What do you want to know? Operative experience predicts the type of questions practicing surgeons ask during a CME laparoscopic hernia repair course

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ARTICLE INFO

ABSTRACT

Background: Given their variegated backgrounds, surgeons taking continuing medical education (CME) courses possess different learning needs. This study examines the relationship between surgeons' levels of experience and the questions they asked in a simulation-based CME course.
Methods: We analyzed transcribed audio-video data collected from surgeons participating in a simulated laparoscopic hernia repair CME course and identified four types of questions learners posed to their instructors. Linear regressions compared how often these questions were asked versus self-reported operative experience.
Results: Both Requesting Guidance and Requesting Confirmation were inversely proportional to experience, whereas Asking About a Specific Case was directly proportional to experience. Requesting Instructor Preference exhibited no significant correlation with experience.
Conclusion: Practicing surgeons with relatively less experience tend to ask for confirmation and guidance, whereas those with greater experience tend to focus on specific hypothetical scenarios. This data can be used to tailor instruction based on learners' self-reported experience level.

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Introduction

Continuing medical education (CME) is vital for the professional development of surgeons in their pursuit of lifelong learning. CME courses not only review and reinforce knowledge, but also keep surgeons on the cutting edge of their disciplines by presenting the newest in research and surgical techniques. Given the hands-on nature of surgery, simulation of various operative procedures is particularly valuable and is becoming more commonly used by both trainees and practicing surgeons.[1] However, little research has explored simulation and CME, nor addressed how these courses meet the needs of surgeon learners with varying backgrounds.

Simulation is often regarded as an opportunity for learners to skill and drill, i.e., develop basic procedural skills.[2] However, previous work has shown that simulation also allows advanced surgeon learners to reflect on their practice and procedure, indicating that surgeons with variegated levels of skill can derive value from simulation.[3] In comparison with traditional lectures, simulation-based courses generally facilitate increased interactivity with instructors, flexibility in course structure, and higher learner-to-instructor ratios. These aspects of simulation allow learners to engage more actively and continuously in a conversation with an expert in their field of interest without fear of disrupting or delaying the progress of a structured lecture designed for a large audience. As such, simulation-based CME courses offer researchers a more learner-centric opportunity to assess the needs of surgeons in an educational setting.

Since all surgeons participate in CME, the courses are often attended by surgeons with a wide variety of backgrounds and surgical experience. Given this, the number of years in practice does not necessarily correlate with familiarity with up-to-date research, a particular procedure, or surgical equipment. Surgeons taking CME

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courses may have very different educational needs, which can present a challenge to instructors and negatively affect surgeon learners' course experience. In the learning sciences, social constructivist theory describes the criteria needed to scaffold, or support, learners at levels suited to their needs. If an educator's goal is to advance the existing knowledge base of a given learner, he or she must first establish *intersubjectivity*, or a shared understanding of what that learner's knowledge base is.[4] Simulation makes intersubjectivity especially easy as it relies on a more conversational, learner-driven process. Here, instructors can ask learners about their goals and experience and the learners can ask questions demonstrating their needs and gaps in knowledge. In turn, these questions provide instructors with insight into how to further tailor their teaching based on the types of questions asked.

To improve our understanding of how CME courses can best serve their learners, the present study examines the relationship between surgeons' levels of operative experience and what types of questions they asked in the context of an annual, simulation-based CME course on laparoscopic hernia repair. In short: Does a surgeon's experience level predict the types of questions he or she asks during a hands-on CME course?

Methods

Setting and participants

The present study included 58 participants (5 general surgery residents, 53 practicing surgeons) who registered for a one-day CME course on laparoscopic inguinal and ventral hernia repair at the 2015 and 2016 American College of Surgeons (ACS) Clinical Congress meetings. The course included an introductory lecture (2 h) and a practicum (4 h). The practicum was conducted in two sessions; participants learned lateral ventral hernia repair in one session (in addition to component separation in the 2015 course), and inguinal hernia repair in the other. All three procedures were taught as mesh repairs. Participants from each year were separated into nine groups of three and one group of two according to similar self-reported levels of laparoscopic expertise. At the beginning of the practicum, each group was assigned to one of ten simulator stations. Twelve experts in laparoscopic hernia repair—one each at eight of the stations, two each at two of the stations—provided instruction using simulators developed for training in these techniques.[5] Facilitators were assigned to stations randomly. All laparoscopic equipment and supplies necessary to repair the simulated hernias using mesh were provided. The University of Wisconsin-Madison Health Sciences Institutional Review Board reviewed and approved this study under exempt status.

Pre-course data collection

Course participants reported their experience performing seven laparoscopic procedures using a Likert scale, where one is "beginner", three is "competent", and five is "master surgeon". Each participant's laparoscopic experience was determined by the mean of his or her self-rated experience with seven laparoscopic techniques: appendectomy, cholecystectomy, colectomy, ventral hernia repair, component separation, TEP, and TAPP. These techniques were chosen for their capture of experience in minimally invasive surgical techniques, as participants expressed goals ranging from incorporation of laparoscopy in their practices to wanting to learn more about specific laparoscopic hernia repairs. Average participant experience ranged from 1.71 to 4.29 (mean = 2.72, SD = 0.52) and was evenly distributed in both 2015 and 2016.

Transcription

All simulated procedures were audio and video recorded. Cameras were placed overlooking each simulator station to provide context for the conversations between participants and instructors. The audio recordings of two of the 40 sessions were corrupted and could not be reliably transcribed; audio from the remaining 38 sessions was transcribed by several undergraduate research assistants. A surgical education research specialist verified each transcription for accuracy and readiness for data processing. The 38 sessions consisted of 17,029 utterances, with a range of 154 to 1252 and average of 898 utterances per session. The session containing 154 utterances was an anomaly which resulted from an instructor leaving his station for part of the session. The rates at which learners asked questions during this session, however, were in line with the others. The total set of utterances were then organized in a file including speaker IDs, group IDs, demographics, and average self-reported laparoscopic experience.

Code development and validation

To investigate what types of questions participants asked during the course, we conducted a *content analysis* of participants' discourse during the simulated procedure.[6] In a summative content analysis, transcripts are evaluated a) qualitatively, to identify potentially meaningful themes or patterns of behavior and b) quantitatively, to determine whether those themes or patterns occur in frequencies that can be statistically analyzed.[7] Our analysis revealed four common themes across the types of questions participants asked: *Requesting Guidance, Requesting Confirmation, Asking About a Specific Case,* and *Requesting Instructor's Preference.* We also coded all utterances for whether they were questions. As the focus of this study was the relationship between learner experience and the types of questions learners asked, we excluded questions posed by instructors from analysis. There exists the possibility that some assertions made by learners (e.g.: "So, this is the vas.") may have been interpreted as questions by facilitators; however, we targeted explicit requests for information in order to establish concrete boundaries for coding and analysis.

We developed automated coding algorithms for each of these codes. For example, to automate the code *Requesting Instructor's Preference*, we developed an algorithm that identifies verbalizations of requests for the instructor's preferences in the discourse by using regular expressions. For instance, the regular expression [\b (do\syou) (?!\swant)] searches text for instances of the phrase "do you"—but only when it is not directly followed by the word "want". For example, this regular expression identifies the question "What type of grasper **do you** prefer to use?" as *Requesting Instructor's Preference*, but not "What **do you want** to do next?". This is an important distinction to be able to make, as "do you" followed by "want" tends to indicate a polite deferral as opposed to a request for an instructor's preferred approaches.

All five automated coding algorithms were validated by two trained human raters. One rater was a surgical education research specialist familiar with the procedures discussed in the CME course; the other rater was a surgical resident who received instruction in qualitative coding of transcribed discourse. Prior to independent coding, these two raters discussed and came to an agreement as to how apply our chosen coding scheme. For each code, the human raters and coding algorithm then independently rated random samples of 50 utterances for each code. Cohen's kappa was calculated between the two human raters and between each human rater and the coding algorithm. To determine whether the kappa values obtained for these samples could be reasonably generalized to the whole dataset, Shaffer's rho (ρ) was calculated for each kappa using

the rhoR package for the R statistical software platform.[8] Rho can be interpreted similarly to a p-value and thus allowed us to measure the significance of agreement between raters. Because kappa was greater than or equal to 0.80 and rho was less than 0.05 for every code and all combinations of raters (Table 1), we used the automated coding algorithms to code all the utterances in the dataset. This automation reduced the total number of utterances that would need to be coded by human raters from 17,029 to 200.

Statistical approach

To analyze the frequencies with which participants asked certain types of questions, we measured how often each of the four types occurred as a proportion of each participant's total questions. This approach allowed us to account for inter-individual differences in how often participants asked questions as a proportion of their overall discourse. We then used standard linear regressions to measure the relationship between each participant's self-reported expertise and how often they asked each type of question. Significance of the relationships between these two variables was calculated using the F statistic and regression results were considered significant if the subsequent p-value was less than or equal to 0.05.

Results

Linear regressions of self-reported level of experience versus types of questions asked

Fig. 1 shows plotted regressions of participants' self-reported levels of experience versus the frequency with which they asked certain types of coded questions. Less experienced participants asked questions coded as *Requesting Guidance* and *Requesting Confirmation* significantly more often than their more experienced counterparts, who asked proportionally more questions coded as *Asking About a Specific Case*. Participants asked questions coded as *Requesting Instructor Preference* at the same frequency regardless of their levels of experience. This result suggests that all participants at the course were interested in how experts in the field of laparoscopic hernia repair approached their craft. Of the 8758 utterances made by learners, 3014 (34.4%) contained questions. No significant differences in this ratio or in the total number of utterances were observed between genders, between participants of differing experience levels, or between the participants of the 2015 and 2016 iterations of the course.

The strongest correlation observed among these results is between *Requesting Confirmation* and relatively lower levels of experience, followed closely by *Asking About a Specific Case*'s correlation with greater experience. This result is to be expected; relative novices to a given operative procedure will be less knowledgeable and less confident in the knowledge they possess, thus prompting a need to ask for confirmation of one's understanding of the procedure and the actions they need to take in order to perform it. Relative experts, by contrast, possess a framework of knowledge, skills, and experience that allows them to ask more detailed, specific questions about complex cases and alternative approaches to the operative procedure in question.

Discussion

Surgeons learning in a simulation-based CME context exhibit different needs as demonstrated by the types of information they request from their instructors. Less experienced learners tend to focus on asking for confirmation and guidance, while more experienced learners tend to focus on specific hypothetical scenarios related to their practice. All learners want to know about the preferences and practices of expert surgeons regardless of background.

This study provides insight into the teaching techniques that can help instructors better meet the educational needs of surgeon learners with varying levels of experience. Prior to instruction, knowing a surgeon learner's level of experience can assist surgical instructors in predicting the types of questions participants will ask. In this way, instructors can create an appropriate instructional plan for a simulation session that targets the educational needs of specific learner groups. They can also ensure that the information relayed to learners does not cause cognitive overload or, conversely, a wasteful reiteration of already-known information. In other words, while more advanced learners may benefit from learning the nuances of very specific cases, less experienced learners may gain nothing from such highly specific information because they lack the more foundational knowledge needed to understand and contextualize it.

The findings from this study can be used to help instructors modify their teaching during a session. For example, if during a course an instructor finds that their participants are frequently requesting particular types of information, such as asking about a specific case, this may be an indication that the learners have a higher level of experience. Consequently, instructors may need to modify their teaching practices to meet more advanced learner needs.

Previous studies have shown that students in a variety of contexts learn best when matched with students who possess similar

Table 1
Description and validation of discourse codes.

| Code	Definition	Example	Human 1 vs. Human 2		Human 1 vs. Computer		Human 2 vs. Computer	
			Kappa	Rho	Kappa	Rho	Kappa	Rho
Question	Asking a question	"Did you guys talk about defect closure?"	1.00	<0.01	1.00	<0.01	1.00	<0.01
Requesting Confirmation	Asking the instructor if what's being done is correct	"Like this?"	0.98	<0.01	0.89	0.04	0.91	0.03
Requesting Guidance	Asking the instructor what to do next or how to do something in the present procedure (as opposed to in a hypothetical)	"Okay, what's next?"	0.97	0.01	0.82	0.04	0.82	0.04
Requesting Instructor's Preference	Asking what the instructor prefers to do in a particular situation	"What do you prefer, do you use permanent or absorbable tacks?"	1.00	<0.01	0.98	0.01	0.98	0.01
Asking About a Specific Case	Describing a particular experience the participant has encountered in the past to serve as the basis for a question	"So the only thing sometimes I question when we put the mesh in …: Once you deflate, how do you know it just doesn't crumble, the mesh?"	0.98	<0.01	0.83	<0.01	0.80	0.02
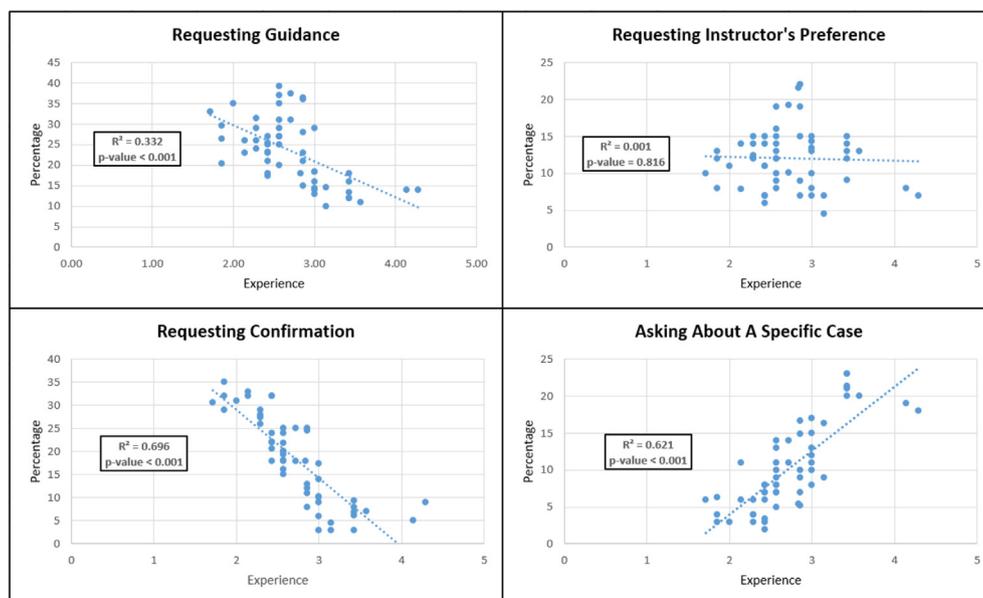
Fig. 1. Plotted regressions of self-reported expertise against frequency of types of questions asked during a hands-on surgical CME practicum. The frequencies with which participants asked questions coded as *Requesting Guidance* (top left) and *Requesting Confirmation* (bottom left) exhibit significant indirect correlations with level of experience, while *Asking About a Specific Case* (bottom right) exhibits a significant direct correlation. *Requesting Instructor's Preference* (top right), however, shows no correlation with level of experience.

levels of knowledge or expertise.[9] As such, it would behoove CME programs to match participants with others of similar backgrounds in order to ensure the best learning experience for everyone. However, even surgeons with similar backgrounds may have different goals. This means that the burden is on these learners to solicit the information they require in order to achieve their goals.

This study provides direction for future faculty development initiatives. There is very little research that offers guidance for surgical instructors utilizing simulation to teach and even less for those working with practicing surgeon learners with varying degrees of operative experience. Our findings offer tangible guidance on the tailoring of instruction to focus on content that learners of a particular level will benefit from most.

The implications of this study's results also extend to the development and implementation of CME courses. Since current CME courses attract surgeon learners from a wide variety of backgrounds and surgeon learners at different levels of experience have different learning needs, perhaps these varying needs could be better met by creating more diversity in simulation courses. For example, a simulation course focused on steps of the procedure may better benefit those who are new to laparoscopic techniques or new to the procedure. Alternatively, a more advanced course could focus on troubleshooting "difficult cases" for surgeons who perform this procedure in their practice. Also, if participants' main objective in signing up for CME courses is to discuss their field with experts and learn more about expert surgeon preferences, perhaps a different educational setting that is less resource intensive may be more appropriate in serving their needs.

The desire for these kinds of informal learning opportunities can be seen in the popularity of "meet-the-expert" sessions at the ACS Clinical Congress as well as the International Hernia Collaboration Facebook group, a forum in which interested surgeons and experts can post questions and answers relevant to their practices and respective domains of expertise. It is perhaps worth exploring the expansion of these types of informal educational experiences. However, even though online learning tools and question forums may support certain types of questions posed by learners, such as asking expert opinion or about a specific case, it may be difficult to support the needs shown by

novices in this study in these environments, specifically requesting guidance and requesting confirmation throughout the procedure.

Since this study took place at an ongoing CME course at a large national conference, we were unable to control several variables such as participants' prior experience with simulation, which could have altered the types of questions they asked during the simulation. In addition, the level of experience of participants was determined by self-assessment, which is highly subjective. Said experience may be more accurately measured by an objective skills assessment or case log submission. As this was a simulation-based CME course, it would be interesting to know if a similar trend of learner experience predicting the types of questions asked holds true in other CME learning contexts and how instructors' responses to these questions influence learning in the context of surgery CME. Although previous work has been done that addresses improving the development of CME courses,[10] further investigation of the learning environments specific to continuing medical education in surgery, which is currently lacking in the literature, will allow for more informed adoption of these recommendations.

Conclusion

In a simulation-based CME course, surgeon learners exhibit statistically different needs as demonstrated by the types of information they request from their instructors. Less experienced learners tend to focus on asking for confirmation and guidance; more experienced learners focus on scenarios related to their practice; and all learners inquire about the preferences of expert surgeons. These findings suggest interventions for future faculty development efforts in CME instruction and in further enhancement of surgical CME courses.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2018.11.027.

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