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Learning curve for endoscopy training: Is it all about numbers?

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A B S T R A C T

Endoscopy training is an important component of postgraduate gastroenterology and general surgery programs. Proficiency in endoscopy requires the development of several tangible and intangible skills. Much attention has traditionally been paid to establishing a threshold, or minimum procedural volume during the training period, which is necessary for a trainee to achieve competence in endoscopy by the conclusion of his or her program. However, despite several attempts to characterize this target, it has become clear in recent years that training programs need to consider other factors rather than relying on this measure as the sole marker of trainee competency. Here, we present a review of general concepts in endoscopy skills acquisition that affect the learning curve, the evolving definition of competency as it relates to procedural volume, the role of simulation in endoscopy training, and the concept of massed versus spaced delivery of endoscopy training.

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Skills acquisition and cognitive load

The pursuit of competence and excellence in the acquisition of skills is dependent upon a blend of innate biological capability, dedicated instructors and many hours of training. The process of skills acquisition has been well-described and involves three major phases. The novice phase involves intense concentration to completely understand the activity and minimize mistakes. The second phase is an evolution to a more fluid and less cognitively arduous step in which trainees begin to perform at an acceptable level. The final phase involves a process of automation in which the skill is precisely and smoothly performed with little or no conscious cognitive involvement [1]. Specifically, with relevance to colonoscopy, a common diagnostic procedure performed world-wide, a novice endoscopist must attend to a myriad of sensory stimuli, including stimuli form the endoscopic image on the monitor, verbal stimuli form the patient, nurse and preceptor, and stimuli from proprioception from the endoscope. These stimuli are all potential sources of cognitive load. These external stimuli exist in addition to the demands involved in performing the procedure itself. Technical demands on the trainee include the process of straightening the scope or loop reduction, a technique critical to the safe and successful completion of colonoscopy. Additional procedural skills required to complete a diagnostic colonoscopy include applying knowledge regarding appropriate positioning of the patient to advance the scope successfully, identifying landmarks of completion, such as the ileo-cecal valve and cecal base, and recognizing pathology. Collectively, these inputs may all contribute to increase cognitive load for the novice trainee.

Using a validated tool (National Aeronautics and Space Administration Task Load Index, NASA-TLX) to estimate cognitive load in GI endoscopy, Mohamed et al. [1] showed through factor analysis that the bulk of cognitive load experienced by trainees during colonoscopy arises from two main sources. The first is related to exertion (combination of the effort and physical demand) and the second is related to the trainee's perception of self-efficacy (subjective interpretation of performance). In this study, the evolution of exertion and self-efficacy during the initial training procedures of novice endoscopists was mapped to the volume of procedures completed. For both colonoscopy and upper endoscopy, there was a steady decline in self-perceived exertion over the 3-month training period. For colonoscopy, there was a progressive increase in self-reported self-efficacy over the first 29 procedures, followed by a drop in self-efficacy scores over the next 25 procedures. These findings were compared to the self-efficacy scores of expert gastroenterologists and were much lower than their expert cohort's. The findings were slightly different for gastroscopy. For upper endoscopies, a rapid acquisition of skills was observed in addition to a rapidly increasing perception of self-efficacy over the first nine procedures that quickly reached a plateau and stabilized. The findings from this study point to the occurrence of sensitive periods for the novice endoscopist that may be strategically managed by the expert preceptor by recognizing the need to minimize additional cognitive load for the trainee, including extra verbal communication. In addition, cognitive load may be further reduced by using standardized language to reflect simple directives such as “tip deflection”, “torque direction”, “insufflation”, “aspiration” so as to provide guidance while not overloading the trainee.

Defining competency

Trainees in gastrointestinal endoscopy are required to demonstrate competency at the end of their program. Competency is defined by the American Society for Gastrointestinal Endoscopy (ASGE) as the “minimal level of skills, knowledge, and/or expertise derived through training and experience that is necessary to safely and proficiently perform a procedure” [2]. Formal studies are lacking among GI and surgical programs that outline the characteristics of colonoscopy education. However, it is likely that a large degree of variability exists in the educational approaches taken towards teaching endoscopy trainees. Historically, educational pedagogy focused on “see one, do one and teach one”, whereas current skills pedagogy has been rooted in incorporating didactic, cognitive inputs with hands-on instruction [3]. One group demonstrated that even among trainees from GI fellowship programs, potential deficiencies may exist in the approach to teaching colonoscopy. Munroe [4] found an adenoma miss rate of 27% amongst GI trainees. In addition, the study investigators highlighted that there was a 2.2-fold decrease in the risk of missing an adenoma with each 10-fold increase in trainee experience. Based on these study findings, the authors concluded that a trainee would have to perform 450