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Strategic Questioning in Surgical Education

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Learner-Centered Questioning:

In the complex and nuanced world of surgical education, one-way teaching – often in the form of directives from attending to resident (i.e. specialist to trainee) – is insufficient in understanding the needs of trainees and developing safe opportunities for learner advancement. We propose a novel learner-centered approach to intraoperative teaching using questioning that integrates (1) Socratic questioning and (2) Bloom's Taxonomy, which respectively incorporates wait time and progressively complex questioning to stimulate higher order thinking.[1-4] As surgical faculty, surgical residents, and medical educators, we collaborate on this action-oriented initiative to enhance trainee

education. The need for this multi-dimensional team approach has become particularly important in the context of educational time constraints as a side effect of trainee work hour restrictions and the exponential growth in surgical innovations, interventions, and technologies.

Although questions are asked during surgical teaching, we found through our experiences and observations that an intentional Socratic method is rarely employed. A more common expression of this strategy was to 'keep asking questions, any questions.' Conscious Socratic questioning contributes to a culture of educational investment and respect that allows trainees to progress efficiently.[5] Socratic principles for questioning have been defined by instances when the educator carefully constructs a series of questions that promote learner awareness and growth. By crafting a response, the learner demonstrates understanding, gains insight into knowledge limitations, and becomes comfortable in the face of uncertainty, thereby maximising the educational value of the operative experience.[1]

Additional aspects of the Socratic method – wait-time and probing – contribute to a learner-centered environment. When using the wait-time technique, faculty members pause for three to 5 seconds after posing a question to provide the learner with time to frame a thoughtful answer, instead of the usual one second.[2] This additional time promotes higher-order thinking and contributes to retention of knowledge.[2] Use of the probing technique judiciously challenges the trainee to provide a correct answer when the trainee is initially unable to do so. Using these techniques, the faculty first identifies knowledge gaps then bridges these gaps using a progression of questions from foundational knowledge to more complex and higher-order questions in order to advance the understanding of the learner.[2,4]

Strategic Questioning:

When working 'at the elbow' in the operating room, the faculty surgeon has a one-on-one learner-centered opportunity to sharpen a trainee's technical skills in addition to problem solving and decision-making abilities. This is an ideal time to observe, listen to, and query the trainee. Implementation of Bloom's Taxonomy, which is commonly used to classify learning objectives, provides a framework for developing questions to

advance learners through increasingly complex and higher order thinking.[3] The foundational level in Bloom's Taxonomy is *remembering*. Each subsequent level (understanding, applying, analysing, and assessing) is built on previous levels (Table 1).

The following questions illustrate strategic questioning in a hernia repair case. Questions at the *remembering* level typically include recall of specific facts (e.g. What is the most common type of inguinal hernia?). *Understanding* questions require learners to put facts together (e.g. Where does an indirect hernia occur?). *Applying* questions examine the application of plans (e.g. What approach would you use to assess for an incarcerated inguinal hernia?). *Analysing* questions have learners converge and diverge information for deeper investigation (e.g. What would you do if you found necrotic bowel when performing hernia repair?). Finally, *assessing* questions call for critical judgment (e.g. If you found the necrotic bowel was due to a femoral hernia, how would your repair change?).

Bloom's Taxonomy provides educators with a framework for establishing questions that are appropriate for the learner. Consequently, not every Bloom's Taxonomy level may be used in a particular educational encounter. Surgical faculty and residents on our team found that faculty members develop questions at different levels along Bloom's Taxonomy based on prior operative experiences with a trainee. This approach led to scaffolding of resident education to incrementally higher cognitive levels.[2,3,4] Accordingly, as residents progress and become increasingly proficient, questions increase in complexity and higher-order thinking. It is at these higher levels that learners process and integrate new information into existing cognitive frameworks with greater depth.[2,3]

In general, strategic questioning is a core pedagogical technique used in surgical education. Whether it is in the context of the operating room, outpatient clinic, morbidity and mortality conference, or attending rounds, trainees are constantly learning through answering questions. Here we have focused on strategic questioning in surgical education; however, deliberate development of questions is applicable to all clinical educators because it (1) supports alignment of learning goals between faculty members and trainees, (2) identifies gaps and strengths to appropriately advance resident knowledge, and (3) requires active learner-centered interactions. Enhancing residency

education with teaching methods that include strategic questioning benefits the learning needs of trainees while simultaneously advances safe patient care.

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Table1. Strategic Questioning Based on Bloom's Taxonomy

	Increasing Complexity →				
	1. Remembering	**2. Understanding**	**3. Applying**	**4. Analyzing**	**5. Assessing**
Categories	Remember foundational principles and recall facts	Understand results and follow guidelines	Use knowledge and understanding in concrete situations to carry out steps or plan	Differentiate information and organise into meaningful pattern	Justify and defend decision
Key Verbs	Identify List Name	Explain Interpret Illustrate	Apply Demonstrate Use	Analyse Compare & Contrast Predict	Critique Judge Justify

Sample Questions	How many…? Where is…? What is…? What is the most common cause of duodenal ulcer?	What is an example of…? Explain in your own words, what does the…? Describe what is happening when…? How would you assess for a duodenal ulcer?	What questions would you ask the…? What approach would you use to…? What is another way to…? A patient presents with burning epigastric pain 3 hours after eating, which improves with eating. What is your initial treatment?	How does this compare to…? What would happen if…? How could this affect…? What if the patient presented with a perforated duodenal ulcer?	Why did you choose…? What changes would you recommend for…? How could you have handled…? Why or why not would you perform an acid reducing or drainage procedure in a patient with a perforated duodenal ulcer?