



A Brief Introduction to Pendleton's Rules and Their Application in Echocardiographic Training

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Dear Editor,

Feedback is the cornerstone of effective clinical training, so that correct performances are reinforced, incorrect ones are modified, and a path toward progress is identified. Feedback provides trainees with information needed to minimize the gap between desired and actual performances and encourages them to rethink and improve their performance (1). The present article describes Pendleton's rules and its benefits, criticisms, its modified form (Pendleton plus), and its application in echocardiographic training.

Pendleton's rules, which outline the usual process for giving feedback to trainees (2), include the following stages:

- Trainee states which items he/she has done well
- Trainer states which items the trainee has done well, and discusses with the trainee how these were performed well
- Trainee states which skills he feels should be performed differently
- Trainer states what the trainee has to do to improve the identified skills
- Trainee provides his practical performance-improving program (3).

According to these rules, the trainer provides the trainee with balanced feedback when there is a suggestion for improvement (2, 4). The trainee and the trainer first focus on the trainee's strengths, then on his weaknesses, and then the trainer provides suggestions for improvement. Thus, strengths and weaknesses are equally considered, where strengths are reinforced, and the trainee is given the opportunity to evaluate his performance prior to receiving criticism, in a way to significantly reduce defense against received criticism. Stating his own limitations provides the trainee the opportunity to rethink, creating a safe environment for receiving feedback (2, 4, 5). For learning to

happen, the trainer should go beyond merely stating what areas are lacking, and he should provide the trainee with corrective suggestions (4).

However, there have been several criticisms exacted on these rules, including inflexibility, the providing of feedback in an artificial setting (2), impossibility of separating strong and weak points in many cases (5), hypocrisy, no consideration for constructive criticism and interactive discussion, time-consuming, allocation of little time to assess weaknesses (4), making the trainee anxious due to the delayed assessment of weak points (2, 4), describing events and inadequate analysis, absence of comment on how good a trainee's performance is (6), and that in applying these rules the trainer often states either what needs to be changed or how this performance can be improved, and rarely both together (6).

According to the conscious-competence model that has been designed for learning skills, when a trainer asks a trainee what he feels he has done well, he is referring to the conscious-competence stage in which the trainee has acquired the skill but has to profoundly focus on that skill when performing it. When the trainer cites any unmentioned items done well by the trainee, he is referring to the unconscious-competence stage, where the trainee has mastered the skill and performs it unconsciously, without thinking (the trainee can also perform other tasks at the same time). When the trainee is asked to state skills that need to be improved, this refers to the conscious-competence stage, since the trainee is aware of these skills and the need to acquire them. When the trainer reviews items that need to be altered to enhance the trainee's skill set, he refers to the unconscious-competence stage, since the trainee has no awareness of the intended skill (7, 8).

Given these criticisms, the modified version of these rules has been presented as Pendleton plus:

- The trainer asks for the trainee's general opinion

about his overall performance, and then briefly provides comments in response. For example, the trainee rates his own performance as excellent, very good, or good, a little problematic, or problematic. In this stage, during the assessment of trainee's insight, general feedback is provided to the trainee, which prevents the trainee and the trainer from being submerged in the narration of the events.

- The trainer asks the trainee what skills he has performed well, and why and how they were done well, and the trainer provides a response. In this way, the first and second stages of Pendleton's rules are integrated.

- The third stage of Pendleton Plus is almost the same as the third stage of Pendleton's rules, in which the trainee states which skills require improvement, and the trainer encourages the trainee to analyze his performance by asking why, and how, he can improve in the future.

- To sum up, the trainer requires the trainee to state the instances where he felt he performed adequately, as well as those that require modification (6).

The assumption in using the Pendleton Plus rules in echocardiography training is that the assistant should perform echocardiography on a patient independently, and that the images of measurements and the videos of all normal pathologies and structures, obtained through different echocardiographic modalities, should be stored in the device. First, the trainer requires the assistant to provide an overview of the echocardiography of the patient, and then expresses his opinion on all images and videos. In the second stage, the trainer requires the assistant to state which measurements, images, and videos of the heart were obtained appropriately, and why. For example, if the assistant states: "The pressure gradient of the pulmonary valve and the measurement of the inner diameter of the left ventricle during systolic and diastolic periods were assessed correctly, due to the alignment of the flow through the pulmonary valve, obtaining clear images of the heart in the para-sternal longitudinal view, attention paid to the endocardial movement of the posterior wall of the left ventricle in systolic and diastolic periods, and careful detection of the papillary muscle and its distinction from the posterior wall." At this stage, the trainer provides corrections for any images wrongly assessed by the assistant, and the trainer confirms the assistant-stated cases that have been performed adequately and points out any other portions that have been completed correctly.

In the third stage, the trainer requires the assistant to state assessment or imaging cases with which he is dissatisfied, and asks why he is dissatisfied while providing the necessary guidelines. The trainer then requires him to state how he would correct his performance, so as not to repeat the same problems with the next patient. For example, if the assistant states "The four-cavity view of the patient is not ideal due to the patient's obesity" the trainer

then repeats the echocardiography, shows the assistant a good four-cavity image, and explains to the assistant how to obtain a good image by turning the probe below the center-line. Lastly, the assistant restates the trainer's instructions for performing echocardiography on obese people. Given that echocardiography depends on the individual's skill level for identifying pathologies of the heart, and understanding that there are both normal cases and complex multistage processes, the trainer should perform echocardiography in the presence of the assistant. While repeating this process, he should provide the assistant with both positive and negative feedback in every stage of measurement, imaging, and pathological assessment. If faults are found in the assistant's performance in each stage, the trainer should also continue to first point out to the assistant any of his appropriate steps completed in that specific stage (not the previous stage or overall echocardiography), then mention the portions that require modification, and lastly teach him how to correct faulty cases. In the fourth stage, the assistant is asked to state some of his strong skills and some that require improvement. For example, the assistant states: "The para-sternal longitudinal measurements of the left ventricle have been done properly, but the heart four-cavity images and their measurements need to be corrected".

The author, who is involved in training specialist heart assistants and echocardiography fellowship assistants, recommends knowledge of Pendleton Plus rules and their use in echocardiography training.

Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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