



Standard Setting Report: Vascular Sonography - Effective August 2026

Background

The mission of the American Registry of Radiologic Technologists (ARRT) is to “to promote safe, high-quality patient care through credentialing, collaboration, and advocacy.” Within ARRT’s examination program, standard setting is a formal, systematic process that links examination performance to a defensible determination of minimum competence for certification. The previous standard setting workshop for the Vascular Sonography (VS) examination was conducted in June 2021.

This report details a standard setting workshop conducted in September 25-26, 2025 for the VS examination. It describes (a) committee composition, (b) the definition of the minimally qualified candidate (MQC), (c) the standard setting methods and training provided, (d) the results from each method, and (e) the ARRT Board of Trustees’ decision and implementation plan.

The VS examination is designed to assess entry-level competence. The passing standard is intended to support public protection by distinguishing candidates who have achieved the minimum required knowledge and skill from those who have not.

Panelists completed required confidentiality and conflict-of-interest attestations consistent with credentialing best practices for accreditation review.

Facilitators:

- Adisack Nhouyvanisvong, Ph.D., Senior Psychometrician at ARRT
- Brandon Loudermilk, M.A., Psychometrician at ARRT

Committee Composition

ARRT selected subject matter experts (SMEs) from the volunteer database to maximize diversity in geography, work setting, and professional experience in Vascular Sonography. When feasible, ARRT biases selection toward practitioners earlier in their career because the examination is designed to assess entry-level competence. ARRT also invites the radiologist assigned by the American College of Radiology to the relevant examination committee.

For this workshop, ten SMEs were invited. Of those, seven SMEs participated as panelists. The panel included six female and one male. Five panelists reported hospital-based practice and two reported clinic-based practice. Five panelists were experienced vascular sonographers and two were entry-level practitioners. Table 1 below summarizes demographic details.

Panel composition was reviewed to ensure appropriate representation across key practice characteristics, including experience level, work setting, and role.



Table 1. Committee Demographics

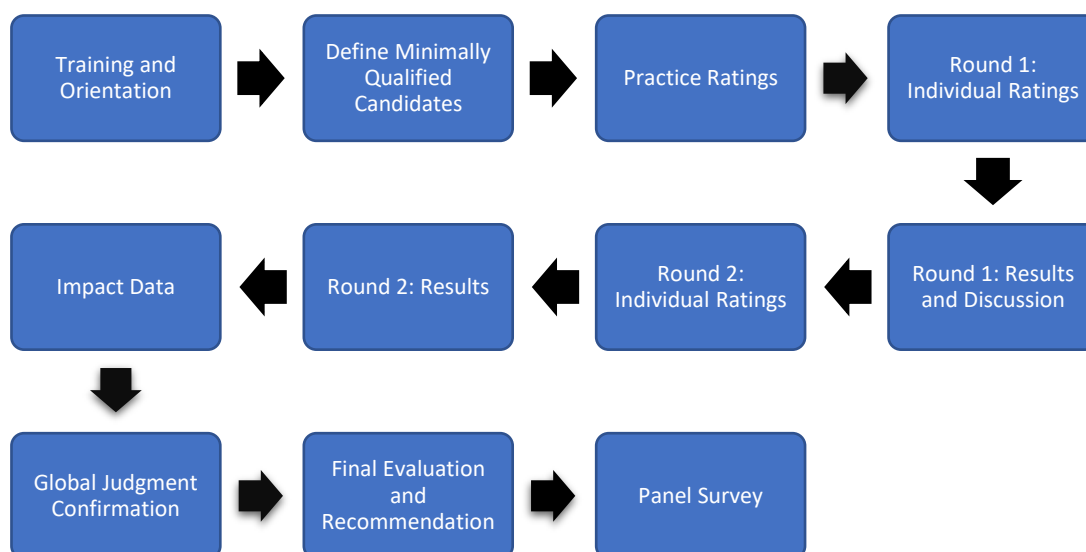
MEMBER	LOCATION	GENDER	INSTITUTION	EXPERIENCE	ROLE	CREDENTIALS
1	AL				Technologist	R.T.(R)(S)(VS)(ARRT)
2	TX				Technologist	R.T.(R)(S)(VS)(ARRT)
3	NY				Technologist	R.T.(VS)(ARRT)
4	AL				Technologist	R.T.(R)(S)(M)(VS)(BS)(ARRT)
5	FL				Technologist	R.T.(VS)(ARRT)
6	AL				Technologist	R.T.(VS)(ARRT)
7	TX				Technologist	R.T.(S)(ARRT)

Standard Setting Process

Prior to the workshop, panelists were sent the examination content specifications, which describes the domain areas assessed on the VS examination. Panelists were also provided with task inventory, a list of activities performed by practicing vascular sonographers, and were asked to review both materials in advance.

Figure 1 summarizes the sequence of activities used during the workshop. The process began with an overview of standard setting and training on the modified Angoff method (Angoff, 1971). Panelists then used the content specifications and task inventory to define the minimally qualified candidate, completed practice ratings, and conducted two rounds of Angoff ratings with structured discussion and feedback. Panelists were instructed to base their judgments on the minimally qualified candidates, rather than on clearly passing (highly experienced) candidates or failing candidates. Finally, panelists completed global judgment activities (Beuk, 1984; and Hofstee, 1983) to evaluate the reasonableness of the Angoff-based results. The committee then made a final committee recommendation based on the Round 2 Modified Angoff results.

Figure 1. Procedures Followed during the Standard Setting Workshop



Minimally Qualified Candidate

Following training on the purpose of standard setting, its implications, and common sources of judgment biases, panelists developed a shared description of the minimally qualified candidate (MQC). The MQC is defined as a candidate who possesses the minimum knowledge, skills, and abilities required for safe and competent entry level practice in Vascular Sonography. This candidate represents the lower boundary of acceptable performance, demonstrating just sufficient competence to practice safely and effectively.

Panelists reviewed the VS content specifications and task inventory and discussed what MQCs can perform reliably and independently, including the minimum level of clinical reasoning and procedural knowledge expected under typical testing conditions. Although the term “entry level” refers to the stage of professional practice, the MQC represents a performance threshold rather than a typical practitioner. Standard setting judgments are therefore based on the MQC as the point at which a candidate’s performance is just sufficient to meet the requirements for certification.

Methods

The workshop used a modified Angoff procedure (Angoff, 1971) as the primary item-centered standard setting method on a VS examination form. Global judgment confirmation method (Beuk, 1984; Hofstee, 1983) was then used to contextualize and evaluate the reasonableness of the Angoff-derived standard.

Modified Angoff Procedure

Prior to operational ratings, panelists completed a structured practice activity using a set of representative items. This exercise was designed to align their understanding of the MQC definition and the application of the rating scale, and to promote consistency in subsequent judgments. Panelists were instructed to make independent judgements, focusing on the MQC rather than on typical candidates or their own expectations.

In Round 1, panelists reviewed each item and estimated the percentage of MQCs who would answer the item correctly. No performance statistics were provided during Round 1.

Before Round 2, facilitators provided structured feedback to support informed reconsideration of judgments, including summary statistics of Round 1 ratings and identification of items with higher rating variability. Where available, first-time candidate proportion correct (or p-value) information was provided as interpretive context, with training that emphasized that operational data may inform (but should not replace) MQC-based judgment.

In Round 2, panelists reviewed their initial ratings and completed a second round of independent judgments. Final Angoff results were computed by summing item-level probabilities to produce a recommended raw score cut and associated percent correct cut on the standard setting examination form.

Global Judgment Confirmation (Beuk and Hofstee) Procedure

Following completion of the modified Angoff procedure, panelists provided independent global judgments using the Beuk (1984) and Hofstee (1983) methods. These procedures directed panelists away from item-level judgments and toward holistic evaluation of the examination form and expected candidate outcomes and are commonly used to contextualize Angoff results.



For the Beuk method, panelists responded to two questions designed to capture global expectations regarding expected percent correct and expected pass rate for the minimally qualified candidates. Panelists indicated (a) the percentage of items an MQC should answer correctly to pass the examination and (b) the percentage of candidates who should be expected to pass.

For the Hofstee method, panelists responded to four questions defining acceptable ranges for both cut scores and pass rates. These questions asked panelists to specify the lowest and highest acceptable cut scores and the lowest and highest acceptable pass rates that would remain defensible in terms of public protection and fairness to candidates.

These judgments were compared to the Angoff results to evaluate consistency and support the reasonableness of the recommended passing standard. This step was confirmatory and did not serve to adjust the cut score.

Results

Results from the standard setting study are presented below, beginning with the modified Angoff procedure and followed by global judgment methods. Tables 2 through 6 summarize the outcomes of each method and supporting evaluation information.

Table 2 presents the distribution of panelist Angoff judgments across Rounds 1 and 2, including measures of central tendency, variability, inter-rater reliability, and standard error of judgment. Specifically, Table 2 shows that the Round 1 mean Angoff recommendation corresponded to a raw score of 109.4 (62.5%), with substantial variability (11.3) across panelists. After feedback and discussion, Round 2 judgments converged to a higher mean raw score of 121.5 (69.4%), with reduced variability (1.1) and increased inter-rater reliability, indicating greater consistency among panelist's judgments.

Table 2. Modified Angoff Results

First Round			Second Round		
Statistic	Raw Scale	% Scale	Statistic	Raw Scale	% Scale
Mean:	109.4	62.5	Mean:	121.5	69.4
SD:	16.5	9.4	SD:	4.8	2.8
Min:	87.0	49.7	Min:	114.0	65.2
Max:	131.6	75.2	Max:	127.4	72.8
Sample SE:	6.2	3.6	Sample SE:	1.8	1.0
IRR-based SEJ:	11.3	6.5	IRR-based SEJ:	1.1	0.6
Max possible:	175	100	Max possible:	175	100
Inter-rater Reliability: 0.53			Inter-rater Reliability: 0.95		
Number of raters: 7			Number of raters: 7		

Note: SEJ denotes the standard error of judgment and reflects uncertainty (i.e., variability) in the panel's judgment-based standard. Inter-rater reliability (IRR) estimates describe agreement among panelists.

The projected impact of the recommended cut score (122 or 69.4% correct) was evaluated by comparing the associated pass rate (55% passing) to the current operational pass rate (58% passing). This comparison provided context for understanding potential changes in candidate



outcomes and supported evaluation of the reasonableness and practical implications of the recommended standard.

Results from the Beuk method are summarized in Table 3, showing that panelists' Beuk judgments yielded a mean cut score of 76.0% correct, with an associated mean (expected) pass rate of 71.4%. The standard deviation reported in Table 3 reflects variability in panelists' holistic judgments regarding both the cut score and the resulting pass rate.

Table 3. Beuk Results

Mean cut score	76.0%
SD cut score	2.9%
Mean pass rate	71.4%
SD pass rate	7.5%

Table 4 displays the mean minimum and maximum acceptable cut scores (70.9% and 79.9%) and pass rates (65.1% and 79.1%) specified by panelists using the Hofstee method. These bounds define a region of acceptable outcomes within which panelists judged both the passing standard and the resulting pass rates to be reasonable for certification decisions.

Table 4. Hofstee Results

Minimum cut score	70.9%
Maximum cut score	79.9%
Lowest pass rate	65.1%
Highest pass rate	79.1%

To evaluate the potential impact of judgment uncertainty on candidate outcomes, projected passing rates were examined across a range of cut scores defined by ± 1 and ± 2 standard errors of judgment (SEJ). Table 5 presents projected passing rates associated with the Round 2 Angoff cut score, as well as Beuk- and Hofstee-adjusted scenarios, relative to the current operational passing standard.

As shown in Table 5, projected passing rates vary across methods and SEJ-adjusted cut scores, illustrating the sensitivity of candidate outcomes to modest changes in the passing standard. The table also provides a reference comparison to the current operational cut score, supporting evaluation of continuity and potential impact.



Table 5. Panelist Cut Scores and Projected Passing Rate

Projected Cut and Passing Rate					
	Cut -2SEJ	Cut - 1SEJ	Cut	Cut + 1SEJ	Cut + 2SEJ
Angoff Cut:	120	121	122	123	124
Pass rate:	56%	55%	55%	53%	5%1
Beuk Adjustment:	120	121	122	124	125
Pass rate:	56%	55%	55%	51%	49%
Hofstee Adjustment:	116	117	118	120	121
Pass rate:	64%	62%	58%	56%	55%
Current Cut:			119		
Pass rate:			58%		

Note: Beuk and Hofstee adjustment values are presented for comparison purposes only and do not represent an alternative passing standard.

Board of Trustees' Decision and Implementation

The ARRT Board of Trustees reviewed the results and discussed the impact of potential new standards before approving a final standard for the Vascular Sonography exam.

ARRT staff presented the committee's results, recommendation, and projected impact information to the ARRT Board of Trustees. After review and discussion, the Board voted to uphold the current passing standard (119 raw score points) for the VS examination.

The Board upheld the current passing standard equivalent to 119 out of 175 items on the exam form used for this meeting. Operational forms are equated to this standard to maintain a consistent passing level across forms. The new standard will go into effect August 2026 and remain in place until the next standard setting is scheduled to take place.

References

- Angoff, W. H. (1971). Scales, norms, and equivalent scores. In R. L. Thorndike (Ed.), *Educational measurement* (2nd ed, pp. 508-600). Washington, DC: American Council on Education.
- Beuk, C. H. (1984). A method for reaching a compromise between absolute and relative standards in examinations. *Journal of Educational Measurement*, 21(2), 147-152.
- Hofstee, W. K. (1983). The case for compromise in educational selection and grading. In S.B. Anderson & J.S. Helmick (Eds.), *On educational testing*, (pp.109-127). Jossey-Bass.

