

Supplemental Digital Appendix 1

Interview Guide, From a Study of 22 Experienced Endoscopy Teachers Who Participated in Interviews Regarding Learner Challenges and Teaching Strategies During Gastrointestinal Endoscopy Training, 2016–2019

1. **[Specific example #1]**

I would like to start by asking you about specific examples of endoscopy teaching. First, please think about an endoscopic procedure that you thought was particularly challenging for the learner. These challenges could relate to any portion of the procedure, including pre-, intra-, or post-procedure. Can you tell me about that encounter?

[If needed can prompt with the following:]

- Tell me about the learner (year, skill level)
- Tell me about the procedure (what was happening, was it complex or routine)
- In what ways, specifically, was the learner struggling?
- Did anything appear to distract the learner?
- How did you help the learner manage the situation?
- Did you have any concerns about patient safety? Procedural efficiency?
- Did you debrief or provide the learner with feedback after the procedure?

2. **[Specific example #2]**

Thanks for that example. Can you think of another, different, situation in which a learner was struggling with a different type of endoscopic procedure? Can you tell me about that experience? How did the challenges they experienced differ from the first example? How did your teaching approach differ?

3. **[General challenges & approaches]**

Thank you for describing those specific examples. Next, I am interested in discussing more generally the challenges that endoscopy learners commonly experience. Of course, I am also interested in any additional specific examples that you may have.

[Depending on forgoing conversation and time, select among the following questions:]

- What do you see as the most significant challenges that learners experience while learning to perform endoscopy (pre-, intra-, or post-procedure), and what techniques or approaches do you use to address these challenges?
 - Part task approach?
 - Setting expectations?
- How, if at all, do you try to alter endoscopy teaching based on the fellow's prior experience or competence level?

- How, if at all, do you try to minimize distractions in the environment, or how do you keep fellows focused on the task at hand?
- How, if at all does fellow mindset affect their endoscopy learning?
- How, if at all, do you promote learning during endoscopy? By learning I mean automation of tasks, formation of learning schema, and consolidate knowledge.
- When you teach endoscopy do you tend to continuously narrate or do you tend more to sit back and observe?
- How do the challenges and/or your approaches to them change with advancing fellows skill and expertise?
- What procedures are most or least challenging for learners?
- Do fellows ever experience challenges pre- or post-procedurally (e.g., pre-procedure workup, report writing, follow-through)?
- How do you approach teaching about complex motor tasks, such as loops?
- How do you decide when to “take over” an endoscopic procedure? How do you decide whether or not to give the scope back to the learner? How do you keep learning active when you’ve taken over the procedure?
 - How does your level of comfort affect when or how you take over the procedure?
- How can you tell when a learner is distracted during endoscopy training? How do you help that learner?
- How can you tell when a learner is overwhelmed during endoscopy training? How do you help that learner?
- How does performance versus mastery mindset affect endoscopy learning?

4. [Curricular & systems contributions]

Let’s switch gears a little bit now to curricular and systems issues.

In your training program, how do fellows learn to perform colonoscopy?

Are there curricular or systemic factors that affect your fellows’ endoscopy training in a positive or negative manner?

[If needed can prompt with the following:]

- Is there a consistent approach to endoscopy training across sites and/or teachers?
- Does your program use simulation, and if so, how?
- Is there a specific curriculum, and if so, can you describe it for me?
- Do clinical or on-call schedules or competing demands interfere with endoscopy training?
- Do fellows have access to adequate numbers of endoscopic procedures?
- Does the endoscopy schedule facilitate enough time per case for fellows to learn?

Supplemental Digital Appendix 2

Definitions of Codes, From a Study of 22 Experienced Endoscopy Teachers Who Participated in Interviews Regarding Learner Challenges and Teaching Strategies During Gastrointestinal Endoscopy Training, 2016–2019

Codes^a	Definitions^b
CHALLENGES	
Emotion/relationship	Trainee emotion is source of distraction; includes emotions independent of, or related to, relationship/interaction between learner and teacher.
Extrinsic challenges	Elements extrinsic to the trainee, teacher, and patient are a challenge. Includes environmental elements like music, people, and conversations, or competing demands like consult service, pager, time pressure.
Innate ability	Trainee lacks innate skills required to learn endoscopy.
Language challenge	Challenge understanding language or terminology used by teacher.
Learner motivation/mindset	Performance over mastery orientation, sole focus on reaching extent of exam, speed prioritized over quality, poor effort, or lack of interest.
Learner self-efficacy	Fear of instrument falling back and losing forward progress, lack of confidence, or low self-efficacy.
Mental model/loops	Trainee doesn’t conceptually understand/grasp what is happening with the equipment inside of the patient, including loops.
Nonresponsive	Trainee does not respond to feedback or instruction.
Overall task	Complexity of overall task (as opposed to individual aspects) is overwhelming for trainee.
Psychomotor control	Any challenge related to physically controlling scope or tools including: - Controls (e.g., dials/knobs, suction, irrigation), - Maneuvering scope through body (e.g., intubating esophagus, positioning scope, mechanical reduction of loops), or - Accomplishing tasks (e.g., biopsy, polypectomy, control of bleeding).
Systems problems	Systems or curricular issues interfere with learning, including: teacher inconsistency, inadequate practice and/or feedback, inadequate tools/supplies, inadequate curriculum.
Tactile	Trainee doesn’t understand how instrument should feel.
Unawareness	Trainee unaware of errors, struggles, or own level of competence.
STRATEGIES	
Check learner schemas	Teacher probes trainee’s understanding of complex concepts such as loops. Examples include asking trainee to describe WHAT and WHY, asking the trainee to propose and explain what is happening and what they want to do about it, or asking trainee to describe problem.
Developmental continuum	Teacher proactively plans teaching based trainee’s level in training and/or competence (e.g., part-task); infers that teacher permits more advanced trainees to do more of procedure, and/or alters teaching based on experience/competence.

Diagnose struggler	Teacher observes trainee in real time to determine when they are struggling, including body language, utterances, posture, non-purposeful movements, or making same maneuvers repeatedly.
Emotional support	Teacher responds to trainee emotions, such as: normalizing struggles, telling stories from own training, encouraging, cheerleading.
Expectation and roles	Teacher works with trainee to set expectations for their anticipated involvement and roles during the procedure, including when teacher may take over.
Feedback	Includes any discussion of providing feedback to trainee.
Mastery	Teacher encourages trainee to have mastery mindset (over performance mindset), including demanding good technique.
Motor instruction	Teacher directs how to perform specific psychomotor tasks.
Optimize environment	Teacher changes aspects of learning environment to improve teaching, such as leaving pagers outside, turning off music, or minimizing conversation.
Repetition	Teachers specifically gives trainees same instructions over time, until they “get it.”
Standard language	Teacher uses specific standardized language to make sure trainee understands.
Stop	Teacher tells trainee to stop performing procedure and to pay attention to teacher.
Systems solutions	Teacher or program makes changes to system, schedules or curriculum to improve learning.
Technical assistance/takeover	Teacher physically assists trainee with aspects of procedure or completely takes over full control of procedure.
Teach schemas	Teaching intended to help trainee understand complex or abstract concepts such as how instrument should feel or physical configuration of the instrument inside of the patient.

^aCoding authors used the above codes and definitions during actual coding. We used template analysis of coded excerpts to develop the set of themes described in the Results section. While all of the above informed the analysis, not all are explicitly mentioned in the manuscript.

^bThese operational definitions used by coding authors have been lightly edited for clarity.