of the mean paired improvement was moderate, which is plausible for a basic course: a short educational intervention should be expected to introduce core principles and support initial skill development, but not to produce expert-level competence.

These results are consistent with the broader literature indicating that structured ultrasound education can improve learners' scanning-related skills and perceived competence [6, 9–12]. They also align with recent discussions on head and neck ultrasound education in Germany, which emphasize the need for standardized curricula, sufficient practical training and more robust methods of competence assessment [8]. At the same time, previous undergraduate and predoctoral ultrasound education studies have reported heterogeneous findings, underscoring the importance of objective competence assessment and longitudinal evaluation in addition to learner-reported outcomes [13, 14]. For future curricular development, the present findings support the continued role of certified basic courses while highlighting the need to connect courses with longitudinal workplace-based supervision and competency-oriented assessment.

# Limitations

Several limitations must be considered. First, the sample size was small and drawn from a single course at a single institution, which limits generalizability. Second, participants were self-selected course attendees and therefore likely had a pre-existing interest in ultrasound; this may explain the high perceived relevance of the curriculum and may overestimate acceptability among all trainees. Third, not all questionnaire items were answered by all participants. The paired VAS analysis was therefore based on 20 complete cases, and percentages were calculated using the respective number of valid responses.

Fourth, the primary outcome was self-assessed competence. No objective structured practical examination, image-quality rating, diagnostic accuracy assessment or independent observer-based skills assessment was performed. The study therefore cannot determine whether the observed improvement in self-assessment translated into measurable diagnostic performance or patient-related outcomes. Fifth, the questionnaire was used for course evaluation and was not a fully validated psychometric instrument. Manual measurement and rounding of the VAS may have introduced additional measurement imprecision.

Sixth, the study assessed immediate post-course effects only. It remains unknown whether the increase in self-assessed skills persisted over time or translated into increased ultrasound use in clinical practice. Seventh, no prospective formal ethics committee approval was obtained for this anonymous course evaluation. Following a subsequent request for clarification, the Ethics Committee of the Faculty of Medicine at Philipps-Universität Marburg stated in writing that formal submission was not mandatory under Section 15 of the Professional Code of Conduct for Physicians in Hesse, provided the data were irreversibly anonymised at collection (AZ 26–162 Anf.; 12 May 2026). Finally, without a control group, improvements cannot be attributed exclusively to the course; motivation, expectation effects and repeated reflection on one's skills may also have contributed.

# Conclusions

A DEGUM-certified basic course in head and neck ultrasound was perceived as clinically relevant by participants and was associated with a significant immediate improvement in self-assessed ultrasound skills. The findings support structured ultrasound courses as a useful complement to clinical workplace-based training. Future research should include larger multicentre samples, validated assessment tools, objective practical competence measures and longitudinal follow-up to determine whether improvements in self-assessment translate into sustained clinical competence.

# Abbreviations

DEGUM
Deutsche Gesellschaft für Ultraschall in der Medizin (German Society for Ultrasound in Medicine)
IQR
interquartile range
SD
standard deviation
VAS
visual analogue scale.

# Declarations

### Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and applicable professional ethical standards. Participation in the anonymous educational course evaluation was voluntary. Before completing the questionnaires, participants were informed orally that their responses could be analysed for research purposes and that the anonymised findings might be published in aggregated form. Completion and return of the questionnaires were taken to indicate informed consent to participate. No patient data or directly identifying personal data were collected. The project was not submitted for prospective formal ethics approval and no ethics approval was granted. Following a request for clarification about review requirements, the Ethics Committee of the Faculty of Medicine at Philipps-Universität Marburg (Ethikkommission des Fachbereichs Medizin der Philipps-Universität Marburg, Germany) issued a written statement on 12 May 2026 (reference: AZ 26–162 Anf.). The committee concluded that the project involved no intervention affecting participants' physical or psychological integrity and no processing of human biological material. It stated that, pursuant to Section 15 of the Professional Code of Conduct for Physicians in Hesse (Berufsordnung für die Ärztinnen und Ärzte in Hessen), submission to an ethics committee was not required provided that the data had been irreversibly anonymised at the time of collection. This statement concerns the requirement for ethics review and should not be interpreted as retrospective ethics approval.

### Consent for publication

Not applicable. The manuscript does not contain identifiable individual person’s data.

# Competing interests

The authors declare that they have no competing interests.

# Authors' information

Not applicable.

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The authors received no specific funding for this work.

# Author Contribution

Wieland Behr: Conceptualization, methodology, investigation, data collection, formal analysis, visualization, writing – original draft, and project administration.Boris A. Stuck: Conceptualization, methodology, interpretation of the findings, supervision, and critical revision of the manuscript for important intellectual content.Simon Klein: Course delivery, investigation, data interpretation, and critical revision of the manuscript for important intellectual content.Urban W. Geisthoff: Study supervision, interpretation of the findings, and critical revision of the manuscript for important intellectual content.All authors read and approved the final manuscript.

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The authors thank the course participants for completing the questionnaires. During manuscript revision, OpenAI ChatGPT was used for language editing, statistical wording and journal-formatting support. The authors reviewed and edited all content and take full responsibility for the final manuscript.

# Data Availability

The anonymised questionnaire data supporting the findings of this study are available from the corresponding author upon reasonable request. Requests will be considered with due regard to the anonymity of the course participants.

## References

1. Gritzmann N. Sonography of the neck: current potentials and limitations. Ultraschall Med. 2005;26(3):185–96.

2. Kunzel J, Strieth S, Wirth G, Bozzato A. Ultrasound in the re-staging of cervical metastases after chemoradiotherapy for head and neck cancer. Ultraschall Med. 2018;39(6):659–66.
3. Quetz JU, Rohr S, Hoffmann P, Wustrow J, Mertens J. B-image sonography in lymph node staging of the head and neck area. A comparison with palpation, computerized and magnetic resonance tomography. HNO. 1991;39(2):61–3.
4. Schneider U, Grass I, Laudien M, et al. Comparison of clinical examination and various imaging modalities in the diagnosis of head and neck cancer. Int Arch Otorhinolaryngol. 2021;25(2):e179–84.
5. Abuhamad AZ, Benacerraf BR, Woletz P, Burke BL. The accreditation of ultrasound practices: impact on compliance with minimum performance guidelines. J Ultrasound Med. 2004;23(8):1023–9.
6. Celebi N, Griewatz J, Ilg M, et al. Three different ways of training ultrasound student-tutors yield significant gains in tutee's scanning-skills. GMS J Med Educ. 2019;36(6):Doc77.
7. Bundesärztekammer. (Muster-)Weiterbildungsordnung 2018 in der Fassung vom 03.07.2025. Berlin: Bundesärztekammer. 2025. https://www.bundesaerztekammer.de/fileadmin/user_upload/BAEK/Themen/Aus-Fort-Weiterbildung/Weiterbildung/20250703_Muster-Weiterbildungsordnung-2018.pdf. Accessed 8 May 2026.
8. Schramm A, Tisch M, Offergeld C. Teaching head and neck ultrasound: current educational formats and assessment structures and their potential influence on future curriculum development. HNO. 2026;74:79–87. 10.1007/s00106-025-01712-2.
9. Koch A, Schick B, Bozzato A. Today's importance of ultrasound in ENT. Rev Laryngol Otol Rhinol (Bord). 2015;136(2):51–9.
10. Andersen CA, Holden S, Vela J, Rathleff MS, Jensen MB. Point-of-care ultrasound in general practice: a systematic review. Ann Fam Med. 2019;17(1):61–9.
11. Mohammad K, Murthy P, Aguinaga F, et al. Simulation-based structured education supports focused neonatal cranial ultrasound training. J Ultrasound Med. 2020;39(6):1195–201.
12. Ernst BP, Strieth S, Kunzel J, et al. Evaluation of optimal education level to implement structured reporting into ultrasound training. Med Ultrason. 2020;22(4):445–50.
13. Bernard S, Richardson C, Hamann CR, Lee S, Dinh VA. Head and neck ultrasound education: a multimodal educational approach in the predoctoral setting: a pilot study. J Ultrasound Med. 2015;34(8):1437–43.
14. Feilchenfeld Z, Dornan T, Whitehead C, Kuper A. Ultrasound in undergraduate medical education: a systematic and critical review. Med Educ. 2017;51(4):366–78.

# Figures

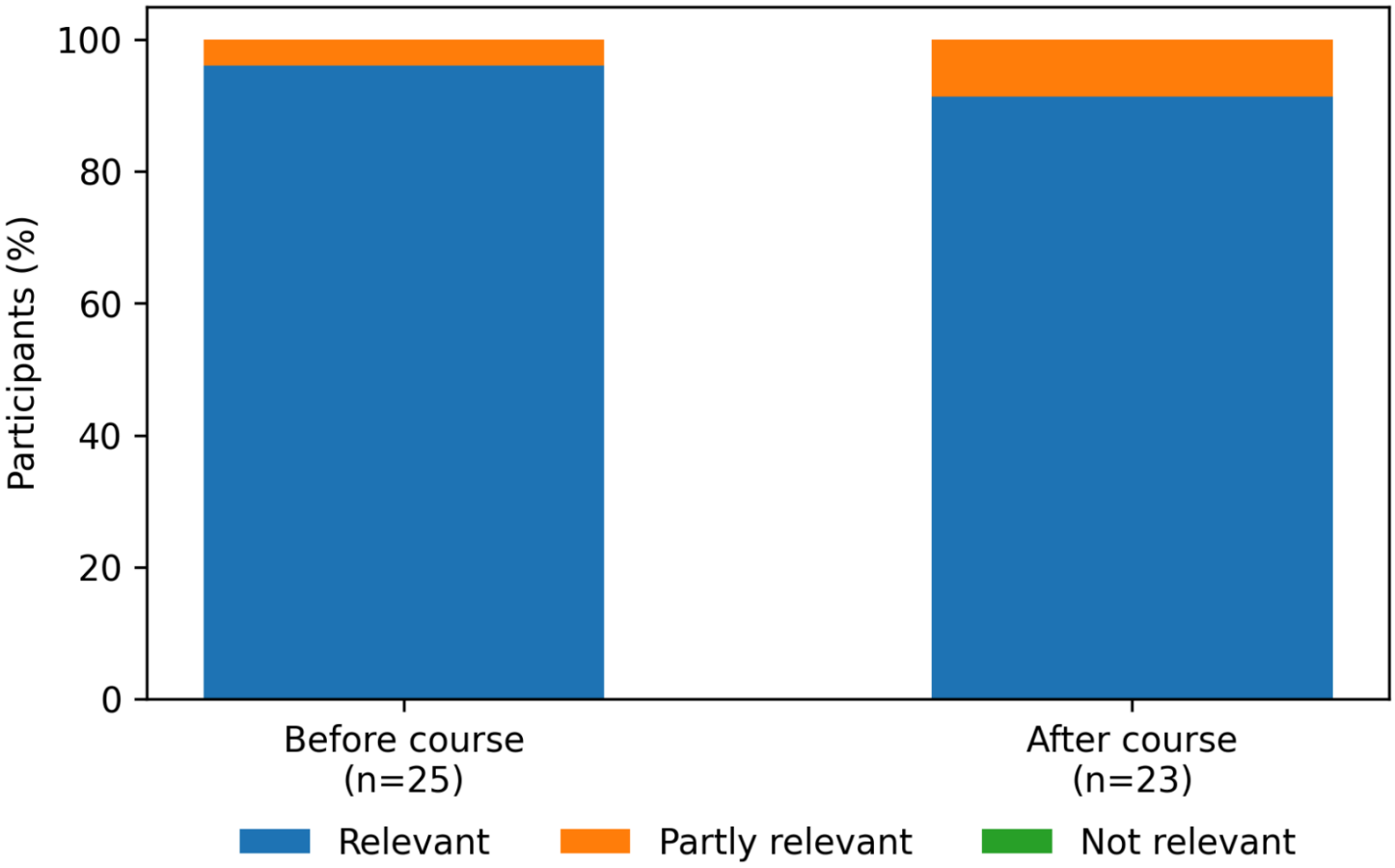


**Figure 1**

**Perceived relevance of curriculum topics before and after the DEGUM-certified basic course. Percentages are based on valid responses before the course (n = 25) and after the course (n = 23).**

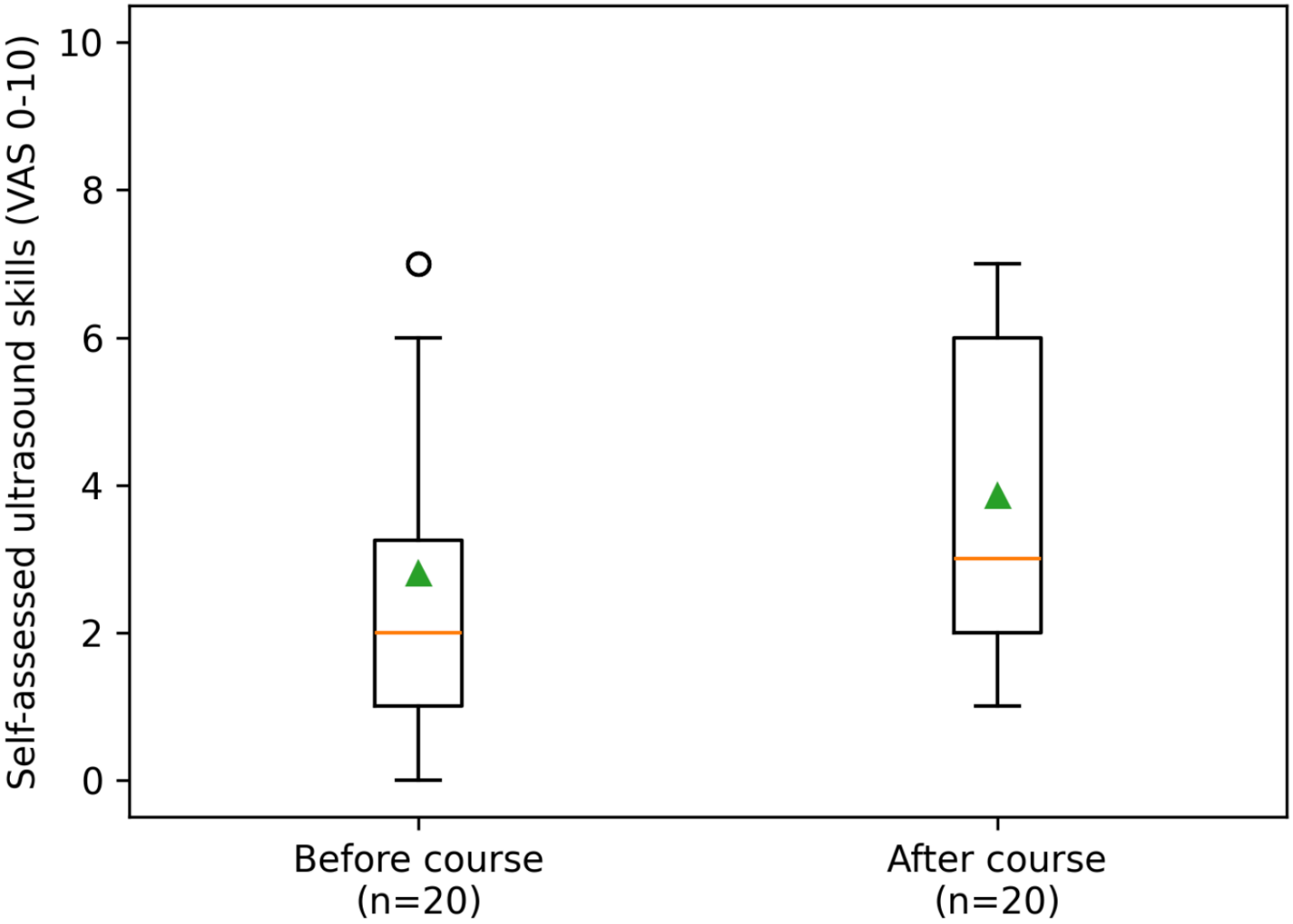


**Figure 2**

**Self-assessed ultrasound skills before and after the course in complete paired cases (n = 20). Scores were measured on a visual analogue scale from 0 (beginner) to 10 (expert). The central line indicates the median; boxes show the interquartile range; whiskers show the non-outlier range; markers indicate means.**