
BY

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DISSERTATION

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Abstract

The transformation of a surgical resident into a qualified surgeon is strongly influenced by supervising surgeons’ guidance in the operating room (OR). Supervising surgeons not only guides residents' learning of technical skills and medical knowledge in the operating room, but also facilitate their independence development. Although OR guidance is one of the core components of the surgical faculties’ duties, the nature of guidance and the means by which the OR guidance is to be provided by supervising surgeon are rarely explored in the past. Therefore, the elucidation of supervising surgeons' guiding behavior in the OR is greatly needed and is crucial for building up a theoretical base for future research.

This study was designed to explore how and why supervising surgeons provide guidance to residents in the operating room. A qualitative research design was used. Data were collected from fifteen cases through video based observations with semi-structured interviews, stimulated recalls with semi-structured interviews, and onsite observations. Qualitative data was analyzed by obtaining emergent themes. Key findings include:

1. A total of sixteen types of supervising surgeons' behaviors from the three OR guiding maneuvers (teaching maneuver, navigating maneuver, and assisting maneuver) were identified as OR guidance, including: physically showing, explain, learn from not appropriate decision, point out with instrument/finger, point out with camera, verbal direct/redirect, direct through teaching medical student, questioning, give feedback to resident's
question, ask next step, confirm and compliment, direct OR team, double check, remind, general comments, and doing part of the procedure.

2. A majority of the reported guiding behaviors were identified in both open procedures and laparoscopic procedures; "point-out" and "verbal direct/redirect" were two types of reported behaviors used most commonly; the reported frequency of teaching maneuver guiding behaviors was lower than those of navigating maneuver guiding behaviors and assisting maneuver guiding behaviors.

3. The difference of OR guidance reported by supervising surgeons and residents were observed in the overall reported frequency and the reported amount of OR guidance: surgeons and residents reported the same amount of guidance on nearly half cases; but the agreement on the overall frequency of reported OR guidance among surgeons and residents had a great range of variation.

4. A total of thirteen contributing factors which might influence supervising surgeons' decisions on guidance in the OR were identified. They were demonstrated in three dimensions: 1) Pre-OR initiators (case property, patient morbidity, case scheduling, trusted resident, and resident's foundation), 2) Intra-Operation influences (case progression, resident's confidence to perform, resident's personal traits, surgeon's previous experience, surgeon's comfort level, and surgeon's preferred way to do surgery), and 3) Rule-of-Control in the OR (surgeon's philosophy of training residents and patient safety).
These four findings suggest that building up a shared perception of OR guidance among surgeons and residents is highly recommended for surgical residency training programs which are envisioning to seek for effective methods to improve the current residency training. Another suggestion from this study is that the scaffolding of residents' learning is suggested to be built on residents' intra-operative case-based Zone of Proximal Development (ZPDs) in order to maximize their learning outcome in the operating room.
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CHAPTER 1

Introduction

Background

The level of interest in examining and enhancing approaches to surgical education has increased dramatically in recent years. In particular, there is a major focus on providing surgical skills training for both surgical residents and established surgeons (Lo & Chan, 1998). Surgery residency is a crucial stage of graduate medical training which usually lasts 5 to 7 years. Traditionally, surgical residents are taught and trained in the operating room (OR). The predominant training modality for surgery residents in the OR involves the resident performing operative procedures while a more senior surgeon supervises, teaches and assists the resident to practice, and to ensure high quality patient care and patient safety. From learning and assessment perspectives, this modality has many advantages as the teacher or trainer observes the entire performance and is in a position to provide feedback and/or evaluate either during or after the performance in the OR. However, residency training usually does not take full advantage of this modality, especially for residents' performance development and evaluation.

In surgery residency training, a supervising surgeon has to be in the operating room together with the resident during the operation. To guarantee patient safety, the supervising surgeon is necessary to provide guidance to the resident throughout the procedure and to facilitate the OR team’s support. For example, the supervising surgeon may draw the anatomy of fistula on the patient’s arm to help the resident conduct better incision planning.
A lot of guidance, which may be verbal or non-verbal and takes the form of prompting, direction, or cueing, for the resident during the operation, may be provided to help the resident perform better and learn better in the OR. The supervising surgeon may also include a performance evaluation of the resident's operative performance at the end of each rotation, or less commonly, evaluate the residents' operative performance right after the surgical case is performed.

Williams and his colleagues (2005) built up an operational definition of OR guidance for the Operative Performance Rating System (OPRS) evaluation instrument. In OPRS, OR guidance can "take many forms including verbal directions, physically setting up the environment (e.g., managing tissue planes), physically pointing out structures or problems (e.g., with the camera) and attending facial expressions, gestures and vocal intonation." And a 3-level rating scale is defined in the instrument: "3" - substantial guidance provided; "2" - some guidance provided; "1" - minimal guidance provided.

OR guidance is important for residents’ performance development. However, little is known about OR guidance, especially in the areas, such as the nature of OR guidance, the taxonomy of OR guiding behaviors, fading mechanisms used, and the factors controlling the frequency level of the OR guidance provided by the supervising surgeon.

There have been some studies reported regarding the clinical supervision. However, OR guidance is quite different from clinical supervision in medical education settings. Recent studies stated that clinical supervision was defined as the provision of monitoring, guidance and feedback on matters of personal, professional and educational development in the context of the trainee's care of patients (Kennedy,
Lingard, Baker, Kitchen, & Regehr, 2007; Kilminster & Jolly, 2000). And four levels of clinical supervision were defined by Kennedy and her team (2007). They are:

- Routine oversight: clinical oversight activities that are planned in advance;
- Responsive oversight: clinical oversight activities that occur in response to resident- or patient-specific issues;
- Direct patient care: refers to instances when a supervisor moves beyond oversight to actively provide care for a resident's patient;
- Backstage oversight: clinical oversight activities of which the trainee is not directly aware.

In medical education, "supervision" applies to broad-performance behaviors across different skill-domains (e.g. performance during a one-month clinical rotation); "OR guidance" is task/case based behavior which focuses on single performance (e.g. performance of a single surgical operative procedure) or even on a single aspect of one performance. Namely, on a single OR case level, guidance is more specific than supervision. Thus, improving single case training efficiency through appropriate guidance in the OR is important for surgical residents' learning in the operating room.

In surgical residency training, however, guidance is not just a component of supervision, especially when the resident is performing in the operating room (OR). In the OR, supervision adheres to the supervising surgeon, but guidance may be provided from both supervisors and non-supervisors in the OR, such as a skilled scrub technician. Thus, the scope of OR guidance source is larger than that of supervision. In addition, clinical supervision usually is passively provided by the supervising physician. But in surgery, the supervising surgeon has to be highly involved in the operation and actively
provides guidance to the resident throughout the surgical case to guarantee the patient safety.

From literature, many researchers have investigated some topics similar to OR guidance, such as coaching (Feltz, Chase, Moritz, & Sullivan, 1999; Mageau & Vallerand, 2003), and mentoring (Wood, Bruner, & Ross, 1976). Most of these earlier studies focused primarily on either describing the phenomena of coaching and mentoring in the cognitive domain with qualitative methods or presenting conceptual models of them in various fields. However, these studies provided little theoretical support for OR guidance. Because guiding, coaching, and mentoring differ from each other though they use similar skills and approaches. Coaching is short or long term task-based. It is performance driven but may be one-to-one and one-to-team intervention. Mentoring is long term relationship-oriented. It is development driven and always a one-to-one intervention. The unique characteristics of OR guidance make it distinct from coaching and mentoring. Guiding in the OR is a one-time, one-to-one, task-based intervention between the supervising surgeon and the resident. Namely, on the same day a resident may be guided by five supervising surgeons respectively if he/she performs five surgical cases in the OR -- this rarely happens in coaching and mentoring. Thus, variations of OR guiding behavior are significantly amplified.

However, the unique characteristic of the surgical residency training -- non-repeatable case-based training with high emphasis on patient safety -- limits the way to assess the OR guidance. In medical education, "supervision" is a broad performance-based behavior across skill domains; "OR guidance" is a task/case-based behavior which focus on micro-level technical skills, such as operative skills for Laparoscopic Cholecystectomy used in the operating room. One way to assess the OR guidance
provided by the supervising surgeon is to ask that supervising surgeon to self-report it. However, the supervising surgeon's dual roles of supervisor and evaluator may impact his/her judgment on the resident's operative performance, for evaluators tend to consistently construct one of a few possible interpretations of each trainee (Gingerich, Regehr, & Eva, 2011). In addition, many surgical residency programs may find hard to get appropriate instruments to assess OR guidance provided by supervising surgeons as well as residents' independent performance.

**Statement of Problem**

A crucial component of training in surgical residency is performing operative procedures in the Operating Room (OR) under the supervising surgeon’s guidance. In the OR, residents practice surgical skills and supervising surgeons provide guidance to residents as instant feedback to improve residents' performance and to ensure the patient safety. Although OR guidance has been considered as a core component of the duties of surgical faculties, the impact of OR guidance on residents' performance development has not been studied systematically and empirically. Since residents are expected to perform surgical cases independently and functionally at the end of training, the balance of providing adequate guidance while allowing resident’s independence in judgment is key to the successful training of residents (Itani, DePalma, Schiffner, Sanders, Chang, Henderson, & Khuri, 2007). The prerequisite for achieving this balance is that both surgical educators and faculties need to fully understand supervising surgeons’ OR guiding behavior and the way to measure it.

Unlike other terms which have been officially defined with clear standards, OR guidance is a term with various definitions based on different individuals. For example,
some supervising surgeons believe OR guidance should be unspoken, some others think everything the supervising surgeon doing in the OR can be called as guidance. No agreement on the definition of OR guidance can be found from the literature. A national survey of more than 750 surgical residents regarding resident educational satisfaction showed that: 40% sometimes felt overly supervised, and 21% often or always felt overly supervised; 61% of important postoperative patient management decisions were made with the resident and the supervising surgeon (Ko, Escarce, Baker, Sharp, & Guarino, 2005). Likewise, Chen et al (2011) reported that 80% of supervising surgeons underestimated the amount of guidance provided to the residents in the OR. Although the root causes for the survey results and the underestimation of the reported amount of OR guidance were not reported, different perceptions of OR guidance may be one reason that caused those variances. As a result, residency programs cannot provide appropriate assistance to enhance residents' performance development and skills acquisition based on their performance evaluation results. Thus, in surgical residency training, the OR guidance provided by the supervising surgeon needs to be factored into residents' performance evaluation. However, few studies explored OR guidance in surgical fields (Farner, 2009). Likewise, instruments for measuring OR guidance are hardly found in the published literature about surgical residency training, except for the Operative Performance Rating System (OPRS). Although some studies about Resident Supervision Index (RSI) instrument have been reported (Byrne, Kashner, Gilman, Aron, Cannon, Chang, Godleski, & et al., 2010; Kashner, Byrne, Henley, Golden, Aron, Cannon, Chang, & et al., 2010), the RSI instrument may not be able to measure OR guidance, for these two terms - OR guidance and clinical supervision - distinct from
each other as being discussed previously. Therefore a new study is needed to explore
the OR guidance.

As Ko et al (2010) stated in their survey report that excessive guidance in the OR
was a difficult issue in surgical residency training because although it was important for
faculties to remain cognizant of how “taking over” the case from residents might affect
their learning experience (and independence development), the faculties must
concomitantly provide the highest quality of care to their patients. Thus, studies about
the balance of adequate OR guidance and residents' training may be strongly
recommended after answering three important prerequisite questions: 1) whether the
supervising surgeon is able to identify what behaviors belong to OR guidance, 2)
whether the supervising surgeon is aware of the amount of guidance he/she provides to
the resident in the OR, and 3) whether supervising surgeons and residents are able to
reach agreement on the OR guidance, including the nature of OR guidance and the
amount of guidance provided/received. So, a study is needed to fill the gap above and
build up a theoretical base for future research.

**Purpose of the Study**

The study in this thesis is the second step from a series research about OR
guidance. Since supervising surgeons play an important role in residents' professional
development, the primary purpose of this study is to explore how the supervising
surgeon provides direct and indirect guidance to residents in the operating room by
beginning and developing a typology of OR guiding behaviors, investigating factors
impact supervising surgeons' decision-making of guidance, and whether the guidance
reported by residents is the same as that reported by supervising surgeons. The
guidance item from the Operative Performance Rating System (OPRS) was used in this study for investigating the relationship between supervising surgeons' and residents' judgments about the amount of guidance reported. OR guidance was explored using observations and stimulated recall with supervising surgeons and residents at the research site. The findings aided to de-construct the phenomenon of guiding in the OR, to build up hypothesis for a future theoretical OR guiding model based on resident performance development, to better educate surgical faculties about instructional techniques and training skills in the OR, and to extend the topic of OR guidance into future research. This study seeks to answer the following four important research questions:

1. What OR behaviors performed by the supervising surgeon can be defined as OR guidance?

2. What is the frequency of overall OR guiding behaviors being reported?

3. What differences exist between the amount of OR guidance reported by residents and by supervising surgeons?

4. What factors impact supervising surgeon' decisions regarding the amount and the type of OR guidance to provide in any particular situations?

**Significance of the Study**

This study describes the guiding behaviors in the OR and enables more extensive studies of the relationship between guidance and performance in future. Meanwhile, the study contributes to the existing body of literature regarding teaching in
the operating room and residents' operative performance development. It also expands
the knowledge about guidance in training professionals to fields beyond surgery.

This study is designed as a second step towards the development of a new
theoretical model about OR guidance. A typology usually consist of a set of descriptive
names or types, attached to thumbnail sketches of typical behaviors and/or attitudes for
each group. It may be based on specific behavior or on response to the client's brand.
Thus, this study is able to furthers the understanding about how OR guidance is defined,
how it occurs, and how it influences residents' learning in the operating room. These
findings will not only help researchers and surgical faculties to better understand the
guidance phenomenon in the OR, but also help to improve residents' OR performance
through appropriate guidance by better educating surgical faculties.

This study is beneficial not only to surgical training, but also to other fields of
professional education which focus on developing learners' job-related technical skills,
such as aviation training, athlete training, and driver training. The reason is that all these
training programs concentrate on developing learners' job-related technical skills,
cognitive skills, interpersonal skills, and leadership skills as well as making intra-
procedure decisions and managing the procedure in their professional working
environments. For example, aviation training (flight training) is a course of study in
learning to pilot an aircraft. Most pilots in the United States undergo flight training as
private individuals guided by a flight instructor, who may be employed by a flight school.
According to Part 61 of Federal Aviation Regulations, a student pilot is an individual who
is learning to fly under the tutelage of a flight instructor and who is permitted to fly alone
under specific limited circumstances. To obtain a certificate, a student pilot usually has
to undergo a course of training with a certificated instructor, accumulate and log specific aeronautical experience, and pass a three-part examination, including: a written knowledge test, an oral test, and a practical test carried out by either a Federal Aviation Administration inspector or a Designated Pilot Examiner. Despite the differences in the training contexts of aviation and those of surgery, these two high-risk domains present many similarities in dynamics of guidance provided by the instructor on-board and by the supervising surgeon in the OR, such as goals of guiding behaviors and interventions. Ensuring safety is the most important goal for the aviation instructor and the supervising surgeon to provide guidance to the trainee either on-board or in the OR. In both domains: 1) guidance is given to develop trainees’ job-related skills including technical skills, cognitive skills, and etc., 2) guidance can be provided in the formats of verbal direction and physical assistance, and 3) the relationships between trainee and trainer are not one-to-one long term orientated. Before becoming a professional pilot, the student pilot (trainee) may experience various instructors on-board -- this is exactly the same as that in surgery residency training where surgical residents work with multiple supervising surgeons during their 5-7 years training. As a result, aviation training may face similar challenges as what surgical residency training does: 1) ambiguous ways to assess the efficiency of guidance on the student pilot’s training and performance improvement, and 2) concerns about its (guidance) relationship with student pilot’s independence development. The OR guidance studied in this thesis precisely explored these challenges, and bridged the gap left by the existing supervision research. Therefore, the theoretical framework of OR guidance, which will be developed in future study, may also be applied in aviation training and other professional training programs, and helps to improve learners' performance development.
CHAPTER 2

Literature Review

The following literature review began with a discussion of the goals of surgical residency program. Then, the characteristics of surgical residency training under the umbrella of the cognitive apprenticeship model was reviewed, and followed by a discussion of two issues, including 1) what is known about resident performance development, which relates to skills acquisition and expertise development, and 2) the current state of resident performance evaluation. Next, the theoretical framework of guidance was discussed by reviewing the literature on instructional guidance, the theory of instructional scaffolding, Vygotsky’s Zone of Proximal Development (ZPD) theory, teaching in the operating room, and other related studies. Finally, the theory of instructional scaffolding was considered as the primary conceptual framework for this study.

Surgical Residency Training

The goal of residency training. Residency is an essential dimension of the transformation of the medical student to the independent practitioner along the continuum of medical education. The concept — graded and progressive responsibility — is one of the core tenets of American graduate medical education. The specialty residency training of physicians to practice independently is experiential, and necessarily occurs within the context of the health care delivery system. For the resident, the essential learning activity is the interaction with patients under the guidance and supervision of faculty members who give value, context, and meaning to those
interactions. And the supervision in the setting of residency training has the goals of assuring the provision of safe and effective care to the individual patient; assuring each resident’s development of the skills, knowledge, and attitudes required to enter the unsupervised practice of medicine; and establishing a foundation for continued professional growth.

According to the Definition and Scope of General Surgery (revision 08/2008) under the Accreditation Council for Graduate Medical Education (ACGME), the goal of a surgical residency program is to prepare the resident to function as a qualified practitioner of surgery at the advanced level of performance expected of a board-certified specialist. ACGME also lists six core competencies for all residency programs as observable and measurable metrics that residents are expected to accomplish. These six core competencies are: patient care, medical knowledge, interpersonal and communication skills, practice-based learning and improvement, professionalism, and system-based practice.

Educational process. In ACGME’s residency program requirements, educational process is clearly defined that it must lead to the acquisition of an appropriate fund of knowledge and technical skills, the ability to integrate the acquired knowledge into the clinical situation, and the development of surgical judgment. During surgical residency training, the educational process of a resident is in fact a process of developing his/her expertise. In general, a surgical resident obtains operative experience throughout the five post-graduate training years (PGY). The type of procedure, the number of cases, and the single case difficulty level will be increased

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1 Source from: http://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/440_general_surgery_01012008_07012012.pdf
along with residents’ post-graduate level. By the time the resident finishes the program, the resident will have performed an average of 1100-1200 cases\(^2\). Before obtaining board certificates in general surgery, residents are required to pass the General Surgery Qualifying Examination (QE) and the General Surgery Certifying Examination (CE). In Illinois, the average success rate on residents' first attempt for both QE and CE was 68.8% from 2007 through 2012.\(^3\)

After the completion of the 5-year residency training, a surgeon can attend a fellowship as an extension of the educational process if additional training is desired. Fellows are allowed to perform more independently in the operating room (OR), and the supervising surgeon may or may not be required in the OR while a fellow is performing the operation.

**Cognitive apprenticeship.** The traditional model of learning in medical practice settings has been that of apprenticeship learning where students start by observing clinical practitioners and are given more tasks to perform as their competence grows gradually (Stalmeijer, Dolmans, Wolfhagen, & Scherpbier, 2009). The central concept of apprenticeship is more experienced people assisting less experienced people by providing instructions and examples to support the attainment of goals (Dennen, 1996). When the apprenticeship model is used in the cognitive domain, it is called cognitive apprenticeship. In 1987, Collins and his team introduced the first cognitive apprenticeship and defined it as “teaching methods that are designed, among other things, to bring these tacit processes into the open, where students can observe, enact, and practice them with help from the teacher and from the other students” (Collins,

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\(^2\) Source from: http://www.siumed.edu/surgery/residency.html

\(^3\) Source from http://www.absurgery.org
Brown, & Newman, 1987, p. 4). This definition represents the core of cognitive apprenticeship as learning-through-guided-experience. However, it is not just learning by doing. Cognitive apprenticeship focuses more on developing cognitive and problem-solving skills rather than physical skills in a specific context (Collins et al., 1987; Dennen, 1996).

According to Stalmeijer and colleagues (2009), there is a pivotal role in the cognitive processes of experts during complex task performance within the cognitive apprenticeship model. Sternberg and Horvath (1999) noted that making explicit the tacit cognitive processes of experts can elucidate complex task performance and help students in observing, enacting, and practicing such tasks. Taylor and Care (1999) also reported that in highly cognitive professions, such as medicine, students can benefit from insight into the cognitive processes underlying expert performance, which can make it easier for them to reproduce certain procedures on their own.

There are six teaching methods that support the goals of cognitive apprenticeship. They are: modeling, coaching, scaffolding, articulation, reflection, and exploration (Collins et al., 1987). The first three methods are the core of cognitive apprenticeship, and are designed to help students acquire and integrate sets of cognitive and meta-cognitive skills through observations and guided practice.

Research shows that a drawback of the cognitive apprenticeship model in learning is driven by day-to-day demands of the workplace where learning opportunities and supervision do not have first priority (Collins et al., 1987; Dornan, 2006; Stalmeijer et al., 2009; Taylor & Care, 1999). During residency training, conflicts between daily service (for patients) and education (of residents) have been recognized as one of the
major barriers in developing residents’ competency (Wartman, Sullivan, and Cyr, 1990). A case in point, in the OR, the supervising surgeon usually has to provide substantial guidance to the resident who is performing the case to ensure patient safety, even though the resident may not need that amount (of guidance).

Another possible weakness of this cognitive apprenticeship model is the difficulty of measurement, especially in measuring the amount of guidance provided -- which is needed and vital for trainees' performance development-- by the instructor or other experienced people as well as the degree to which it may influence trainees' learning outcomes. Although many studies have been conducted to investigate methods for measuring cognitive complexity (Rauterberg, 1992), cognitive style (Lohman & Bosma, 2002), and cognitive psychology (Embretson, 2006), little research has been done to directly explore how guidance provided by experts/trainers, who are the key component in the cognitive apprenticeship model, impacts trainees' performance development and learning outcomes. Fortunately, from the literature of medical education and performance improvement, there are two major theoretical frameworks that may be used to explain residents' performance development. They are expertise development and skills acquisition. These two frameworks support the theoretical base of residency training, and provide a rational explanation of why OR guidance is needed during training indirectly. These frameworks will be discussed in the following section.

**Expertise development.** Expertise development is one of the most rapidly expanding topics within psychology, training, and education. In this section, two perspectives of expertise development will be reviewed: 1) Anders Ericsson expertise theory, and 2) the Dreyfus & Dreyfus model.
**Anders Ericsson expertise theory.** Ericsson (2006) referred to expertise as the "characteristics, skills, and knowledge that distinguish experts from novices and less experienced people". From his recent research in sports (Ericsson, Prietula, & Cokely, 2007), Ericsson and his colleagues indicated that outstanding performance was the product of years of deliberate practice and coaching, not of any innate talent or skill. Ericsson used a golf game case to illustrate the player’s performance was not improved after some point even if he/she spent additional time on the course. And then he brought up the importance of deliberate practice to develop expertise. Deliberate practice, according to Ericsson, et al, includes two kinds of learning: improving the existing skills and extending the reach and range of current skills. However, experts who have reached a high level of performance often neglect deliberate practice, for they may be too familiar with the situation and respond automatically. Ericsson also pointed out that expert performance was difficult to measure. At the end, Ericsson suggested that experts in training might need different kinds of teachers at different stages of their expertise development.

Ericsson's expertise theory primarily comes from non-life-threatening settings, such as sports, music, and the arts, thus, not all his findings and recommendations work for medical residents’ expertise development which happens in a clinical setting. For example, in the clinical setting, a surgical resident cannot only follow one supervising surgeon to practice in the OR during his/her first year training. Because 1) although patients come in and out every day, no patient case can be the same; 2) different rotations have surgical faculties (surgeons) from different specialties. Residents have to work with all surgical faculties simultaneously throughout the residency training to obtain
sufficient operative experience. This conflicts with Ericsson's suggestion about "different kinds of teachers are needed at different stages" to some degree.

**Dreyfus and Dreyfus model.** Dreyfus and Dreyfus (1980, 1986) have published a five-stage model of individual expertise development. The five stages are: novice, advanced beginner, competency, proficiency, and expert. In novice stage, beginners are context free and recognized as people without experience. In this stage, self-observation and/or instructional feedback can help to improve novice's performance and expertise. A novice usually progresses to the advanced beginner stage after a period of time of exposure to the field. And the competency stage comes after the advanced beginner. Learners at this stage can have better general performance, take increased responsibility, and have stronger ability to handle complex situations. Benner et al. (1996) pointed out that emotions had significant impact on learners' performance on this stage. Proficiency is the fourth stage in the model. Here learners can use intuition in decision-making, and develop a perception of both time and reasoning through observed transitions. Experts in the last stage are "able to see the big picture, see situations in different ways and weigh alternatives" (Dunphy & Williamson, 2004, p. 112). And many aspects of their performance are interlinked, so as to improve the overall performance.

The main idea of Dreyfus and Dreyfus model is that intuition is a major aspect of expertise. Although Benner (1984) applied this model to nursing practice regarding the acquisition and development of skills, the Dreyfus and Dreyfus model does not fit in surgical residency training very well. For one thing, the five stages of Dreyfus model do not match well with the educational goal and process of surgical residency training
which involves 5-7 years post-graduate training. According to the surgical residency training goal (see p. 11), a resident may not reach the "expert" level stated in the Dreyfus and Dreyfus model. In addition, residents' expertise level cannot be simply defined by their PGY level. For the other, the Dreyfus model presents the development stages of individual learner's intuition/expertise without the consideration of supervisor's guidance. Although Dreyfus and Dreyfus used the terms "rules" and "tasks" in the description of the original model, no human supervisors and the supervisor's guidance were addressed -- which are two key components of current surgical residency training. Therefore, surgical residents' performance development will become hard to estimate and measure if put in the Dreyfus and Dreyfus model.

**Skills acquisition.** From Merriam-Webster dictionary, "skill" refers to the ability to use one's knowledge effectively and readily in execution or performance. The category of a skill (e.g. motor skills) and the complexity of a skill are very important in the acquisition of that skill. In addition, skill acquisition can also be influenced by the level of the learner, his/her personal traits, relationship with others, and the way skills are taught/learned. In surgical residency training, skills acquisition influence residents' performance development directly.

The teaching of surgical skills in the OR is constrained by the complexity of procedures, medical concerns (patient safety), time limits, and fiscal issue. Thus there is little opportunities for residents to reflect during a procedure (MacIntyre & Munro, 1990; Steele, Logie, & Munro, 1989). From surgical training literature, Fitts and Posner's (1967) three-stage model for psychomotor skill acquisition is widespread and considered to represent how surgical skills and techniques are acquired (Dunphy &
Williamson, 2004; Hamdorf & Hall, 2000; Kaufman, 1987; Kopta, 1971; Lippert, 1975; Lippert & Farmer, 1984). The three stages in this model are:

1. Cognitive: residents try to define the goal and methods of the task; but frequent errors may make his/her performance quite variable.

2. Associative/Integrative: residents practice skills, try to avoid ineffective movements in the task, and are able to recognize inappropriate performances; his/her performance becomes consistent; fewer errors; refinement of skills can be produced by quality practice.

3. Autonomous: residents do not need to think about each step or rely on external clue to apply his/her skills; movements appear automatic, stable and effortless.

During the phase of surgical skill acquisition, knowledge of results becomes an essential part of the surgical training process (Dunphy & Williamson, 2004). Evaluation information is the knowledge of the results. It is provided to the resident after the completion of a procedure relevant to the adequacy of performance in that practice trial. Residents cannot acquire adequate psychomotor skills and motor skills without the presence of knowledge of results (Newell, 1974). There may be great potential harm for a resident to practice and not know either if he/she is performing adequately, or what must be done to correct any errors. But guidance and/or supervision provided by the supervising surgeon may diminish this risk for a resident at some level. Therefore, for better skill acquisition and for better training outcome, performance evaluation is necessary for surgical residency programs to determine how much guidance should be provided for residents in different surgical skills development stages and to estimate the impact of guidance on residents' training outcomes.
**Performance evaluation in residency training.** Swanson (1999) introduced a Systems Model of Performance Improvement (Figure 2.1) which is a five-phase process working with other core processes within an organization. The final "Assess" Phase Ones focused on the evaluation of performance outcomes, so the organization is able to determine performance improvement progress from the evaluation results. Evaluation is reported to have different roles in different views of performance improvement (Sleezer, Zhang, Gradous, & Maile, 1999), but Swanson (1999) believes that performance improvement can only be manifest through outputs, and changes in outputs can only be accessed through some form of measurement.

*Figure 2.1 Systems model of performance improvement.*

However, in practice, the concrete determinants of performance differ in various workplace settings. As a result, the meanings of the evaluands - the subject of an evaluation -- will change with practical contexts. Guerra-Lopez (2008) defined
evaluation as a concept that "compares results with expectations; finds drivers and barriers to expected performance; produces action plans for programs and solutions being evaluated so that expected performance is achieved or maintained and organizational objectives and contributions can be realized". Based on this concept, the evaluation of residents' operative performance in surgical residency training is to assess whether the resident is able to achieve the expected performance in the OR under the supervising surgeon's guidance.

Residency programs should be able to determine the progression of residents' performance and know more about performance improvement process from the evaluation results which are collected through appropriate evaluation instruments. Thus, a lot of residency programs design instruments for their performance evaluations, and use these evaluation instruments as tools to improve residents' performance.

According to the Accreditation Council for Graduate Medical Education (ACGME), thirteen evaluation tools are listed for U.S. residency programs to assess residents' competency and performance (see Table 2.1). Though these evaluation tools are recommended by ACGME, their reliability is still a critical issue which has been questioned a lot. For example, the use of portfolio is growing; but its inter-rater reliability was reported to not reach a level which could support making a safe summative judgment on residents' performance and competency (Pitts, Coles, & Thomas, 1999; Pitts, Coles, Thomas, & Smith, 2002).
<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Recommended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>360-Degree Evaluation Instrument</td>
<td>Assess interpersonal and communication skills, professional behaviors, and some aspects of patient care and system-based practice.</td>
</tr>
<tr>
<td>Chart Stimulated Recall Oral Examination (CSR)</td>
<td>Assess clinical decision-making and the application or use of medical knowledge with actual patient.</td>
</tr>
<tr>
<td>Checklist Evaluation of Live or Recorded Performance</td>
<td>Assess any competency and competency component that can be broken down into specific behaviors or actions.</td>
</tr>
<tr>
<td>Global Rating of Live or Recorded Performance</td>
<td>Used for marking the end of rotation and summary assessments about performance observed over days or weeks.</td>
</tr>
<tr>
<td>Objective Structured Clinical Examination (OSCE)</td>
<td>Provides a standardized means to assess physical exam and history taking skills, communication skills with patient and family members, breadth and depth of knowledge, ability to summarize and document findings, ability to make a different diagnosis or plan treatment, clinical judgment based on patient notes.</td>
</tr>
<tr>
<td>Procedure, Operative, or Case Logs</td>
<td>Useful for determining the scope of patient care experience</td>
</tr>
<tr>
<td>Patient Surveys</td>
<td>Assess satisfaction with patient care competencies, interpersonal and communication skills, professional behavior, and aspects of system based practice.</td>
</tr>
<tr>
<td>Portfolios</td>
<td>Evaluating mastery of competencies that are difficult to evaluate in other ways such as practice based improvement.</td>
</tr>
<tr>
<td>Record Review</td>
<td>Provide evidence about clinical decision-making, follow-through in patient management and preventive health services, and appropriate use of clinical facilities and resources</td>
</tr>
<tr>
<td>Simulations and Models</td>
<td>Assess clinical reasoning, diagnostic plans and treatment for a variety of clinical disciplines as part of licensure and certification examinations.</td>
</tr>
<tr>
<td>Standardized Oral Examination</td>
<td>Assess clinical decision-making and the application or use of medical knowledge with realistic patient.</td>
</tr>
<tr>
<td>Standardized Patient Examination (SP)</td>
<td>Assess history-taking skills, physician exam skills, communication skills, differential diagnosis, laboratory utilization, and treatment.</td>
</tr>
<tr>
<td>Written Examination (MCQ)</td>
<td>Medical knowledge and understanding can be measured by MCQ examinations. Helpful to identify residency training experiences that might be improved</td>
</tr>
</tbody>
</table>
The ACGME's suggested uses of these thirteen evaluation tools are organized by core competencies instead of residency specialties. In this way, some evaluation tools may be very popular in some medical specialty, but may not be suitable for residency programs in other specialties, especially the residency program in surgery. Currently a surgical resident's OR training outcome integrates the resident's independent operative performance with the impact of OR guidance provided by the supervising surgeon. Since supervising surgeons are highly involved in residents' OR training, a new way needs to be found out to assess residents' independent performance in the OR. However, none of the thirteen ACGME evaluation tools are designed to address the impact of guidance from supervising surgeons and to assess residents' independent operative performance.

Recent studies showed that a new evaluation instrument called operative performance rating system (OPRS) was useful in addressing the amount of guidance reported by the supervising surgeon and tracking resident development throughout residency training. On the OPRS instrument, "Guidance" is a 3-point scale item which is defined as taking many forms of behaviors including verbal directions, physically setting up the environment (e.g. managing tissue planes), physically pointing out structures or problems (e.g. with the camera) and attending facial expressions, gestures and vocal intonation. Data collected from the guidance item at least provides a clue for performance reviewers to adjust the resident's performance outcome, and assess whether the resident has achieved the expected development goals. Namely, in some degree the OPRS instrument is helping to assess residents' independent operative performance. The OPRS evaluation items are procedure-specific and unique to each surgical procedure. Therefore, OPRS instrument offers a structured means of certifying
operative skills (Larson, Williams, Ketchum, Boehler, & Dunnington, 2005). It is able to provide objective assessment of operative performance and technical skills, and serves as a reliable indicator of residents’ real independent performance (Kim, Williams, Boehler, Ketchum, & Dunnington, 2009).

Although the Accreditation Council for Graduate Medical Education (ACGME) has a clear set of national standards for surgery residency programs, there are many differences among programs themselves, such as the size of the institute, the size of the patient base, the number of residents, and the number of faculties. Thus, each program is given some level of autonomy in deciding how to evaluate residents' performance beyond the national standards. But some research has pointed out that within a program there were as many models of evaluation as there were faculty members (Anwar, Bosk, & Greenburg, 1981), and a consistent evaluation of resident operative performance was necessary but difficult to achieve (Kim, Williams, Boehler, Ketchum, & Dunnington, 2009). To help surgical residency programs accurately assess residents' operative performance, the current study of supervising surgeons' OR guiding behavior is necessary. The nature of OR guidance, how and why supervising surgeons provide guidance are unique components of operative performance evaluation and development regardless of the models of evaluation (instruments) used. In the following section, the theoretical framework of guidance will be introduced to support this OR guidance study.

**The Theoretical Framework of Guidance**

Research indicates that effective learning in medical practice strongly relies on good clinical supervision (Dolmans, 2002; Dornan, 2006). This finding is inarguably true
in surgical residency training. For better learning and teaching outcomes, the supervising surgeon usually provides guidance for the resident during the operation. Although providing guidance in the operating room (OR) is common in surgical residency training, the nature of guidance, the relationship between the amount of guidance and performance ratings, the impact of guidance on residents' performance development, and how supervising surgeons provide guidance are still unclear.

**Definition of guidance.** A common definition of the term “guidance” beyond the Human cognitive architecture and cognitive load theories context, as found in the Merriam-Webster online dictionary, is that guidance is the act or process of guiding, the direction provided by a guide, or advice on vocational or educational problems given to students. The operational definition of guidance used in this study comes from the Operative Performance Rating System (OPRS) evaluation instrument (Williams, et al., 2005). In OPRS, guidance can be direct or indirect, and take many forms including verbal directions, physically setting up the environment (e.g., managing tissue planes), physically pointing out structures or problems (e.g., with the camera) and supervising surgeon's facial expressions, gestures and vocal intonation.

Guiding (in the OR) overlaps coaching to some extent on the single surgical case level. Coaches usually act as collaborators and partners to assist practitioners to develop a better understanding of their own performance, but coaches do not judge or instruct -- they help practitioners to use their knowledge, experience, and abilities to provide the best care possible (Greenberg, 2012). Likewise, when the supervising surgeon provides guidance in the OR, he/she may act as a partner and assist -- not instruct and/or direct -- the resident in order to help the resident provide the best care.

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treatment for the patient. But this type of guiding relationship will only exist when the surgical case is performed by a senior (PGY4 and PGY5) resident who has more operative experience than junior residents and is trusted by the supervising surgeon. Supervising surgeons have to instruct and direct junior residents' performance in the OR due to the consideration of patient safety.

However, given the entire surgical residency training domain, coaching and guiding are distinct from their applicable subjects and working models/relationships. As discussed above, coaching may not be applicable if the surgical case is performed by a junior resident, because the supervising surgeon may make judgments in the case and instruct/direct the resident during the case. But guiding residents in the OR may work throughout the 5-year residency training regardless the level of residents. Because guiding in the OR may include directing, teaching, assisting, and facilitating behaviors from the supervising surgeon. In addition, coaching and guiding have different working models/relationships: in professional training fields other surgery, coaching is either a one-to-one or one-to-multiple long-term relationship between the coach and the trainee; in surgical residency, guiding is a one-time one-to-one one-task working model which means one resident has to work with various supervising surgeons in the OR. Based on the surgical residency training goals, the supervising surgeon’s guiding behavior in the OR is both performance driven and development driven. The OR guidance is to develop residents' operative performance to the expected level but not sacrifice the patient safety.

From the discussion in the last section, guiding in the OR is the center of surgical residency training because residents learn through practical operations guided by
supervising surgeons throughout their five-year training period. However, what is the theoretical foundation behind guiding behavior? How should the supervising surgeon provide guidance for the resident in the operating room? From the following literature review, the theory of instructional scaffolding can be considered as an appropriate theoretical framework for supporting the behavior of guidance.

**Theory of scaffolding.** Although Sweller (2006) and Hmelo-Silver (2007) had a strong argument in the form of minimal guidance approaches, Sweller (2008) pointed out guidance should have fading effects. The guidance fading effect (Renkl & Atkinson, 2003) occurs when novices are initially presented with worked examples, but with increasing expertise those worked examples are replaced by completion problems. This truly aligns with the residency training goals and residency programs’ graded and progressive responsibility for residents. And the guidance fading effect fits the characteristics of Instructional Scaffolding model.

**Instructional scaffolding.** The term ‘scaffolding’ was first introduced by Wood, Bruner, and Ross (1976) to describe the process in which a child or novice could be assisted to achieve a task they may not be able to achieve if unassisted, until they are able to perform the task on their own (Dennen, 1996; Wood, et al., 1976). In the construction industry, scaffolds are temporary structures that physically support workers while they complete jobs that would otherwise be impossible. In education, the scaffold is a metaphor which is the basis for a theoretical model of the teacher in informal education (Greenfield, 1984). Scaffolding closes the gap between task requirements and the skill level of the learner, creating what Hunt (1961) called "the match" between the cognitive level of the learner and the characteristics of instruction”. But scaffolding
does not involve simplifying the task during the period of learning. Instead, it holds the task constant, while simplifying the learner's role through the graduated intervention of the teacher (Greenfield, 1984). In other words, the scaffold may not be built unless the teacher is able to identify what information or skill students are lacking, and then the teacher can bridge the gap with scaffolding to enable students to reach the new knowledge and skills.

**Practical applications.** Since the late 1970s, an increasing number of educators and researchers have used the concept of scaffolding as a metaphor to describe and explain teaching and learning in different areas. In many practical cases, scaffolding is a learner-centered strategy whose success is dependent on its adaptability to the learner’s needs. Scaffolding may support a wide range of instructional targets including: learning domain knowledge, learning about one’s own learning, and learning how to adapt to a particular instructional context. Within each of these instructional targets, scaffolding may support the development of declarative, procedural, conceptual, or meta-cognitive knowledge (Azevedo & Hadwin, 2005). Four attributes are associated with scaffolding regardless of the instructional targets. These attributes are: diagnosis, calibrated support, fading, and individualization. Usually the diagnosis and calibrate support are on-going. However, decisions on when and how much to fade instructions is based on the instructor's observations of student behavior during the scaffolding process. The gradual removal of instruction allows the teacher to evaluate to what degree the student has grasped the concept or idea, and then provide better next level "calibrated support". This is also true in surgical residency training.
According to the program requirements that a supervising surgeon has to work with the resident in the operating room regardless of the resident's PGY level, the supervising surgeon should decrease the amount of OR guidance provided to the resident gradually in order to help him/her develop performance towards the training goal. Figure 2.2 shows a modified scaffolding model in surgical residency training.

To help the resident to achieve the expected performance outcome, the supervising surgeon provides guidance to the resident in the OR. Supervising surgeons' guiding behaviors may be planned and/or subconscious. Usually more OR guidance will be given to residents with lower PGY levels as a counterbalance to their competencies/skills which are still in the early development stage.

![Figure 2.2 Scaffolding model in surgical residency training.](image-url)
However, the amount of OR guidance provided by supervising surgeons should be faded out along with the growth of residents' competencies/skills, for the goal of surgical residency training is to prepare the resident to function as a qualified independent practitioner of surgery. Thus, the instructional scaffolding is appropriate to serve as the theoretical foundation for this study. Likewise, how to provide OR guidance based on residents' needs and their levels of competencies/skills development become very important for scaffolding.

Today, scaffolding theory has been applied to different fields including childhood education, adult learning, and computer based learning. For example, Morelock and his research team (2003) noted in their study that mothers adapt their scaffolding to the perceived abilities of their children; Kao (1996) postulated that scaffolds could be embedded in hypermedia or multimedia software to provide students with support while using the software; Hmelo-Silver (2006) developed guidelines for applying scaffold in technology-based inquiry. Additionally, some recent studies have provided evidence that when students learn about complex topics with computer-based learning in the absence of scaffolding they show poor ability to regulate their learning, and fail to gain a conceptual understanding of the topic (Azevedo & Cromley, 2004; Greene & Land, 2000; Hill & Hannafin, 1997; Land & Greene, 2000).

**Limitation.** The limitation of the instructional scaffolding literature is that majority of studies were focused on domain knowledge and/or meta-cognitive processes, such as the acquisition of meta-cognitive skills, strategic learning, and other self-regulatory processes. Very few studies addressed how to apply scaffolding theory and/or models
on the acquisition of technical skills in micro-level within high-risk professional domains, such as surgical residency training. And this limits its contribution to the current study.

**Zone of Proximal Development (ZPD).** Although the term "scaffolding" was first introduced to educational research by Wood, Bruner, and Ross in 1976, the concept of scaffolding was derived primarily from the Zone of Proximal Development (ZPD) theory developed by Lev Vygotsky (1962, 1978). Zone of Proximal Development is at the heart of scaffolding. In the next section, the concept of ZPD, the relationship between ZPD and scaffolding, and the recent studies of ZPD will be reviewed.

**ZPD and Scaffolding.** The Zone of Proximal Development (ZPD) has been defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Vygotsky believed that when a student was in the zone of proximal development for a particular task, providing the appropriate guidance (scaffolding) would boost the student's ability to achieve the task. Once the student, with the help of scaffolding, was able to master the task, the scaffolding (guidance) should then be faded little by little to enable the student to complete the task all on his own.

Learning within the ZPD can be divided into four stages (Dunphy & Dunphy, 2003, p. 49-50).

- Stage one is where the performance is assisted by more capable others. In the early stages, the learner may have a limited understanding, the expert offers directions or modeling, and the learner's responses are
acquiescent or imitative. During stage one, there is a steady decline plane of teacher responsibility for task performance and a reciprocal increase in the learner’s proportion of responsibility.

- Stage two is where the performance is assisted by itself. In stage two, the learner carries out a task without assistance from others except of experts. What was guided by others is now beginning to be guided and directed by the learner. At the micro-genetic level, adults consistently talk to themselves, and assist themselves in all ways possible.

- Stage three is where performance is developed, and automatized. Once all evidence of self-regulation has vanished, the learner has emerged from the zone of proximal development (ZPD) into the developmental stage of the task. Assistance at this stage could be disruptive.

- Stage four is where de-automatization of performance leads to recursion back through the ZPD. Lifelong learning by an individual is made up of these same regulated ZPD sequences, from other-assistance to self-assistance, recurring over and over again for the development of new capacities.

Dunphy & Dunphy (2003) also indicated that stage one was where performance is assisted by more capable others. In fact, the amount of outside guidance depends on the nature of the task and the characteristics of the learner. As the learner develops his/her capacities to full extent, the expert should diminish guidance to the zero level.

Hmelo-Silver stated that “scaffolding makes the learning more tractable for students by changing complex and difficult tasks in ways that make these tasks
accessible, manageable, and within the student’s zone of proximal development” (Hmelo-silver, et al., 2007, p. 100). Vygotsky’s ZPD refers to the gap between what a given learner can achieve alone, their potential development as determined by independent problem solving, and what they can achieve through problem solving under adult guidance or in collaboration with more capable peers (Bliss & Askew, 1996). The ZPD is a dynamic region that is just beyond the learner’s present ability level; as learners gain new skills and understanding, their ZPD moves with their development (Dennen, 1996).

The ZPD is a critical concept for providing scaffolding. According to Dennen (1996), scaffolding affects learners both cognitively and emotionally. It impacts not just learners’ skills and knowledge, but also learners’ motivation and confidence when approaching a task and these impacts must occur within the ZPD. The limitation of Vygotsky’s definition of the ZPD is that it may leave open the task of identifying the nature of the guidance and the collaboration needed (Bliss & Askew, 1996). Another limitation of the ZPD may be that it does not present how to quantify adult guidance along with learners’ development in the model. However, there is a consensus that Vygotskian socio-cultural psychology and the notion of the zone of proximal development are at the heart of the concept of scaffolding (Berk, 2001; Daniels, 2001; Wells, 2001; Krause et al, 2003; McDevitt & Ormrod, 2002).

Although the value of ZPD to scaffolding is not arguable, the interpretations of their relationship are various in the literature. For example, Mercer and Fisher (1993) viewed the ZPD characteristic of transfer of responsibility for the task to the student as the major goal of scaffolding in teaching (Verenilcina, 2003). The interpretations of the
relationship between ZPD and scaffolding may be different in different educational contexts. These interpretations still have some common features, including the emphasis on learning leading development, and on the role of adult assistance and guidance in enabling the learner to do in collaboration with more expert while the learner is not yet able to do alone (Wells, 1999, p. 314).

**Research about ZPD.** Nyikos and Hashimoto (1997) discussed the cognitive apprenticeship in search of the ZPD within the constructive learning in teacher education. They indicated in ideal apprenticeship, trainees continue to build personal empowerment through increasing practice; power-sharing and mutual understanding were required for the ZPD to function; without a strongly supportive social interaction, the ZPD for both individual and group learners was undermined. Although Nyikos and Hashimoto's study reported one key requirement -- the social interaction -- for the ZPD to function, some theoretical concerns about the concept of ZPD still need to be addressed, such as the operational definition of "development" under different interpretations of the relationship between ZPD and scaffolding. For example, if applying the ZPD and scaffolding on surgical residency training, supervising surgeons may want to clarify the resident's boundary of the "zone of ZPD". And then the supervising surgeon can provide guidance to this resident based on the assessment of his/her development stage.

Another recent study of ZPD was in the field of medical education. Dunphy & Dunphy (2003) theoretically applied ZPD as an educational model and approach to existing knowledge about surgical skills acquisition, and then suggested ZPD would "provide a valuable framework for planning and assessing surgical education programs"
In their paper, Dunphy & Dunphy (2003) outlined the association between stages of the ZPD, stages of acquiring psychomotor skills and medical terminology used to describe learning processes (Table 2.2). They stated that in any domain of skill "teaching can be said to occur when assistance is offered at points in the ZPD at which performance requires assistance" (Dunphy & Dunphy, 2003, p. 49). The nature of the task or performance may be a major variable in providing assistance and/or guidance within ZPD. When the development of independence is defined as a goal, such as the training goal of surgical residency programs, the pattern of assistance and/or guidance provided by the expert should be more responsive, contingent, and patient. So, if "assistance" is offered at too high a level, it may disrupt learner performance and is not effective teaching.

<table>
<thead>
<tr>
<th>Stage of the ZPD</th>
<th>Psychomotor Phases</th>
<th>Medical Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>Cognitive and integrative/associate</td>
<td>Skill training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The learning curve</td>
</tr>
<tr>
<td>3</td>
<td>Autonomous</td>
<td>Competence</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>None routinely used</td>
</tr>
</tbody>
</table>

Dunphy & Dunphy also summarized the association between stages of the ZPD, stages of acquiring psychomotor skills and medical terminology used to describe learning processes in surgical education. After reviewing related literature, Dunphy & Dunphy pointed out that stage one and stage two of the ZPD might belong to some surgical procedures (Boeckx, Gruft, & Brosens, 1985; Cox et al., 2001; Dunphy,
Sheperd, & Cooke, 1997; Trimbos, Hellebrekers, Kenter, Peters, & Zwinderman, 2000), and some procedures were of such complexity that not every surgeon might be able to master them (Graham & Deary, 1991; Murdoch, Bainbridge, Fisher, & Webster, 1994). These two stages had also been described as the learning curve (Dunphy, Sheperd, & Cooke, 1997). During stage two of the ZPD, the surgeon "is learning to carry out a task without assistance from others" (Dunphy & Dunphy, 2003, p. 53). In addition, Dunphy and Dunphy also addressed that surgical procedures, required technical skills, goals, and the level of (case) complexity should be able to impact the assistance and/or guidance provided at different stages in the ZPD.

Pratt (2009) stated Zone of Proximal Development (ZPD) can be considered as a critical educational strategy for surgical residency training. Within the zone of the ZPD, there were a lot of things residents can do with guided discovery and direct practice -- this was where the supervising surgeon taught and guided the resident in the OR. Beyond this zone of the ZPD, residents are either able to do things by themselves or not able to do things even with the supervising surgeon's assistance. Pratt (2009) also presented an approximate scaffolding model in the OR (Figure 2.3).

**Teaching in the operating room.** Daniel Pratt and his colleagues pointed out "adult and higher education are pluralistic in purpose and procedure, in context and content, and in regard to what is considered effective teaching" (Pratt, D, 1998, p. 4). Teaching in the operating room is a good case in point under Pratt's proposition. Because it is different from traditional teaching in the classroom due to the contextual influences in the OR, such as time sensitivity (e.g. urgency of patient situations causing time pressure), patient census (e.g. pace of patient movement through OR influencing
the time on task), and conflict with provision of direct teaching causing by multiple levels and roles of the OR team members (Pratt, 2009). In addition to the contextual influence, rules of engagement in classroom differ from those in the operating room. For example, things in the classroom are ordered and predictable, but engagement in the OR can be risky especially when things getting wrong (Pratt, 2009).

<table>
<thead>
<tr>
<th>Learner does this:</th>
<th>Teacher does this:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observes (with direction)</td>
<td>Models (normal practice w/explanation)</td>
</tr>
<tr>
<td>Participates (on margins)</td>
<td>Models (w/explanation)</td>
</tr>
<tr>
<td>Common, uncomplicated cases, features</td>
<td>Point out diagnostically meaningful information, discriminating</td>
</tr>
<tr>
<td></td>
<td>Allow for interruptions and questions;</td>
</tr>
<tr>
<td></td>
<td>Have them give you a</td>
</tr>
<tr>
<td></td>
<td>&quot;cognitive rehearsal&quot;</td>
</tr>
<tr>
<td>Practices (within zone)</td>
<td>Coach (w/guidance -- hand on shoulder)</td>
</tr>
<tr>
<td>More responsibility</td>
<td>Debriefing: what went well?</td>
</tr>
<tr>
<td>&quot;make a commitment&quot;</td>
<td>What would you do differently next time?</td>
</tr>
<tr>
<td>Refines &amp; Extends</td>
<td>Fades</td>
</tr>
<tr>
<td>Learning variations instead of rules</td>
<td>Withdraw, but at the ready</td>
</tr>
</tbody>
</table>

This is approximate. It depends on the learner's ZPD and the case. e.g. removal of hardware vs. total hip or complex pelvis fracture.

*Figure 2.3* Daniel Pratt's approximate scaffolding in the OR.

Pratt et al (1998) proposed "A General Model of Teaching" (Figure 2.4) and applied it in a study about teaching and learning in the OR recently (Vikis, Mihalynuk, Pratt, & Sidhu, 2007). The model and the findings from Vikis have been cited by several educational studies conducted in surgery (Butvidas, Anderson, Balogh, & Basson, 2011; Cable, Chong, & Pratt, 2011; D'Cunha, Schmitz, & Maddus, 2011; Skoczylas, Littleton, Kanter, & Sutkin, 2012). Applying this model to surgical residency training, focuses on the five elements (teacher, learners, content, context, and value) and three relationships (line X: teacher used different means to engage learners in the content; line Y: teacher
preferred different kinds of relationships with learners; line Z: teacher held contrasting beliefs about an instructor's content credibility) are changed (Pratt, 2009). Under the influence of cognitive apprenticeship, importance of "Context" is highlighted due to various patient situations and possible risk of patient safety. Likewise, "Teacher", "Content", and line Z are synthesized, which may represent learning contents in the OR adhere to the supervising surgeon, and the supervising surgeon's expertise is demonstrated through the case (Figure 2.5).

Figure 2.4 A general model of teaching. The model contains five elements (teacher, learners, content, context, and value) and three relationships (lines X, Y, and Z). People used different means to engage learners in the content (line X), preferred different kinds of relationships with learners (line Y), and held contrasting beliefs about an instructor's content credibility (line Z).

Pratt also pointed out within the General Model of Teaching, the three aspects of commitments in teaching were revealed through "the way a person teaches (actions), what's a person is trying to accomplish (intension) and statements of why those actions
and intentions are reasonable, important, or justifiable (beliefs)” (Pratt et al, 1998, p. 7). Likewise, a teacher’s commitment was usually directed more towards one or two elements than others. According to ZPD, scaffolding and the "General Model of Teaching", Pratt suggested that supervising surgeons should adapt their teaching to residents’ zone of ZPD to guide and to direct their practice in the OR in his later presentation.

![General model of teaching in cognitive apprenticeship](image)

*Figure 2.5 General model of teaching in cognitive apprenticeship.*

Teaching in the operating room is reported to remain as one of the main cornerstones of surgical education due to the time available for the OR teaching is decreasing (Roberts, Brenner, Williams, Kim, & Dunnington, 2012). Even under the guidance of a senior experienced supervising surgeon, residents have an unparalleled opportunity to learn in the operating room. To maximize the effectiveness of OR teaching, Roberts et al (2012) conducted a study to explore the types of verbal interactions that occurred between the supervising surgeon and the resident in the OR recently. Four broad categories of surgeon-resident interactions emerged from the Roberts’ study: Instrumental, Pure Teaching, Instrumental + Teaching, and Banter.
Instrumental refers the supervising surgeon used the resident as he/she might use a surgical tool. For example, the supervising surgeon simply directed the resident to do what needed to be done in that moment of the operation. Pure Teaching usually encompasses demonstrations of techniques, explanations of pathological conditions, or allow the resident to “feel the pathology” (Roberts, Brenner, Williams, Kim, & Dunnington, 2012, p. 645). The purpose of Pure Teaching was not to move the case forward but rather to move residents’ understanding forward, such that they would acquire knowledge to guide their future performance. Instrumental + Teaching means not only moving the operation forward but also including explanation or elaboration that likely guide residents' thinking and future performance. Banter helps to create the OR environment and set the tone for the operation. But sometimes it involved commenting the operation without teaching purposes; sometimes it focused on something peripheral to the case; sometimes it was conversation unrelated to the procedure. In addition to Pratt and Roberts, various researchers have studied teaching in the OR for different research focuses. Blom et al (2007) analyzed the verbal communication during teaching in the OR and classified four types of communication including: commanding, explaining, questioning, and miscellaneous, as well as nine content areas: method of operation, location, direction, instrument handling, visualization, anatomy and pathology, general, private, and undefinable. Likewise, Hauge et al. (2001) identified operating room teaching behaviors in four categories: informing, questioning, responding, and setting the tone.

Although various types of OR teaching interventions were reported by Robert (2012), Blom (2007), and Hauge (2001), surgeons’ decision-makings on these teaching interventions were rarely investigated until 2010. Moulton et al (2010) spent 15 months
on a study relating to expert judgments for teaching in the OR. This study was designed to explore surgeons' perceptions of "slowing down" in clinical teaching activities using the setting of surgical practice, especially the intra-operative (OR) environment. The "slowing down" was a phenomenon that existed in the clinical/surgical teaching before Moulton's study. But it was first defined and introduced in Moulton's paper. Moulton deconstructed the phenomenon of "slowing down when you should" based on surgeons' perceptions of this phenomenon in clinical practice and determined whether the phenomenon was recognizable to surgeons. Moulton collected the data through observations and interviews. A conceptual framework of "slowing down" phenomenon with four dimensions (initiators, influences, manifestations, and experience of control) was built based on the grounded theory in this study (Figure 2.6).

Moulton referred the "initiators" to proactively planned slowing down moments which were planned according to anticipated critical events prior to surgery or caused by emergent intra-operative issues. "Influences" consisted of three factors: transitory internal factors (e.g. physical ailments), personality factors (e.g. ego), and situational factors (e.g. time pressure). Moulton reported four types of manifestations of the slowing down phenomenon observed in the OR. From the most obvious to the most subtle, they were: stopping, removing distractions, focusing more intently, and fine turning. Finally, the "experience of control" was described as issues of control manifesting in surgeons' supervisory practices relating to the slowing down phenomenon in the OR.
Figure 2.6 Conceptual framework of "slowing down" phenomenon.
Moulton's study established a good framework to explore surgeons' decision-making phenomenon in regard to an emerging perception of existing behaviors. However, residents' perspective was not included in Moulton's study, though it was an important element in the "slowing down" phenomenon. Recently, a national survey about teaching in the OR from the residents' perspective (Snyder, Tarpley, Davidson, Brophy, & Dattilo, 2012) was published and indicated that: 1) 55% residents reported supervising surgeons verbalized operative approach during the case, 2) 61% residents agreed supervising surgeons included them in making level-appropriate intra-operative decisions, and 3) 84% residents indicated supervising surgeons offered constructive technical tips during the procedure. However, this survey also revealed: 1) 85% residents reported supervising surgeons did not recommend specific educational materials or guides to help residents prepare for a case, 2) 59% residents reported supervising surgeons did not identify their personal specific goals to the level of training before the procedure, and 3) 40% residents indicated supervising surgeons did not reinforce educational points after the completion. This survey demonstrated that from the residents' perspective, a lot of obvious opportunities exist to improve teaching in the OR, especially pre- and post-operation sections. But this survey also brings up another question: how do surgeons think about teaching in the OR? Butvidas and her colleagues conducted a study about the disparities between residents and surgeons perception of intra-operative teaching (Butvidas, Anderson, Balogh & Basson, 2011). Butvidas found out residents and supervising surgeons had substantial differences in how good teaching behaviors commonly occur in the OR. In their study, they identified 26 common good teaching behaviors in the OR, but only six out of them (6/26) shared the same average frequency reported by residents and surgeons. And this disparity
becomes "a major gap in surgical education and training" (Butvidas, Anderson, Balogh & Basson, 2011, p. 388). Likewise, Butvidas et al. also pointed out "no teaching or communication", "nervous supervising surgeon", and "not being allowed to perform the surgery" were three of nine factors that made residents and surgeons felt unsatisfied with the case.

These studies about teaching in the OR were all grounded in surgical education and exploring some kind of behavior in the OR, such as teaching behaviors. Thus, the methodologies and findings of these studies provide solid supports current study, though little about the nature and frequency of the OR guiding behaviors were reported.

Summary of Literature Review

The preceding review of literature is the basis for the conceptual framework of the OR guidance. Under the scope of the cognitive apprenticeship model, the 5-year surgical residency training is characterized as “learning-through-guided-experience”.

From the literature of medical education and performance improvement, there are two major theoretical frameworks that can contribute to residents' performance development. They are expertise development and skills acquisition. In the Systems Model of Performance Improvement, "assess" is the final and necessary stage to evaluate residents' performance outcomes and to determine their performance development. But the unique characteristics of surgical residency training make direct observations from the supervising surgeon become a necessary component of residents' performance evaluation, and then bring up the issue of OR guidance. However, to study the impact of OR guidance provided by the supervising surgeon on the resident's performance evaluation and development, the identification of supervising surgeons' OR guiding
behaviors needs to be done first to build up a typological benchmark of the OR
guidance.

Although the ACGME suggests thirteen evaluation tools for the graduate medical
(residency) training, no one has been reported that can be used to measure the OR
guidance, except for the OPRS instrument developed by the Southern Illinois University.
From the description of guidance on the Operative Performance Rating System (OPRS)
evaluation instrument, OR guidance can take many forms, and was divided into three
levels (minimum, some, and substantial). In order to train residents to operate
independently towards the end of residency, OR guidance should be faded out
gradually. The instructional scaffolding model, which is supported by Vygotsky’s Zone of
Proximal Development (ZPD) theory, provides a theoretical approach towards this goal.
However, the majority of scaffolding studies was conducted in cognitive skills
development domain, not in technical skills domain. Though Dunphy and Dunphy
proposed a four-stage ZPD model in surgical education, no methods were given to
quantify the zone of the ZPD, and no empirical evidence was generated to support this
model either. Since the balance of guidance and independence is a critical but difficult
issue in the surgical residency training as well as the OR guidance has very little
empirical or theoretical foundations, an appropriate OR guidance-providing model
needs to be created to better educate supervising surgeons in the near future.

The literature review shows that the OR guidance is perceived as an important
issue of surgical residency training and performance development. But no adequate
studies strongly indicate the effect of OR guidance on residents’ operative performance
development and no detailed strategy has been recommended for the fading
mechanism of supervising surgeon’s guidance. Although Swanson's System Model of
Performance Improvement was addressed in the literature review, "performance improvement" is a term that is seldom used in surgical residency training. There is no well-established performance improvement model reported in surgical residency training, if the Fitts and Posner's three-stage skill acquisition model is excluded. Pratt's "A General Model of Teaching" has been cited as the theoretical framework by several educational studies conducted in surgical education. He suggested that supervising surgeons should adapt their teaching to residents' zone of ZPD to guide and direct their practice in the OR. And this may bring up another question: how do surgeons make judgments for their teaching and/or guiding interventions in the OR. Moulton's conceptual framework of "slowing down" phenomenon answered this question theoretically. However, till now it lacks solid existing theoretical foundations to provide a valid tool to conduct a reliable measurement of OR teaching/guiding interventions, the influence of the OR guidance, which is provided by the supervising surgeon, on the resident's independent performance development is unknown. Therefore, how the OR guidance influence residents' operative performance development and how to manage the OR guidance become two critical questions for future studies which are designed to explore the effectiveness of surgical residency training in the OR. But identifying what behavior can be called OR guidance and what factors may trigger it must be done prior to answering these question
CHAPTER 3

Method

This study is within the framework of qualitative studies. Because a qualitative study is generally undertaken in a natural setting where the researcher is an instrument of data collection who gathers words or pictures, analyzes them inductively, focuses on the meaning of participants, and describe a process that is expressive and persuasive in language (Creswell, 1998). This study captured several characteristics of qualitative study mentioned by Creswell, including: 1) the study was conducted in a natural setting, 2) researcher worked as a key data collection instrument, 3) multiple sources of data (interviews, observations, and documents), 4) inductive data analysis was applied, 5) explored the meaning of participants, and 6) developed a complex picture of OR guidance via interpretation of findings.

A qualitative method research design was used to clarify the categories of supervising surgeons' guiding behavior in the OR, to explore what factors may impact supervising surgeons' decisions on guidance provided, to investigate the nature of guidance, and to examine whether the nature and/or amount of guidance reported by residents in the OR differs with that reported by supervising surgeons. These questions are important and necessary for studies conducted in the future to explore the impact of OR guidance on residents' performance development and its management strategy, because the primary purpose of this study is to discover what types of guiding behaviors the supervising surgeon performs in the operating room and to explore how and why the supervising surgeon provides OR guidance to the resident. Findings from this study add new knowledge to the existing surgical residency training literature, and contribute to
generate hypothesis to build up a theoretical model of OR guidance in future studies. Qualitative research has been used successfully to develop theories regarding complex social interactions in medical education (Dornan & Bundy, 2004; Hoshmand, 1989; Lingard, Reznick, & Espin, 2002; Musselman, MacRae, & Reznick, 2005). Hence, the qualitative research method was deemed most appropriate in this study.

**Overview**

This study was divided into two phases: Phase One focused on collecting data from eight pre-recorded operative performance (surgical case) videos which were reviewed by non-operating surgeons; Phase Two concentrated on collecting data from seven operative performance videos which were reviewed by their operating surgeons. Because most OR surgical cases aren’t video recorded and those videos that recorded were destroyed right after the procedure due to confidentiality issues, only a few video records are kept. Likewise, due to the unpredictable patient cases number, and the hospital’s new scheduling policy as well as highly-restricted infection control policy, only very limited cases can be captured in Phase Two. Guidance evaluation data, video-based observations with interviews, direct on-site observations in the operating room, and stimulated recalls with general interviews were applied in this study.

Since experiments in the operating room cannot ethically be used to study the treatments (supervising surgeons’ guidance on the resident) and the investigator cannot control the delivery of treatments, the effects of treatments need to be examined in an observational study (Rosenbaum, 2005). Thus, observational study methods were used throughout Phase One and Phase Two.
An observational study refers to a study in which a researcher simply observes behavior in a systematic manner without influencing or interfering with the behavior\(^5\). In psychology, observational studies can involve naturalistic observation and laboratory observation. Naturalistic observation refers to the collection of data without manipulation of the environment; the goal of naturalistic observation in psychology is to study the behavior of an organism in natural settings (Bakeman & Gottman, 1986; DiNardo, 2008). The laboratory observation involves observing behaviors in a research laboratory; the advantage of laboratory observation is that the situation can be controlled by the experimenter; the drawbacks of laboratory observation are that the setting can be unnatural and subjects are aware that they are being studied. But in the field of surgical residency training, observational studies may only include naturalistic observations.

Likewise, in surgical education, observational study involves observing one or more subjects performing a task with the intention of describing or comparing particular aspects of their performance\(^6\). According to the classification addressed by Altman (1991), the research design of Phase One in this study was an observational retrospective cross-sectional study. And the design of Phase Two was an observational retrospective cross-sectional study as well.

Observational study may be prospective or retrospective. In Mosby's Medical Dictionary (8th edition), "prospective study" is defined as an analytic study designed to determine the relationship between a condition and a characteristic shared by some members of a group. A prospective study may involve two to many variables; it may seek to demonstrate a relationship that is an association or one that is causal.

Retrospective study, in the same dictionary, refers to a study in which a search is made

\(^5\)Source: www.psychologyandsociety.com
\(^6\)Source: American College of Surgeon
for a relationship between one (usually current) phenomenon or condition and another that occurred in the past. There is a clear distinction between prospective studies and retrospective studies: in prospective studies, the data to be studied are yet to be generated and the events have not yet occurred; while in retrospective studies, data refer to past events and may be acquired from existing sources, such as final exam grades, or interviews (Altman, 1991, p.76). In Phase One, eight pre-recorded videos were used to collect data. Since these videos are existing data sources, the research design of Phase One is a retrospective study. Likewise, though some videos in Phase Two were not yet generated at the beginning, the research design of Phase Two is still a retrospective study. Because the majority of data in Phase Two was collected with existing sources (videos) via stimulated recall -- a method which invites participants to review their videotaped records and answer interview questions.

Cross-sectional study is a scientific method for the analysis of data gathered from two or more samples at one point in timeline. And many cross-sectional studies are descriptive (Altman, 1991, p.99). In this study, both Phase One and Phase Two are cross-sectional studies.

The next section presents the data collection and analysis methods in Phase One and Phase Two respectively, and then followed by a detailed description of the research setting, research design, participants, and research instruments.

**Data Collection and Analysis**

This study was designed in two phases which created two separate data sets (Figure 3.1). Phase One resulted in transcripts from video-based observations with semi-structured interviews and field notes; Phase Two involved transcripts from
stimulated recalls with semi-structured interviews, field notes as well as electronic feedbacks from residents.

Figure 3.1 Study process.

**Phase one: video-based observation with interview.**

**Purpose of phase one.** This Phase One is designed to explore surgeons’ perceptions of the supervising surgeon's OR guiding behaviors and its nature within a videotaped surgical case, and to explore the general factors that might impact supervising surgeons’ decision on OR guidance. In this phase, the observing surgeons were not the supervising (operating) surgeons in the videos.

**Process of phase one.** Eight pre-recorded operative performance videos were purposefully sampled. These eight videos were: Laparoscopic Cholecystectomy case 1
and 2, Open Inguinal Hernia Repair case 1 and 2, Thyroidectomy case 1 and 2, and Laparoscopic Ventral Hernia case 1 and 2. These eight cases coming from four most common procedures also represent: laparoscopic procedures and open procedures, more and less complicated cases, and cases involving various PGY level residents (five PGY 5 residents, four PGY4 residents, and one PGY3 resident). What's more, these eight videos had been evaluated by seven external expert reviewers before this study, and a “Gold Standard” regarding the difficulty of the case and the amount of OR guidance provided by the supervising surgeon has been established (Williams, Sanfey, Chen, & Dunnington, 2012). And this information can serve as key references for all eight cases.

Each of these operative performance videos has been divided into several chapters, and each chapter lasts two minutes. To concentrate on the intra-operative OR guidance provided by the supervising surgeon, the first 10-minute (preparation section) and last 10-minute (closing section) video segments were excluded from considerations. The researcher randomly selected four chapters from each video, and the conjunct chapter right after each selected video segment (chapter) was included as well. So, there were four 4-minute video segments for surgical faculty members to review.

Eight surgical faculty members participated in the video-based observations with interviews in Phase One voluntarily. And following criteria were applied on screening surgeon reviewers: 1) different experience level (e.g. junior surgeon, or senior surgeon), 2) different sub-specialty within surgery, and 3) including both female and male surgeons. These criteria helped enhance the representativeness of these eight participants and diversified the input sources. These eight reviewers were not the supervising (operating) surgeons in the videos, and one of them came from outside
research site. These eight surgical cases they observed were video records of operative performances that occurred more than one year ago.

During each video based interview, the observing surgical faculty member can skip up to one 4-minute video segment if he/she thinks there is not adequate information about the OR guidance existing. The observing surgical faculty member was asked to narrate what he/she observes from the video segments, and then answer key interview questions listed in the semi-structured interview guide (see Appendix A). These observations of interviews contribute to answer all four research questions (see p. 8). All video-based interviews were captured by Camtasia – a software application that records the reviewer’s voice and on-screen mouse movement. That is beneficial to the later data analysis.

To determine the level of agreement, one surgical faculty member who did not serve as one of the eight observing surgeons in Phase One was recruited to review all eight video records to judge the nature and the amount of OR guidance. To ensure the validity and quality of reviews, this surgical faculty member: 1) is a senior faculty who has more than 15-years’ experience as a surgeon, 2) has a professor appointment at the research site, and 3) has a reputation in surgical education. This senior surgical faculty member worked as a second reviewer and participated in the video-based observations with interviews for all video segments used in Phase One. And the same set of interview questions was applied. This senior surgical faculty also contributed to triangulate the sources of data collected in Phase One.

Eight residents from general surgery residency training program at the research site were recruited for the video-based observations with interviews in Phase One. 7 out of 8 residents were not the resident who performed in the video, but their current
training levels were close to the training level of the resident who operated the case. For example, a senior (e.g. PGY5) resident can be recruited to review a video segment which was performed by another senior (e.g. PGY4) resident, but not by a junior (e.g. PGY2) resident. Although all residents came from SIU -- the research site, residents might review up to three videos per person due to the limited number of general surgery residents. These residents observed the same video segments as the surgical faculty did, and answered questions from the same interview guide. These residents’ video-based interviews were also captured by Camtasia.

**Data analysis in phase one.** At the end of Phase One, all video-based interview records were transcribed and documented as well as field notes. To improve accuracy, the researcher checked the interview notes with the video records again to ensure that all key information captured. To ensure validity, the researcher sent back key finding to observers to confirm the accuracy. Manual coding was then conducted. Rather than attempting to apply a priori constructs to the data, the researcher began with a close, descriptive coding of the data set. Codes that “go together” were amassed into categories, and those categories were further built into a broad conceptual framework that can be used to explain the data set given the question. And then immersion of transcripts from eight cases was undertaken to identify themes and ensure the exhaustion of any new themes. Pratt's General Model of Teaching (see p. 36), Roberts' four types of verbal teaching interactions in the OR (see p. 39), and Blom's four types of communications and nine types of contents (see p. 40) were used to assist the development of the coding framework.

As a case in point, one observing surgeon commented on one video segment:
The supervising surgeon is pointing out some vessels that if approach too close could cause bleeding -- that clearly is guidance.

Figure 3.2 Code example.

The first level of code in this example was "guidance", because for one thing, the "guidance" was not only the key topic of this study, but also a statement/belief of the behavior; for another, this example contained a "direction provided by a guide (see p. 25)" and was reported as "guidance" by the observer. The second level was "guidance/point-out. This "point out" behavior was an action connecting with the statement/belief of the behavior (the first level of code). It also referred to "physically pointing out structures or problems" which matched the operational definition of guidance described in the Literature Review (see p. 25), thus it was coded. The third level of code was "guidance/point-out/direction". According to Pratt's General Model of Teaching, the intention of a "point out" behavior/action was to "indicate the position or direction"7 of the vessel to the resident in this example. Likewise, "direction" was reported as one of the nine teaching content categories in the OR by Blom (2007). So

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7 source from: http://dictionary.reference.com/
the third level - intention of this behavior - was coded as "direction". Since the framework of the code in this example helped to enrich the understanding about the intention of the content of "point out" behavior happened in that situation, the theme that emerged here was "guidance for the intention of direction ". The researcher also brought this theme and the example to the next observing surgeon to seek for additional feedback from the participants' point of views. A case in point, the guiding behavior of "pointing out" was reported having an intention of "directing" the resident in Case One; during Case Two, if the observing surgeon also reported this behavior, the researcher then would follow up with the intention of the (pointing-out) behavior; if no "pointing-out" behavior was identified during Case Two, the researcher would ask the observing surgeon during the semi-structured interview to see whether any other surgeons shared similar intention of the "pointing-out" behavior.

To enhance the validity, peer examination was applied. This peer met the following criteria: 1) doctoral student from the Department of Education Policy, Organization and Leadership at the University of Illinois, 2) had achieved a Master degree in human resource education and training filed, 3) had more than 3 years working experience and research experience in education as well as Human Resource administration and training, and 4) had peer review experience in previous. The researcher and the peer coded the first three cases separately with the three level-coding strategy discussed above, and met together to discuss and refine the guidance events. And then, transcripts were re-coded if needed. Finally, coded transcripts of eight cases were reviewed during later data analysis section in Phase One. Themes were organized using three modified categories of teaching-intention guidance (pure teaching), direction-intention guidance (instrumental/instrumental + teaching), and
assistance-intention guidance (banter) from a Roberts’ study of verbal teaching interactions in the OR. Each category included multiple guiding behavior event examples. These three interim category of OR guidance were then created and would be re-analyzed after Phase Two data collected.

**Phase two: stimulated recall with general interview.**

*Purpose of phase two.* Phase Two is designed to explore the in-depth supervising surgeons’ guidance behavior in the operating room, especially factors that trigger their decisions about OR guidance provided to the resident during the procedure and the nature of guidance chosen.

*Process of phase two.* Phase Two involves two sections. During Part One “Long-term Stimulated Recall”, three surgeons were invited to review their pre-recorded surgical cases which were videotaped 1-2 years ago, and these three surgical cases were conveniently selected. In Part Two “Short-term Stimulated Recall”, three surgeons were invited to review their recent record performance, and one of them review two surgical cases performed by himself; totally four surgical cases were reviewed. In Phase Two, six operative procedures were conveniently sampled to represent the common surgical cases performed by residents. They included Laparoscopic Cholecystectomy, Open Inguinal Hernia Repair, Laparoscopic Ventral Hernia, AV Fistula Revision, AV Fistula Creation, and Laparoscopic assisted Jejunostomy. Thus, during Phase Two, seven video recorded interviews were conducted to explore the fourth research questions of this study (i.e. factors that influence supervising surgeons’ decision-making on guidance) and obtained a deeper understanding about the OR guidance from the supervising surgeon's perspective. And these surgical cases which were used in Phase Two should meet the following criteria: 1) cases should differ in difficulty levels, and 2)
residents should be at different PGY levels. The Case difficulty level was reported by
the supervising surgeon, and the PGY level was the current post-graduate training level
of the operating resident.

A total of seven cases were conducted in Phase Two. Although the case number
(sample size) is limited, it is sufficient to explore supervising surgeons’ decision-making
on guidance and its influencing factors. For one thing, this is an exploratory study; its
findings contribute to building up the hypothesis of OR guidance for future study, not to
generalize the results. For another, evidence from recent literature suggests seven
surgical cases may be acceptable. Dr. Smink and his team used three surgeons as
study subjects to explore intra-operation decision points to identify different teaching
objectives (Smink, Peyre, Soybel, Tavakkolizadeh, Vernon, & Anastakis, 2012).
Although Dr. Smink used mix-method, his publication indicated that data collected from
three surgeons were good enough for identifying intra-operation teaching objectives and
convinced the reviewers. Likewise, only four surgical procedures were used to collect
data in Roberts' study about verbal teaching communication interactions in the OR
(Roberts, et al, 2012); eight laparoscopic cases contributed to Blom's study of verbal
communication during teaching in the OR (Blom et al, 2007).

The data collection process of each surgical case in Part two was similar to that
of Phase One. These surgical case videos were randomly sampled a 30-minute
segment by the surgeon who was performing in the video to be reviewed.

The surgical faculty was asked to narrate his/her performance from the video
segments. The researcher paused at the guidance event, which was either reported in
Phase One or identified by the reviewing surgeon, to explore the supervising surgeon's
decision-making factors. And then, a semi-structured interview was conducted with the participating surgeon provided with the interview guide (see Appendix A). These observations of interviews contribute to answer research questions one and four (see p. 14). All video-based interviews were captured by Camtasia – a software application that records the reviewer’s voice and on-screen movement. That benefits the later data analysis.

The data collection process in Part Two consisted of four stages for each case.

- **Stage 1**: Right before the surgical procedure, the researcher identified the resident, and asked the supervising surgeon to estimate whether the upcoming case fits the resident's PGY level.
- **Stage 2**: During the surgical procedure, the researcher stayed in the operating room and observed both the supervising surgeon's and the resident's behaviors; the whole operative performance was videotaped via multiple cameras in the OR - the video file became accessible within 24 hours; the sound was also recorded.
- **Stage 3**: Right after the surgical procedure, two short interviews were conducted with the supervising surgeon and the resident respectively.
  - Supervising surgeon: the researcher asked the supervising surgeon to tell the overall purpose of guiding the resident in this case, and requested the supervising surgeon to immediately complete the entire OPRS evaluation form, which includes the case difficulty item, and the degree of guidance item, if possible.
Resident: the researcher asked the resident to estimate: 1) the amount of guidance he/she received from the supervising surgeon in this case based on the "Degree of Guidance" scale listed on the OPRS evaluation form, and 2) how often the OR guidance provided by the supervising surgeon influenced his/her intra-operative decision making and overall performance.

Stage 4: After the surgical procedure, the supervising surgeon was invited to participate in the stimulating recall with general interview in 1-3 business days. The resident was also invited separately if he/she was available. The detailed stimulated recall procedure will be discussed in the next section.

The procedure of collecting data through the stimulated recall with general interview is similar to the video-based observations with interviews used in Phase One. But in stimulated recall the participating surgeon reviewed his/her own case instead of other surgeons’ case. The supervising surgeon was asked to narrate what he/she observed about his/her own behaviors from the video. The participating surgeon or the researcher can pause at any guidance event points to explore the supervising surgeon's decision-making factors and the primary purpose of guiding at that moment. At the end, the participated surgeon was interviewed with the interview guide (see Appendix A). All stimulated recalls were recorded with Camtasia, and saved for future analysis.

The resident also participated in a stimulated recall. He/she would review the video as the supervising surgeon did, and answered the same set of questions. Residents' comments were collected as another data source to enrich the theme of
interest. They also help to build up a holistic picture of supervising surgeons’ guiding behaviors in the OR. Because the supervising surgeon and the resident are two essential elements in the OR guiding event scenario, guidance is an intervention between them. Without the resident, the guiding event scenario is incomplete, although the supervising surgeon is the primary study subject. The resident's stimulated recall was also captured by Camtasia.

To enhance internal validity, triangulation method was applied in Phase Two through collection of data using different methods: interviews, observations, and documents (field notes). In order to obtain a deeper meaning to the interviewee’s perception of OR guiding behaviors, the research also situationally used probing questions during the interview. For example, if the supervising surgeon took over the resident's grasper to operate, the research would ask the reviewing surgeon "why did you take over at this point?"; after the reviewing surgeon responded, the researcher stated what the reason was; the researcher then follows up "What makes you think of that reason?"; after the reviewing surgeon responded, the researcher stated the reviewing surgeon's answer again; the researcher then might ask another "why" question to seek for deeper information. Pendleton’s Rules for providing feedback was referred as guidelines for probing questions.

Data analysis in phase two. The Phase Two outcome analysis process is similar to that of Phase One. At the end of Phase Two, all stimulated recalls with general interview data were documented. These data were integrated with data collected from stage one, stage two, and stage three. To improve the accuracy, the researcher checked the interview field notes with the video records again to ensure all
information was correct, and key comments from interviews were sent back to participants to confirm accuracy respectively. Manual coding was then conducted. After coding the first case separately, the researcher met with the peer reviewer -- the peer was the one who participated in Phase One -- to discuss the coding themes. Transcripts were re-coded if needed. All coded transcripts were reviewed later in Phase Two data analysis section. Pratt's General Model of Teaching (see p. 36), Roberts' four types of verbal teaching interactions in the OR (see p. 39), and Blom's four types of communications and nine types of contents (see p. 40) were used to assist the development of the coding framework. And then, data collected from Phase Two, which focused on research question four, were synthesized with data collected from Phase One, which focused on research question one, two, and three, and was organized according to the research questions for final analysis.

**Description of the Research Setting**

The research site is the General Surgery residency at the Southern Illinois University (SIU) College of Medicine in Springfield, which is a community based, fully accredited Accreditation Council for Graduate Medical Education (ACGME) program with three categorical residents at each level. General Surgery is a division under the Department of Surgery, and has fourteen full-time surgical faculty members. Every year three new residents are enrolled in this program.

SIU General Surgery Residency training takes place at two major teaching hospitals: Memorial Medical Center (562 beds) and St. John’s Hospital (731 beds). The first two years of the residency provide an experience not only in general surgery and trauma, but also in orthopedics, urology, neurosurgery, burns, anesthesia, vascular, and
critical care. The third and fourth year expands the experience to general surgery and trauma with the addition of Cardiothoracic, vascular, and pediatric surgery.

In Phase One and Two, all interviews were conducted in either the researcher’s office or the observing surgeon’s office. In Phase Two, all surgical procedures were videotaped in operating rooms at Memorial Medical Center. Videotaping and recording equipment is permanently installed in these operating rooms.

Description of Participants

Faculty. Both full-time and part-time surgical faculties may be involved in this study. In Phase One, nine surgical faculties were recruited to review the pre-recorded videos. They were either full-time or part-time faculties, and might not be the supervising surgeon in the video. In Phase Two, six surgeons were recruited for the study. They were all the supervising surgeons in the videotaped surgical cases.

Residents. In Phase One, eight PGY2 - PGY5 surgical residents from the SIU General Surgery residency program were recruited to review the pre-recorded videos via purposeful sampling. These residents’ postgraduate year (PGY) level should be close to the resident performed in the video respectively. For example, a PGY5 resident can review a video case which was performed by a PGY4 resident, but not by a PGY3 resident. Likewise, four surgical residents were recruited to participate in Phase Two. They may not be involved in Phase One, but must be the person who performed the surgical procedure in the video.

Description of the pre-recorded videos

Eight pre-recorded operative performance videos were used to conduct video-based interviews in Phase One. These eight videos cases were: Laparoscopic
Cholecystectomy case 1 and 2, Open Inguinal Hernia Repair case 1 and 2, Thyroidectomy case 1 and 2, and Laparoscopic Ventral Hernia case 1 and 2. The choice of the eight videos was based on several factors, including the type of procedure, time length, case difficulty, degree of guidance, resident's PGY level, and the quality of recorded video and audio. The eight selected videos from four different procedures, ranging from 36 minutes to 226 minutes in length, represented: laparoscopic procedures to open procedures, straightforward case to complicated case, and PGY 3 to PGY 5 residents. Additionally, five out of eight cases had operative performance ratings provided by supervising surgeons. What's more, these eight video cases were evaluated by seven external expert reviewers, and a “Gold Standard” regarding the quality of the performance and the amount of guidance has been established. From these seven expert reviewers' feedbacks, "OR guidance" was marked as a "weakness" in four out of eight video cases (Sanfey, Williams, Chen, & Dunnington, 2012).

Description of the Rating Instrument and Guidance Item

OPRS Instrument. Although only limited comparison data about the amount of guidance provided by supervising surgeons were needed for this study, all these data were collected with the "Degree of Prompting or Direction" item from the Operative Performance Rating System (OPRS) evaluation form (see Appendix B) in Phase One and Phase Two during semi-structured interviews (see Appendix A). For example, during one semi-structured interview:

The researcher: "What is the overall amount of guidance you gave to the resident in this case?"
The surgeon: "For his PGY level, I think he is doing a good job, I would say minimal to some (guidance)."
These comparison data - descriptions of the level of guidance reported instead of rating scores - helped to answering the research question "What difference exists between the amount of guidance as reported by residents and supervising surgeons?"

The OPRS is a 10-item evaluation instrument with two open-ended questions that ask the rater to identify strengths and weakness of the resident’s performance. It begins with the identification of “Case Difficulty” and is followed by the item called “Degree of Direction and Prompting (Guidance item). A rating scale of 1 to 3 (see “Guidance Item”) is applied to this item. The next are two components: procedure specific items and general items. The four or five procedure specific items focused on procedure-specific operative skills and operative decision making. They are unique to each surgical procedure. Four general items, developed at the University of Toronto, covering tissue handling, time and motion, flow of operation, and overall performance were included in each instrument. A rating scale of 1 to 5 (5 = excellent performance) is used to evaluate each performance item. The four or five procedures specific items are specific to the operative procedure. A rating scale of 1 to 5 which is the same as that of General Items is used to evaluate each performance item.

The OPRS is useful in helping residents improve their operative performance in next case and tracking residents’ development throughout residency training and offers "a structured means of certifying operative skills (Larson, et al., 2005, p640)". Currently, no training or assessment instruments have specifically incorporated measures of guidance in the OR, and the OPRS is unique in that each sentinel procedure instrument includes one item which is specially designed to measure OR guidance. The accumulating evidence regarding the reliability, feasibility, and validity of the OPRS instrument was also examined and reported by Williams and his colleagues (Williams,
Sanfey, Chen, & Dunnington, 2012). Findings from Larson and Williams’ study indicated that the average rater agreement was reliable. The internal consistency reliability of the OPRS instrument ranged from 0.70 to 0.95 on six operative procedures respectively. Williams et al. also concluded in his study that “the OPRS complements traditional evaluations by providing objective assessment of operative decision-making and technical skills. Inter-item correlations indicate the average rating of items provides a reliable indicator of resident performance. In addition, another study reported by Williams and his colleagues indicated that two evaluations with the OPRS instrument per month are able to provide a dependable basis for judging resident operative performance annually; to make semi-annual decisions, 14 evaluations with OPRS instrument per resident per six months are needed (Williams, Verhulst. Colliver, Chen, Sanfey, & Dunnington, in press). In this study, only the "Degree of Prompting or Direction" item on the OPRS instrument was used to collect the comparison data,

Guidance Item. The OPRS is a procedure-based, nationwide operative performance evaluation tool designed and developed by Southern Illinois University. Since May 2009, the Guidance item has been included in all Operative Performance Rating Instruments (OPRS). On each instrument guidance is described as taking many forms including “verbal directions, physically setting up the environment (e.g. managing tissue planes), physically pointing out structures or problems (e.g. with the camera) and attending facial expressions, gestures and vocal intonation.” The rating scale of guidance described in the OPRS instrument is:

1: Minimal direction by the supervising surgeon. Resident performed most steps and directed the surgical team independently with minimum or no direction from the attending to either the resident or to the surgical team.
2: Some direction by the supervising surgeon. Resident performed most steps and the supervising surgeon provided occasional direction to the resident and/or to the surgical team.

3: Substantial direction by the supervising surgeon. Resident performed most steps but the attending provided constant direction to the resident and the surgical team.

Descriptions of the guidance rating scales were used to investigate the extent of the difference existing between the amounts of OR guidance reported by residents and by supervising surgeons, for these descriptions, together with participants' comments, might help to better understand the guidance phenomenon through limited participants.

Description of Variables

Given the research questions, the outcome variable of this study was the OR guidance provided by the supervising surgeon. The majority of qualitative data was collected through video-based interview in Phase One and stimulated recall with general interviews in the Phase Two; the majority of amount of guidance comparison data came from the “Degree of Direction and Prompting” item in the OPRS form. Based on the research questions, the measurable variables in this study include the category of OR guidance, frequency of OR guidance, supervising surgeon’ rating, residents’ rating, case difficulty, residents’ year of residency training (PGY year) level.

Data Reliability and Validity

To enhance internal validity and reliability, the following strategies were applied: triangulation, double check, member check, peer debriefing, and thick description. The purpose of triangulation is to build the picture by investigating through multiple sources
or using a variety of methods (Creswell, 2009; Rossman & Rallis, 2003). In this study, the triangulation occurred throughout collection of data using different methods, including interviews, observations, and documents. Double check in this study is to check transcripts with digital records again to "make sure they do not contain obvious mistakes made during transcription" (Creswell, 2009, p. 190). Member check was used to determine the accuracy of the qualitative findings by taking parts of case analysis or specific descriptions to participants and see whether they agree with the findings (Creswell, 2009). In this study, the researcher asked participants to check their key comments and verified the specific themes/descriptions obtained from one participant with another to provide an opportunity for participants to comment on these findings.

According to Creswell (2009), the peer debriefing can enhance the accuracy of the account, because “this process (peer debriefing) involves locating a person who reviews and asks questions about the qualitative study so that the account will resonate with people other than the researcher” (Creswell, 2009, p. 192). This peer should meet the following criteria: 1) doctoral student from the same department as the researcher does, 2) has work experience and research experience in education or training, and 3) has peer review experience, educational journal preferred. This is an exploratory study about OR guidance, a peer from outside surgery or medicine is able to provide comments from pure educator's perspective, though the researcher needs to introduce the context to this peer at the beginning. Finally the researcher located a doctoral student who met the given criteria to review and ask questions about the study. The researcher provided interview transcripts to this peer coder. In Phase One, the researcher gave the first three cases transcripts to the peer, and then met together; the difference of coding was discussed; transcripts were re-coded based on updated coding.
strategy; coded transcripts done by the peer and by the researcher were then compared again; controversial issues were discussed; the consensus was obtained after the final discussion. Next, the researcher used the final coded transcripts for the data analysis. In Phase Two, the researcher gave the first case to the peer, and the following consensus procedure was the similar with that in Phase One.
CHAPTER 4

Results

This chapter includes findings from Phase One and Phase Two. Both Phase One and Phase Two involved two stages of data analysis: within-case analysis and cross-case analysis. In within-case analysis, all information about the case, including interviews with surgeons and residents, observations, and field notes, was brought together, and analyzed. After that, cross-case analysis was applied to synchronize all cases conducted in Phase One and Phase Two, respectively, to establish a general perception of OR guidance and to explore supervising surgeons' decision-making factors on guidance.

Overall Findings

The distinguishing feature of Phase One was that participants were observing other people's videotaped performance. In Phase One, eight surgeons, eight residents, and one senior surgical faculty participated. All of them reviewed a 16-minute long video that was randomly selected for each of them. Table 4.1 illustrates these participants' background information, such as teaching experience and PGY level, in the order in which I contacted them. Among these surgeons, seven out of eight were surgical faculties at the research site, and the rest came from another medical school in the Midwest region. Since the resident-interviewee's current PGY level should be close to the PGY level of the resident who performed in the video, three PGY5 residents, three PGY4, and two PGY2 residents were invited to participate in Phase One.
A total of 780 minutes video-based observations with interviews were conducted during eight pre-recorded surgical cases of four different procedures in general surgery. Two of these cases (Laparoscopic Cholecystectomy case1 and Open Inguinal Hernia case1) were conveniently selected to serve as mini case studies. During Phase One,
the operating resident in Open Inguinal Hernia case1 had not yet graduated, and another observing resident had worked as the first assistance for the operating surgeon of Laparoscopic Cholecystectomy case1 in the OR before. Therefore, the Laparoscopic Cholecystectomy case1 and the Open Inguinal Hernia case1 were observed by the two residents mentioned above, another surgeon, and a surgical faculty. Surgical residents’ direct experience would provide a deeper understanding about the OR guiding behaviors from their perspective. The rest of pre-recorded surgical cases were observed by three interviewees per case: one resident, one surgeon, and one surgical faculty. Digital records from surgeons’ observational interpretations were transcribed into texts. As mentioned in Chapter Three, the researcher and the peer coder worked on these transcripts separately and then discuss them together. The coding agreement between the researcher and the coder was improved after refining the coding strategy and re-coding the transcripts. After that, the researcher reviewed the coded transcripts and the field notes for multiple times to obtain a holistic view for each case. A total of 116 procedurally relevant OR guiding events and 16 guiding behavior types were reported. An inter-rater reliability analysis using the Cohen's Kappa statistic was performed in Phase One. According to Landis & Koch (1977), the result indicated that there was a substantial agreement among raters (Kappa = 0.689) on the basic themes.

The distinguishing feature of Phase One was that participants were observing self performance. In Phase Two, seven cases were captured from both open and laparoscopic procedures. In Part One, three pre-recorded surgical cases (Open Inguinal Hernia Repair A, Open Inguinal Hernia Repair B, and Laparoscopic Ventral Hernia Repair) were reviewed by their operating surgeons for 30 - 45 minutes respectively. In Part two, four surgical cases (AV Fistula Revision, AV Fistula Creation, Laparoscopic
Cholecystectomy with IOC, and Laparoscopic assisted Jejunostomy) were live recorded in the operating room, and the operating surgeons in these cases were then invited to review their videotaped performance by individual for 30 - 45 minutes after the operation. Table 4.2 illustrates the background of these cases in the order in which they were contacted by the researcher during each stage.

Table 4.2

**Phase Two Case Background.**

<table>
<thead>
<tr>
<th>Case</th>
<th>Case length (Min)</th>
<th>Review length (Min)</th>
<th>Status of Operating Surgeon</th>
<th>Resident PGY</th>
<th>Case Difficulty Level reported by Surgeon</th>
<th>Case Difficulty Level reported by Resident</th>
<th>Degree of Guidance reported by Surgeon</th>
<th>Degree of Guidance reported by Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part One</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Inguinal Hernia Repair A</td>
<td>68</td>
<td>45</td>
<td>Junior</td>
<td>PGY3</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Open Inguinal Hernia Repair B</td>
<td>60</td>
<td>35</td>
<td>Senior</td>
<td>PGY5</td>
<td>Low</td>
<td>NA</td>
<td>Minimal</td>
<td>NA</td>
</tr>
<tr>
<td>Laparoscopic Ventral Hernia</td>
<td>129</td>
<td>30</td>
<td>Junior</td>
<td>PGY5</td>
<td>Low</td>
<td>NA</td>
<td>Substantial</td>
<td>NA</td>
</tr>
<tr>
<td>Part Two</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV Fistula Revision</td>
<td>113</td>
<td>30</td>
<td>Senior</td>
<td>PGY2</td>
<td>High</td>
<td>High</td>
<td>Substantial</td>
<td>Substantial</td>
</tr>
<tr>
<td>AV Fistula Creation</td>
<td>80</td>
<td>30</td>
<td>Senior</td>
<td>PGY2</td>
<td>Low</td>
<td>Mediate</td>
<td>Moderate</td>
<td>Substantial</td>
</tr>
<tr>
<td>Laparoscopic Chole w/ IOC</td>
<td>85</td>
<td>45</td>
<td>Senior</td>
<td>PGY4</td>
<td>Mediate</td>
<td>Low</td>
<td>Moderate</td>
<td>Minimal</td>
</tr>
<tr>
<td>Laparoscopic Jejunostomy</td>
<td>63</td>
<td>40</td>
<td>Senior</td>
<td>PGY5</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Minimal</td>
</tr>
</tbody>
</table>

A total of 255 minutes of stimulated recall with general interviews were conducted with six operating surgeons for seven cases during Phase Two (Table 4.3). Digital records from surgeons' observational interpretations were transcribed into texts. As mentioned in Chapter Three, the researcher and the peer coder worked on these transcripts separately and then discuss them together. The coding agreement between
the researcher and the coder was improved after clarifying the codes and re-coding the transcripts. After that, the researcher reviewed the coded transcripts and the field notes for multiple times to obtain a holistic view for each case. A total of 13 guidance decision-making contributing factors were reported. An inter-rater reliability analysis using the Cohen's Kappa statistic was performed in Phase Two and the result indicated that there was a substantial agreement (Landis & Koch, 1977) among raters (Kappa = 0.674) on basic themes.

Table 4.3
Phase Two Case Summary.

<table>
<thead>
<tr>
<th>Case</th>
<th>Surgeon</th>
<th>Surgeon Level</th>
<th>Board Certified in</th>
<th>Resident</th>
<th>Resident PGY</th>
<th># of Guidance Event Explored</th>
<th># of Reported Contributing Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Inguinal Hernia A</td>
<td>O</td>
<td>Junior</td>
<td>2000s</td>
<td>Z</td>
<td>PGY3</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Open Inguinal Hernia B</td>
<td>T</td>
<td>Senior</td>
<td>1980s</td>
<td>N/A</td>
<td>PGY5</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Laparoscopic Ventral Hernia</td>
<td>S</td>
<td>Junior</td>
<td>2000s</td>
<td>N/A</td>
<td>PGY5</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>AV Fistula Revision</td>
<td>P</td>
<td>Senior</td>
<td>1970s</td>
<td>Y</td>
<td>PGY2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>AV Fistula Creation</td>
<td>P</td>
<td>Senior</td>
<td>1970s</td>
<td>Y</td>
<td>PGY2</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Laparoscopic Cholewith IOC</td>
<td>R</td>
<td>Senior</td>
<td>1990s</td>
<td>W</td>
<td>PGY4</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Laparoscopic Jenunostomy</td>
<td>Q</td>
<td>Senior</td>
<td>1980s</td>
<td>X</td>
<td>PGY5</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

Type of OR Guiding Behaviors

During Phase One and Phase Two, surgeons often used various terms, such as direction and instruction, in their descriptions of OR guidance during the semi-structured interviews with observations and stimulated recalls. In total 16 types of behaviors
performed by supervising surgeons were defined as OR guidance in Phase One. These behaviors were grouped by their behavior intentions as followings (see Figure 3.2).

- Guidance with the intention to teach the resident: the intention of these guiding behaviors performed by the surgeon is to teach the resident something new by showing how to operate the current case, by explaining the surgeon’s thought process to shape the resident’s future intra-operative judgments, and/or by adding new knowledge about instruments for future cases.

- Physically show the resident how to apply an operative skill and/or a technique to the current case. For example:

  **Description:** The resident pulled the tissue with a grasper and tried to dissect it with scissors (struggling with it) and then flipped the scissors (upside-down) to dissect again. The surgeon put down the camera and said “*May I switch your hand for a second?*” The resident said “*sure*”, and then the surgeon left his position, passed the camera to the resident. The resident put down the grasper and scissors, and took the camera. The surgeon said “*I want to show you the tool (through) demonstrating by my hands*”; then they switched positions. The surgeon held the grasper with one hand and the scissors with the other hand, said “*I noticed you put a lot of tension like this,* (the surgeon’s both hands holding the handle and trigger tight) *put your hands opposite there and thumb here,* and *put your thumb here* (the surgeon manipulated his fingers on left hand and picked up the grasper); *keep your wrist (moving) stably,* you still can seize things like we normally do; put your wrist in a line, do this along uphill (the surgeon was moving the grasper upward), *and find it*”; the resident said “*OK*”.

  **Comment:** “*The supervising surgeon was actually telling the resident -- it is teaching about how to go ahead and dissect*”; “*the supervising surgeon was doing the case now -- that is guiding by taking over.*”
- Explain the surgeon’s thought process or intra-operation decisions on actions to shape the resident's judgments in future cases. Two examples:

**Description 1:** The resident was dissecting, the surgeon asked the medical student to hold the hemostat for him and (picked up a bovie) and asked the resident “Shall I divide? It may help to come down toward the bottom of the sac (pointed the sac with bovie)”; the resident held the hemostat, paused, and said “Sure”; the surgeon then dissected with bovie; (when done) the surgeon said “Okay. This allows us to be sure there’s no cord or blood supply there”.

**Comment 1**: “Clearly here, the supervising surgeon wants the resident to open the sac further; he explains the reason to do this.”

**Description 2:** The resident was suturing. The surgeon asked the resident whether she remembered how they did it (next action) before while retracting, and then told the resident “We’re going to get an Allis (clamp) on the aponeurosis of transversus abdominis”. The resident asked “Prior to this stitch?” The surgeon said “I think so, because it avoids getting that tissue”. The resident said “OK”.

**Comment 2**: “Once again, the supervising surgeon is teaching with open ended question; ... the supervising surgeon is explaining his method (to the resident).”

- Allow the resident to learn from under-controlled "not appropriate" decisions/actions. A case in point:

**Description:** The surgeon ordered a small (retractor); the resident wiped the incision with gauze and then told the scrub tech “Tight with just a vicryl. Do you have 3-0; is that what you have out?” The scrub tech said “Whatever you like”; meanwhile the surgeon put the retractor on; the surgeon was holding the retractor and pulling up the sac; the resident said “A 3-0 is fine” (then the scrub tech ordered two for her); the surgeon pointed the sac with his finger and said “See how well this reduces now. That’s going to reduce fine”; the resident used gauze to wipe the sac, put it away, and touched the sac with her finger; then the surgeon said “OK, that’s fine”; (the surgeon asked the scrub tech “You have that vicryl?” The scrub tech said “I do”) the surgeon was retracting and pointing the sac with his finger, said “So once again it’s important we make sure
all contents are reduced there. There’s nothing in the sac” and then picked up the sac with a hemostat.

Comment: “The supervising surgeon gave the resident opportunity to operate as independently as you can with senior staff; he did not correct resident on suture choice -- choices what she wants to do, but I am sure if he would, he could concern the patient safety; the supervising surgeon makes a general phrase about reducing the contents to safety reason, but also a lesson teaching the resident something in person.”

• Guidance with the intention to direct the resident: the intention of these guiding behaviors performed by the surgeon is to direct/navigate the resident based on his/her level of knowledge and skills throughout the operation directly or indirectly towards the successful completion of the case.
  • Point out the critical spot or the direction of next step with an instrument or finger directly or indirectly in open procedure. Two examples:

  Description 1: The resident asked “And do you like to sew this across the…I’ve done it before where we’ve twisted… (the surgeon asked “What do you like to do?”) …then just put a stitch and tie it off”. The surgeon said “Your choice. Your choice” (and pulled up the sac). The resident said “It seems you want me to do this” and began suturing.

  Comment 1: “He (surgeon) is indicating his preference -- there is a lot of ways to close the hernia sac -- the surgeon twists it around and then suture it, or holds it up and runs the suture back and forward -- and he holds it up, so he indicates to the resident of his preference.”

  Description 2: The surgeon was holding the babcock in one hand and a forceps in the other hand. The resident was dissecting the muscle. The surgeon put his forceps next to (a spot near) the resident’s clamp and said “This is the recurrent laryngeal nerve (then pulled up a muscle nearby). Do you want to take it out?” The resident said “Yeah”.

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Comment 2: “He (the surgeon) opens it now and points out where it is and implicit in his direction, the resident is easy to identify the landmark of the recurrent laryngeal nerve.”

- Point out the critical spot or direct the resident to the next step through driving the camera in laparoscopic procedures. For instance:

Description: The surgeon and the resident were watching the screen. The surgeon was holding the camera; the resident was holding a grasper with one hand and dissecting the tissue with the other hand. The resident used the grasper to pick up a scar tissue and dissected it; then the resident asked “Working right on the soft spot?” The surgeon did not answer immediately, just watched the screen. The resident continued dissecting. In couple of seconds, the surgeon said “Mm-hmm, that little loop back problem down there” and pushed the camera a little closer to the spot where the resident was dissecting on. The resident picked up the scar tissue, and then dissected the tissue with scissors on that spot.

Comment: “I think the supervising surgeon at this point is directing the resident with the camera -- directing him where to go by moving the camera; not verbally saying that, but focusing the camera so that's the part he (resident) can see, and the resident is cueing on that part and moving along. Moving the camera is one of the ways to direct the resident to work - it is kind of telling them here is what I want you to be.”

- Verbally direct or re-direct steps of procedure and/or the resident's intra-operative judgment. Two examples:

Description 1: The resident ordered a forceps to do exposure; the surgeon helped the resident to stretch some tissue with a clamp (the resident then dissected that tissue), and then returned the clamp back to the scrub tech. After that, the surgeon put a retractor on and told the resident “Dissect from the wall (of thyroid)”. The resident said "Yes".

Comment 1: “The supervising surgeon is doing a little retraction here; ... He gave quite a lot of verbal direction, but did not interfere physically with the resident”.

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Description 2: The resident pulled up the scar tissue with a grasper and dissected it. The surgeon said “Now, work from front to back there (and moved the camera to the right)”. The resident said “Yep” and picked up the right side of the tissue with a grasper, pulled it up, and dissected it with a pair of scissors.

Comment 2: "The supervising surgeon wanted the resident to change the direction -- it is instruction and guidance."

- Direct resident's action and intra-operative decision through teaching medical students knowledge of the anatomy and the procedure/steps based on the resident's level. Namely, if the knowledge taught to the medical student is too simple or basic for the resident, this behavior will be excluded from guidance. Two cases in points:

Description 1: The resident was dissecting the sac. The surgeon was pulling up the sac with a hemostat while holding a bovie with the other hand. The surgeon talked to the medical student standing next to him “In the plug and patch repair our preference is not to open the sac, and actually just reduce it without opening”. The medical student said “Mm-mm”; the surgeon continued “And the thought is that by actually opening the sac (meanwhile the resident was checking the sac with her finger, and then picked up the sac with a forceps) we’re inciting some peritoneal inflammation or irritation which may increase postoperative pain, so that’s been the trend in the last few years to avoid opening the sac. What she’s looking for is the plane between the sac (meanwhile the resident checked the cord with fingers) and the cord and its contents. Being able to lift the sac in its anterior medial location up (the resident resumed dissecting the sac) and free from the cord contents so we can reduce it, mobilizing it all the way to its neck”. Then the surgeon looked at the incision while holding the sac.

Comment 1: “The supervising surgeon is giving some guidance (to the resident) about what he wants to happen in this case for the patient via teaching the medical student. He is not explicit on ”I want this done” but he is giving guidance I believe he wants the resident to do some thinking intra-operationally for the specific patient. He is explaining exactly what she is doing”.
Description 2: The resident was dissecting the sac. The surgeon asked the medical student “So if this is a hernia sac, which is anterior medial like you said, exactly where you said it was going to be, right, so anterior to the cord and medial. (the surgeon pointed the cord with a snap) So, what type of hernia does he have?” The medical student answered “It’s most likely going to be indirect”.

Comment 2: “He (surgeon) is teaching the medical student. But it is not guidance (for the resident), for it is pretty basic stuff (for the resident).”

- Proactively question the resident’s judgment to prompt further thinking. For example:

Description: The resident was dissecting the sac with a forceps while the surgeon pulling up the sac to her. The surgeon watched and asked “Don’t do anymore dissection distally than you need to though?” The resident said “Right, I just think the original plane I had been getting some of the core structures up (the resident pointed the sac with a snap, and the surgeon said “OK”), we’re still stuck up in it. Do you (scrub tech) have a snap?” (the surgeon told the scrub tech “Give her a hemostat”) Then the resident got a hemostat and dissected the sac.

Comment: “The supervising surgeon gave guidance again by (indirectly) saying "don’t do anymore dissection".

- Direct the resident between steps of procedure by providing feedbacks or clues to the resident’s questions. For instance:

Description: The resident was stretching the sac for the surgeon to dissect (with a bovie). The resident asked “Do you like to take a little triangle out of the distal, or a little wedge?” The surgeon held the bovie and asked “Tell me about that, why do you do that?” The resident stretched the sac and said “I’ve been told that it decreases the chance that it will scar down, and again, for the hydrocele formation, but I know some people do it and some people don’t”. The surgeon picked up the sac and said “I don’t usually, but...”. The resident asked “You don’t?” The surgeon continued “You’re the operating surgeon here”.

Comment: “The resident is asking the supervising surgeon for guidance again. This is interesting, because he (surgeon) is (also)
asking (question), gets the whole guidance question become complicated”.

- Ask the resident to tell the next step. For example:

**Description:** The surgeon looked at the incision and said “Goes all the way into the scrotum. All the way up into the abdomen. There are no contents in the sac as you can see”. Meanwhile the resident pulled up the sac with a forceps, and checked the sac with her finger. The surgeon got a hemostat from the scrub tech and continued "So it’s completely reduced. So what would you like to do next?” The resident was pointing with a finger and said “So I’d like to take it down, divide it about here and then cut”. The surgeon said “OK” and then the resident took a hemostat and picked up the sac.

**Comment:** “The surgeon asks the resident what she wants to do to stimulate her to think about what they (resident and surgeon) want to do, and the resident answers; this is an open option, I am sure the surgeon could correct the resident if he doesn’t agree (with the resident)”.

- Direct the resident to the next step by confirming or complimenting his/her action. A case in point:

**Description:** The resident was dissecting the sac. The surgeon held the camera and said “I can’t tell if that’s bowel right there or if that’s just... (meanwhile the resident picked up the sac with a pair of scissors and said “I can’t either”) peritoneum”. The resident then brought the scissors next to a tissue and dissected it. The surgeon watched and said “Yeah, excellent. Just keep doing what you’re doing right there”.

**Comment:** “I think even (the surgeon was) confirming -- (e.g.) saying “that’s good” -- is considered as guidance.”

- Guidance with the intention to assist the resident: the intention of these guiding behaviors performed by the surgeon is to assist the resident to complete the task by facilitating the OR team to effectively support the case, by reassuring the resident's intra-operative judgments, or through performing in accordance with the resident's decisions.
• Direct the OR team to support without asking the resident. For example:

Description: The surgeon held the camera and focused it on the gallbladder (where the resident was dissecting). The resident was picking up the gallbladder with the grasper. The surgeon then told (the nurse) “More head up (of the patient)… (A nurse came and adjusted the patient’s head) thank you”. Then, the surgeon pushed the camera a little bit closer.

Comment: "Right now the surgeon is giving couple of direct instructions to the person (OR staff) -- which is interesting. He uses (a) alternative way to tell the resident he had trouble to see what he wants to do instead of letting him to do, maybe he knows the resident well and think he can do, but also maybe the resident indeed doesn't know how to do; the surgeon should ask the resident what he wants to do".

• Double check critical points of the procedure or the judgment which have been made by the resident. Two cases in points:

Description 1: The surgeon put away the bipolar after the dissection was done, and the resident continued dissecting the muscle. In a while, the surgeon said “Could you hold it on for a second? Let me see the feeling (and inserted his finger to check the thyroid)”. The resident said “OK”, took away the babcock, and paused dissection. The surgeon said “I feel it leach”. The resident then wiped the gland with gauze, and dissecting with a bipolar.

Comment 1: "The supervising surgeon is asking the resident to pause, so he can exam and help via inserting his figure to orientate himself in the dissection."

Description 2: The resident was suturing, the surgeon was retracting for her. The resident wiped the sac with gauze, checked the sac with fingers, and then said “I think we’ll need just a patch”. The resident then took out her finger and told the scrub tech “Yep, why don’t we get a large patch?” The scrub tech ordered a large patch for her. Meanwhile, the surgeon inserted his fingers to the sac and said “So, a large (patch needed) you think? (the surgeon was checking with his fingers) It’s a two-finger (width). (A large patch is) Okay”.

Comment 2: "The resident made the decision about the size of the patch, and the surgeon wants to check by himself -- that’s exactly
what I would do, too. I think he agrees (with the resident’ judgment).”

- Remind the resident at cautious points. For example:

Description: The surgeon was driving the camera; the resident was dissecting. When the resident was approaching a blood vessel, the surgeon said “Be careful with your hand that you’re tearing those vessels a little bit. See how it’s tearing there just a little bit. I’m gonna work on something different here a little bit”. The surgeon moved camera from left to right, and refocused on one point. The resident then dissected on that spot.

Comment: "He (the surgeon) was not really telling him (the resident) how to roll and how to pull off everything, (it is) more like a cautious note. Basically, the surgeon just tries to tell the resident to be careful to have respect to the tissues, when handling the tissue, there should be no tearing."

- General comments on the procedure or the anatomy. For example:

Description: The resident was dissecting the sac while the surgeon pulling it up to her. The surgeon said “Almost always a little bit of fat associated with a sac like this, sometimes called a lipoma of the cord, but more appropriately just retroperitoneal fat that comes out with the sac over time. (The resident completed dissection) All right.” The resident then wiped the incision with gauze.

Comment: “This is guidance; the surgeon gave general comments about anatomy, he (surgeon) did not play a significant role in managing this case, but did come up with future case again. He gives comments about what he thinks about anatomy are -- I think he reinforces what the resident is thinking”.

- Doing part of the procedure as a surgeon of the OR team while the resident leading the case. For instance,

Description: The resident picked up the sac with a snap. The surgeon looked down the incision, lifted up the retractor a little bit, and then repositioned it. The surgeon then picked a sac with a snap. In a while, the surgeon put down the snap, and watched the resident operating. The resident checked the sac with his finger and said “I might need to extend this a little bit”.
Comment: "The supervising surgeon is pulling the retractor (without asking the resident) -- that is guidance."

These 16 types of OR guiding behaviors also contributed to the later secondary data analysis which was conducted based upon Dr. Moulton’s conceptual framework of "slowing down" phenomenon in the OR (see Figure 2.6).

**Frequency of Reported Guiding Behaviors**

There are 16 types of guiding behaviors in total across three types of guiding intentions in the OR. Figure 4.1 provides a summary of the frequency for each type of guiding behavior reported in Phase One. The frequency was also broken down to open procedure and laparoscopic procedure, and the eight observing surgical cases equally fell into these two procedure categories. The frequency of OR guiding behaviors is considered as a natural property of OR guidance. It is a countable unit and provides objective evidence to balance the amount of OR guidance which is self-reported by supervising and/or observing surgeons. Three things are revealed in Figure 4.1:

- "Verbal Direction / Redirection" and "Point-out" are two types of reported guiding behaviors which were most commonly used in both open procedures and laparoscopic procedures. The reported "Verbal Direction/Redirection" guiding behaviors were identified by observing surgeons and/or the senior surgical faculty in cases where the case difficulty level ranged from low to high and residents' training level (PGY) varied from PGY3 to PGY5. The same situation occurred in "Point-out" guiding behaviors except those reported only in low and moderate difficulty level cases.
- A majority (11/16) of the reported guiding behaviors was identified in both open procedures and laparoscopic procedures. Some guiding behaviors just apply to
certain surgical procedures. For example, “Point-out with Camera” only occurs in laparoscopic cases when the supervising surgeon is driving the camera (laparoscope). But many OR guiding behaviors can be found in both open and laparoscopic procedures, though their reported frequencies might be different. In other words, most OR guidance can be applied to various surgical cases regardless of the types of procedure.

- The average reported frequency of guiding behaviors with the intention to teach (3.33) is lower than those of guiding behaviors with the intention to direct (10.25) and to assist (7.00). According to the defined features of these three groups of guiding behaviors in the OR (see p.75-84) and the scaffolding model in surgical residency (see Figure 2.2), the frequency of the guiding behaviors with the intention to teach may decrease when the operating resident's knowledge, experience, and training level increase, though supervising surgeons may still teach residents new instruments or techniques for future use. In Phase One, seven cases were performed by senior residents (PGY4 and PGY5) and one was performed by a PGY3 resident. Usually surgical residents in their training levels are considered to be more competent than junior residents. This may be one of the possible reasons why guiding behaviors with the intention to teach occurred less frequently in Phase One. Other factors, which influence the supervising surgeons’ decision-making on guidance were explored in Phase Two and will be discussed in a later section of this chapter.
Figure 4.1 The frequency of reported OR guiding behaviors in Phase One.
Different Perceptions of OR Guidance

Table 4.4 illustrates the difference between OR guidance reported by surgeons and residents throughout Phase One. The difference is observed in the following two areas:

- The overall frequency of reported OR guidance: the difference in the overall frequency of reported OR guidance was identified if the resident did not share the same attention and interpretation of the guiding behavior reported by the observing surgeon and/or by the observing senior surgical faculty, and vice versa.
- The amount of OR guidance reported: the amount of guidance was collected with the descriptions from the "Degree of Guidance" item on the OPRS instrument after the observation.
Table 4.4

OR Guidance Reported by Surgeons and Residents in Phase One.

<table>
<thead>
<tr>
<th>Case Name</th>
<th>Case Difficulty</th>
<th>Operating Resident PGY Level</th>
<th>Seven Experts Rating on Degree of Guidance</th>
<th>Reviewing Resident PGY Level</th>
<th>Amount of Guidance Report by Observing Surgeon / Resident</th>
<th>Total Number of Guidance Events Identified in the Video Segment</th>
<th>Agreement on the Reported Overall Frequency of OR Guidance between Surgeon and Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laparoscopic Cholecystectomy</td>
<td>Low</td>
<td>PGY5</td>
<td>Moderate</td>
<td>PGY 5*</td>
<td>Minimal /Minimal</td>
<td>11</td>
<td>54.5% (6/11)</td>
</tr>
<tr>
<td>Case 1</td>
<td></td>
<td></td>
<td></td>
<td>PGY3</td>
<td>Minimal /Minimal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic Cholecystectomy</td>
<td>Low</td>
<td>PGY5</td>
<td>Minimal</td>
<td>PGY4</td>
<td>Minimal /Minimal</td>
<td>9</td>
<td>44.4% (4/9)</td>
</tr>
<tr>
<td>Case 2</td>
<td></td>
<td></td>
<td></td>
<td>PGY5</td>
<td>Substantial/Moderate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Inguinal Hernia Repair</td>
<td>Low</td>
<td>PGY3</td>
<td>Moderate to Substantial</td>
<td>PGY3*</td>
<td>Substantial/Moderate</td>
<td>16</td>
<td>37.5% (6/16)</td>
</tr>
<tr>
<td>Case 1</td>
<td></td>
<td></td>
<td></td>
<td>PGY5</td>
<td>Substantial/Moderate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Inguinal Hernia Repair</td>
<td>Low</td>
<td>PGY5</td>
<td>Moderate</td>
<td>PGY5</td>
<td>Moderate / NA</td>
<td>24</td>
<td>54.2% (13/24)</td>
</tr>
<tr>
<td>Case 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroidectomy</td>
<td>Moderate</td>
<td>PGY4</td>
<td>Substantial</td>
<td>PGY5</td>
<td>Substantial/Moderate</td>
<td>10</td>
<td>60.0% (6/10)</td>
</tr>
<tr>
<td>Case 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroidectomy</td>
<td>Moderate</td>
<td>PGY4</td>
<td>Substantial</td>
<td>PGY4</td>
<td>NA/ Substantial</td>
<td>17</td>
<td>82.4% (14/17)</td>
</tr>
<tr>
<td>Case 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic Ventral Hernia</td>
<td>High</td>
<td>PGY4</td>
<td>Moderate</td>
<td>PGY3</td>
<td>Moderate /Minimal</td>
<td>11</td>
<td>63.6% (7/11)</td>
</tr>
<tr>
<td>Case 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic Ventral Hernia</td>
<td>Low</td>
<td>PGY5</td>
<td>Substantial</td>
<td>PGY4</td>
<td>Substantial/Substantial</td>
<td>16</td>
<td>18.8% (3/16)</td>
</tr>
<tr>
<td>Case 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. According to the sampling criteria (see p. 50), this resident was the primary data contributor.
Except two cases (Open Inguinal Hernia Repair 2 and Thyroidectomy 2) which contained incomplete ratings on the amount of guidance, observing surgeons and residents reported the same amount of guidance on half of the cases (3/6); in rest cases, the amount of guidance reported by observing surgeons were higher than that reported by observing residents. The agreement on the overall frequency of reported OR guidance between observing surgeons and residents had a large range of variation (from 18.8% to 82.4%). And three noteworthy scenes were found during the data analysis. First, surgeons and residents had different interpretations of the same behavior. Namely, they did not agree on whether this behavior was guidance or not from their comments. For example:

The resident picked up the sac with a snap. The surgeon looked down the incision, lifted up the retractor a little bit, and then repositioned it.

"The supervising surgeon is pulling the retractor (without asking the resident) -- that is guidance." -- Observing senior surgical faculty;  
"The surgeon is (just simply) pulling the retractor." -- Observing resident.

Although the senior surgical faculty and the resident both paid attention to the behavior of "moving the retractor", obviously the senior surgical faculty identified it as guidance while the resident did not.

Second, in some cases residents identified certain behavior as guidance but not all surgeons were aware of it. A case in point:

The resident was dissecting. The surgeon asked "How about if I hold this one (retractor)? So I can see now. Let's get over that superior pole". The resident said "OK".

"I don't see (any) guidance here." -- Observing surgeon;  
"I think the surgeon is talking to the resident, giving guidance the resident needs." -- Observing resident.
The third scene, which occurred most commonly during Phase One, was that residents were not aware of or did not pay attention to behaviors reported and identified by surgeons as guidance. For instance:

The resident picked up a sac with a snap, watched the surgeon checking the sac, and said "It's here I think, (the bleeding is) in this thing, right from here...Yeah, I think it's caught up here". The surgeon then said "I use 2-0 vicryl all the way out until the 3 and then 4-0' and pointed a spot with his cautery. The resident said "OK".

"The surgeon is making the decision how to repair this (for the resident) -- this is also considered as guidance." -- Observing surgeon; the resident did not comment anything on this conversation.

Feedback from the semi-structured interviews also coincided with these three scenes. Findings indicated that there was no well-established tacit perception about OR guidance between residents and surgeons, as well as within the residents. This might lead to a divergence in the frequency and amount of OR guiding behaviors reported by surgeons and residents. As the result, residents may receive less guidance than what supervising surgeons expect, or more guidance than they (residents) are aware of when trained in the operating room.

**Contributing Factors to the Decision of OR Guidance**

Prior to further exploring contributing factors that influence supervising surgeons' decisions on OR guidance in Phase Two, 12 general contributing factors (Table 4.5) were pointed out by observing surgeons in Phase One during the semi-structured interviews. Nearly half (5/12) of these factors were related to residents; some (4/12) were related to supervising surgeons, and the others (3/12) were related to the case. Observing surgeons gave examples to demonstrate these factors during interviews. However, since they were not supervising surgeons in those videotaped cases, Phase
Two was then carried out to investigate how these contributing factors influence the phenomenon of guiding residents in the OR.

Table 4.5

*Contributing Factors to the Decision of OR Guidance in Phase One.*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Examples Provided by Surgeons</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factors relate to the Resident</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resident's PGY Level</td>
<td>A supervising surgeon may feel the need of providing more guidance for a junior resident who is performing a difficult case rather than for a senior resident.</td>
<td>6</td>
</tr>
<tr>
<td>Resident's Skills Level</td>
<td>If the supervising surgeon knows the resident is good at laparoscopic Cholecystectomy procedures, she may be more watchful and let the resident lead the case.</td>
<td>3</td>
</tr>
<tr>
<td>Resident's Pre-experience with the Surgeon</td>
<td>If the supervising surgeon has worked with the resident 500 times, he may know what the resident will do next without asking or telling.</td>
<td>2</td>
</tr>
<tr>
<td>Resident's Personality</td>
<td>If the resident becomes aggressive during the operation, the supervising surgeon has to jump in and give guidance.</td>
<td>1</td>
</tr>
<tr>
<td>Resident's Confidence on Performing the Case</td>
<td>This is a key issue that impacts the supervising surgeon's decision on whether to provide more guidance to the resident.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Factors relate to Supervising Surgeon</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgeon's Personal Style</td>
<td>If the supervising surgeon is a talkative person, he may prefer to give more verbal guidance to the resident.</td>
<td>5</td>
</tr>
<tr>
<td>Surgeon's Confidence Level in the Resident</td>
<td>If the supervising surgeon doesn't know and trust the resident, it is very uncomfortable for him to keep silent and have the resident perform.</td>
<td>2</td>
</tr>
<tr>
<td>Surgeon's work Experience</td>
<td>In general, junior surgeons may provide more guidance than senior surgeons do in the OR.</td>
<td>2</td>
</tr>
<tr>
<td>Surgeon's Self Residency Training Experience</td>
<td>The supervising surgeon's self-residency training experience may remind him that this is a very important thing to tell the resident, then he will provide guidance to the resident.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Factors relate to Case</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Difficulty and Progression</td>
<td>If it is a very difficult case, or at that moment, the case situation becomes complicated, the supervising surgeon will provide more guidance to ensure patient safety.</td>
<td>6</td>
</tr>
<tr>
<td>Type of Procedure</td>
<td>Usually residents receive more verbal guidance when performing laparoscopic procedures than open procedures, for the supervising surgeon can do a lot more in the open procedures.</td>
<td>3</td>
</tr>
<tr>
<td>Case Scheduling</td>
<td>The supervising surgeon may not want to offer as much guidance during the operation if the case is scheduled right before his dinner.</td>
<td>1</td>
</tr>
</tbody>
</table>
In Phase Two, a total of seven surgical cases were reviewed by their operating surgeons, meanwhile, 13 factors were identified. These factors were grouped upon the elements listed in Pratt's General Model of Teaching (see Figure 2.4). They were: OR setting-related factors (*context*), case-related factors (*content*), resident-related factors (*learners*), and supervising surgeon-related factors (*teacher and value*).

- **OR setting-related factors:** this group of factors was derived from the element of "context" in Pratt's General Model of Teaching. In this study, context referred to the setting of OR, such as the case scheduling and the patient. The OR setting was the major factor that influenced the supervising surgeon’s decision on guidance at that moment.
  - **Case scheduling:** this factor refers to the starting time of the case planned in the operating room. For instance:
    - "Yes, (OR schedule influences my way to provide guidance) in morning cases, I will be more casual (let residents do more and involve medical students more) unless we are really busy then I will speed things up; but for the afternoon cases, probably I will speed up and won't let the resident do much."

- **Patient Morbidity:** this factor refers to the diseased state or symptom of the patient. Two cases in point:
  - "It (AV Fistula Revision) is a very difficult case for the resident because the patient has a lot of scars (from her previous surgery). ... (AV Fistula) Creation is much easier than this one (unless the patient condition is worse). I let her do most of the case."
  - "(I discussed with the resident regarding another possible way to do this case) I did this (way) before, it is doable, but hard for a patient has half of her stomach removed already, so it is harder to do ... and this patient's case is a little bit challenge, we did that is for the patient safety."
• Case-related factors: this group of factors was derived from the element of "content" in the General Model of Teaching. In this study, case referred to issues that concentrated on the case, including the case progression, the case frequency, key steps of the procedure, and type of the procedure.

  ▪ Case property: this factor refers to the natural constant attributes of the case, including the procedure type and the local case frequency.

    Two examples of comments:

    ▪ "(Surgical) Procedure does make a difference. (In open cases) If something is inside the belly, and my hands on it, I can directly control (the resident); but (in laparoscopic procedures) with a laparoscope, I can (only) point them (residents) the direction and physically tell them how to do more than able to direct something in open (procedures)."

    ▪ "If it is a rare case, I probably will give more guidance (to the resident)."

  ▪ Case progression: this factor refers to the dynamic instance of case developments, including case pace, critical points of the procedure, and vital anatomic sites. Four examples:

    ▪ "(The reason why I checked that spot with my fingers because) I want to make sure everything is right, and everything is on its spot; (because) this is sewing the mesh, this is the repair, this is the whole reason we came here to fix the hernia. It is a very vital step. I will nearly do it for almost every resident."

    ▪ "(I picked up these contents to teach at this moment) because this part is so visual. This is a fuzzy concept they learn from med school, but it suddenly become so clearly defined at this point. It is a perfect time (that I can use) to help them (resident and medical student) understand."

    ▪ "I observe them and watch them; if I feel them cannot do it within the time I given (in mind), I will stop them and show them the way I want them to do."
• “Now she can (only) do some section (of the case). ...I can sit there and do nothing, but the operation will take twice longer.”

• Resident-related factors: this group of factors was derived from the element of "learner" in the General Model of Teaching. It referred to the issues that were related to the fact that the operating resident might influence the supervising surgeon's decision on guidance. It included the resident's PGY level, trustworthiness, confidence, experience, personality, and skills.

  • Current status of the resident: this factor refers to the competency level on which the resident currently stands. It composes two or more characteristics, which come from the resident's PGY level, knowledge, experience, and skills, into a single or unified factor/entity. Two cases in point:

    • “It (issue may impact my decision on guidance) is not only (residents') PGY level, but my personal experience with them, the case frequency, and residents' experience in similar cases. I need to know where they are on the learning curve (before the case), and then I can decide how much guidance I should provide.”

    • “Sometimes residents make stuff up but just don't have the foundation, and (it) usually leads to waste of time. .. Yes (foundation refers to their knowledge and experience). Like in the phase that they develop anatomy, I almost keep silent and see how well they can do that. And then, I can redirect if they are wrong; or I think they do something really well and reinforce their right choice.”

• Trustworthiness of the resident: this factor refers to the resident's deserving of trust which was evaluated by the surgeon based upon knowing the resident through previous co-operative experience. Two cases in point:
“Before we start the case, I know what I am going to do with the case. (At that moment) I don't care which (PGY) level he is, I want to know the resident first before doing that (case). So I need to know the resident before I decide how much to let him do. Private practice 100% comes from referral. So I need to make sure I trust the resident before I let him do it.”

“If I know she cannot do something well, I will give more guidance on this part (in next case). For residents I know (them), I likely give less guidance and direction unless things do not go the way we plan to go.”

Resident's confidence to perform: this factor refers to the level of confidence which was shown by the resident and assessed by the surgeon during the operation. Two examples:

- “I pointed out the vein to the resident because her time was going slowly. Her (operating) speed was not slow, but her dissection did not move along as expeditiously as I thought - - she was just not sure (so I pointed it out to her).”
- “If I detect them lack of confidence to perform the case, I will give guidance.”

Resident's personal traits: this factor refers to the visible behavior caused by the resident's personality or the resident's preferred way to learn in the OR. Two examples:

- “(The resident was pulling up the sac) He was a little bit more aggressive than I expected, so I told him to use more sharp dissection -- this is a method he has used many times.”
- “Yes (the resident's personality will impact the way I give guidance), some (resident) may take some kind of guidance better than others. Even the resident is aggressive, I may not want to control more, but may give more vocal (guidance) about how I do it and what I want to do.”

Supervising surgeon-related factors: this group of factors was derived from the elements of "teacher" and "value" in the General Model of Teaching. It referred to issues emerging from what the supervising surgeon believed to be valuable and important, such as the preferred way
to do surgery, personal training philosophy, and the responsibility for the patient safety.

- Surgeon's previous experience: this factor refers to the previous training experience and the working experience of the surgeon as well as his/her co-operating experience with the resident. Two examples:
  
  - "In laparoscopic cases, you may need to take more direction for the PGY2 to make her things done; I did a lot of directing (for PGY2) because I won't assume she knows how to do it; for the PGY4, I know what she can do, I know she knows the cystic duct, so I let her pull out and dissect it. I will give the PGY2 more direction if she was the only resident in this case. I don't make assumptions until I work with this resident for a while. If I know she cannot do something well (from previous cases), I will give more guidance on that part; for residents I know, I likely give less guidance and direction unless things do not go the way we plan to go."
  
  - "By the time I let him do this much, I know he knows how to do the case because I led him do the (type of) case before."

- Surgeon's comfortable level of resident's action: this factor refers to the surgeons' level of a state of ease and satisfaction. Two cases in point:
  
  - "The resident is gonna put the stitch the way I don't want, that's why we had that discussion. I tried to explain to him why I put the mesh and stitch the way I do. I want him to see my way. I did not feel comfortable to allow him to try and see different ways (as a junior resident at that moment)."
  
  - "(I did the majority job) because this is a case I don't feel comfortable to give away (to the resident)."

- Surgeon's preferred way to do surgery: this factor refers to the personal favorite way(s) that the surgeon wants to use in the case. Two examples:
- "I don’t like the one (forceps) she ordered. I don’t care (whether she is able to choose a right instrument), I just want her to do (and follow) what I want."
- “With having a 4th year resident, I don’t need to do much direction, and I will let them (PGY4) do more actual direction unless something I want them to be done in my specific way."

- Surgeon's philosophy of training residents: this factor refers to the surgeon's personal ways and belief in training residents in the operating room. Two examples:
  - "I sort of divide residents into three groups: naïve, medium, and chief. Naïve (residents) may have done the procedure 1 or 2 times, but it -- the upcoming case -- is a new procedure for them, so I need to provide guidance in almost every step and between steps. The medium (residents) are people who have done a few cases, their confidence is higher, most of the time they may guess what the next step is, or maybe they can do quite well on one step, but they may (get) stuck (in between steps) when moving to the next step, so I provide guidance on between-steps to help them proceed to the next step. Chief (residents) is the group (of residents) that really gets the big picture -- usually they are chief residents. I try to stand back, not even guide between steps. I am helping them to go ahead. My only contribution is if there are some fine points that I think they miss or I want to reinforce. So I have a different focus on each resident (group)."
  - “When I decide my teaching mode, I will also decide my primary teaching purpose of the case and the teaching method. For senior (residents), usually I will let them learn by doing more; for junior (residents), I probably will show them more."

- Responsibility as a surgeon: this factor refers to the aspect that the surgeon was aware of the responsibility as a surgeon and provided guidance to the resident to ensure patient safety. For instance:
  - "I did the majority job (of the case) and the resident just assisted. ... (I gave) a lot of guidance because the case was too difficult. ... I am not sure about her previous experience, but I felt guilty not letting her do a lot in this case.... (Because)"
I define my role as a teacher in the OR no matter which resident works with me. At the same time, I am a surgeon as well. I need to ensure my patient safety. My goal is 'perfect case for each case'."

After synthesizing data collected in Phase One and Phase Two, an emergent theme of OR guiding phenomenon was initially formed. To know more about this phenomenon, a further in-depth analysis of the aggregate data was conducted to deconstruct the guidance decision-making phenomenon based on Dr. Moulton's framework of "slowing down" phenomenon (Figure 2.6). Moulton's framework of "slowing down" phenomenon was considered as the theoretical base to deconstruct supervising surgeons' decision-making on guidance phenomenon in the OR, because 1) judgments for "slowing down" and decisions on guidance both occur in the OR settings, and 2) interventions happen between similar types of learners (residents) and teachers (surgeons). A conceptual framework of the decision-making phenomenon about a guiding in the OR (Figure 4.2) was gradually evolving during the in-depth data analysis. According to the Scaffolding Model in Surgical Residency Training (Figure 2.2), OR guidance was provided by the supervising surgeon to support (provide scaffolding for) the resident’s OR performance based upon his/her current competency level to achieve the expected operative performance in the operating room. This conceptual framework, which was built on the Scaffolding Model and Moulton's conceptual framework, included four dimensions: Pre-OR Initiators, Intra-Operation Influences, Intra-OR Maneuvers, and Rule of Control in the OR. All contributing factors to the decision of OR guidance were classified into the dimensions of Pre-OR Initiators, Intra-Operation Influences, and Rule of Control in the OR. And the OR guidance provided by the supervising surgeon was reflected in the Intra-OR Maneuvers which covered the 16 types of OR guiding behaviors discussed in the last section.
Figure 4.2 Conceptual framework of the decision-making phenomenon about guidance in the OR.
A conceptual model of OR guiding phenomenon

This conceptual framework illustrates that the supervising surgeon's guiding behaviors or the overall decisions on guidance are initially planned based on the case and the resident before the case, and are kept adjusting, including amount and frequency, throughout the case under the influence of the case progression and personal factors. But each surgeon may have his/her own strategy/rules to control the guidance during the operation. This framework will be discussed in detail in the following section.

Pre-OR initiators. In the process of in-depth data analysis, one emergent theme was that supervising surgeons tended to have an initial guiding plan, especially regarding the overall amount of guidance, for the resident after knowing which resident would work with him/her on what case. For instance:

Researcher: *When you receive the case and know who will work with you, will you make a brief decision on how much case you would like to let the resident do?*
Surgeon: *Right.*

The Pre-OR Initiators considered the case and the resident as two contributing factors. The factor of "Case" includes three contributing factors which have been reported in an earlier section (see p.92-94): case property, patient morbidity, and case OR scheduling. The factor of "Resident" contains the resident's trustworthiness, and his/her status of competency which is composed of two or more issues from the resident's PGY level, knowledge, skills, and experience. Table 4.6 provides an emergent description of the Pre-OR Initiators.
Most supervising surgeons in Phase Two indicated that once the resident and the case were confirmed, they would roughly have an initial idea about how much guidance they would provide to the resident before getting into the OR. As one surgeon stated:

"Yes, it is a huge part that I will decide the amount of guidance provided to the resident after confirming the case and who will work with me. I will let a senior resident have some freedom and will not watch (him) as closely as I would do with the junior type of resident; (but) if this is a junior resident, I probably will guide him a lot more than what I did in this case with this (senior) resident."

Although the "Case Pre-OR Initiators" and the "Resident Pre-OR Initiators" had an impact on most supervising surgeons' planned guidance before getting into the operating room, this pre-OR guiding plan was initially established and would be changed once the case started. As another surgeon indicated:

"It (issue may impact my decision on guidance) is not only (residents') PGY level, but my personal experience with them, the case frequency, and residents' experience on similar cases. I need to know where they are on the learning curve (before the case), and then I can decide how much guidance I should provide. ... If I found out a resident does not (perform) as well as I anticipated during the first 10-15 minutes (after the case begins), I will step in and provide guidance. So it is a combination of pre-operation needs assessment and intra-operation assessment."

In this case, it is very obvious that the Case Pre-OR Initiators and the Resident Pre-OR Initiators contributed to the "pre-operation needs assessment" mentioned by the supervising surgeon. Although these two initiators might be kept throughout the case, some other factors would influence the supervising surgeon's "intra-operation assessment" and then change his decision on guidance. As a result, he would "step in and provide guidance" to the resident.
Table 4.6. Emergent descriptions of Pre-OR Initiators.

<table>
<thead>
<tr>
<th>Description of Initiators</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max=15</td>
</tr>
<tr>
<td><strong>Case Pre-OR Initiators</strong></td>
<td></td>
</tr>
<tr>
<td>Case Property</td>
<td></td>
</tr>
<tr>
<td>This initiator refers to the natural constant attributes of the case, including the procedure type and the local case frequency.</td>
<td>4</td>
</tr>
<tr>
<td>Patient Morbidity</td>
<td></td>
</tr>
<tr>
<td>This initiator refers to the diseased state or symptom of the patient.</td>
<td>3</td>
</tr>
<tr>
<td>Case Scheduling</td>
<td></td>
</tr>
<tr>
<td>This initiator refers to the planned start time of the case in the operating room.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Resident Pre-OR Initiators</strong></td>
<td></td>
</tr>
<tr>
<td>Trustworthiness</td>
<td></td>
</tr>
<tr>
<td>This initiator refers to the resident’s deserving of trust which is manifested in the resident and evaluated by the surgeon upon knowing the resident through previous co-operative experience.</td>
<td>7</td>
</tr>
<tr>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>This initiator refers to the competency level on which the resident currently stands. It composes two or more characteristics listed below into a single or unified factor/entity.</td>
<td></td>
</tr>
<tr>
<td>• PGY</td>
<td>13</td>
</tr>
<tr>
<td>• Knowledge and Skills</td>
<td>6</td>
</tr>
<tr>
<td>• Experience with similar cases.</td>
<td>6</td>
</tr>
</tbody>
</table>

Note. See p.92-98 for detail examples.

**Intra-Operation influences.** As indicated by its name, the Intra-Operation Influences refer to factors that may influence the supervising surgeon's intra-operation guiding behaviors, especially the guiding frequency, throughout the case. As one surgeon mentioned:

"Usually Laparoscopic Ventral Hernia is for PGY4 and PGY5, and sometimes also for talented PGY3. But it depends on the case. So you
have to engage in the case, when you get in there, you may change (your) mind.... You know, once the complicated case starts, things may change with the case.”

The Intra-Operation Influences contain two types of contributing factors which were mentioned earlier in this chapter: the case progression and the personal factors (Table 4.7). And the personal factors include:

- Factors from the resident: resident’s personal traits, and how confidence the resident demonstrates to perform the action;
- Factors from the supervising surgeon: surgeon’s previous experience, how comfortable to let the resident take certain action, and the surgeon’s personal preferred way to do the surgery.

Surgeons have described their experiences of "making decisions on guidance" intra-operatively as either planned (proactively planned) or unplanned (situationally responsive). Planned guidance occurred at critical points of the procedure (e.g. the mesh location in an open inguinal hernia repair procedure) and/or the step which the resident did not do well in recent similar case(s). Unplanned guidance was described as the guidance occurring in response to unexpected events caused by a variety of situations along with the ongoing case. For example, surgeon S saw his resident caused a little bleeding while cauterizing the sac in his case, he told the resident to ignore it and move on, because he believed that when cauterizing, if the surgeon/resident stopped too many times, the case would totally be stopped. In this example, causing a little bleeding on the patient was not expected by surgeon S before the case started. So his guiding behavior -- telling the resident to ignore and move on --
was in response to the "bleeding" situation with an intention of moving the case forward without jeopardizing the patient safety.

Comments from the stimulated recalls and semi-structured interviews revealed that under the impact of personal influences from resident and surgeon as well as the case progression, unplanned guidance occurred more frequently than the planned guidance made during an operation. As one surgeon stated:

"I make the decisions of guidance mostly based on the real-time case situation. ... The decision (of guidance) also depends on who is (working with me) and how he acts (during the case)."

In other words, the Case Progression Influencer (e.g. real-time case situation), Resident Personal Influences (e.g. how the resident acts), and Surgeon Personal Influences (e.g. Comfort level of resident's action) had a joint impact on the supervising surgeon's intra-operational decision of guidance. Since unplanned intra-operation guiding events are random, hard-to-control, and hard-to-predict, the OR guidance provided by the supervising surgeon may have a large amount of variation in the reported frequency from case to case.

No matter whether the OR guidance is planned or unplanned, the intention of the guiding behavior is to teach, to navigate, and to assist the resident to successfully complete the case. To accomplish this goal, three types of intra-operation maneuvers might be used to guide the resident. These maneuvers will be discussed in the next section.
Table 4.7

*Emergent Descriptions of Intra-Operation Influences.*

<table>
<thead>
<tr>
<th>Description of Influences</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case Progression Influence</strong>&lt;br&gt; <em>This influence refers to the dynamic instance of case developments, including case pace, critical points of the procedure, and vital anatomic sites.</em></td>
<td>12</td>
</tr>
<tr>
<td><strong>Personal Influences from the resident</strong></td>
<td></td>
</tr>
<tr>
<td>Confidence to Perform&lt;br&gt; <em>This influence refers to the level of confidence which is shown by the resident and assessed by the surgeon during the operation.</em></td>
<td>4</td>
</tr>
<tr>
<td>Personal Traits&lt;br&gt; <em>The influence refers to the visible behavior caused by the resident's personality or the resident's preferred way to learn in the OR.</em></td>
<td>3</td>
</tr>
<tr>
<td><strong>Personal influences from the surgeon</strong></td>
<td></td>
</tr>
<tr>
<td>Previous Experience&lt;br&gt; <em>The influence refers to the previous training experience and the working experience of the surgeon as well as his/her co-operating experience with the resident.</em></td>
<td>6</td>
</tr>
<tr>
<td>Comfort Level&lt;br&gt; <em>The influence refers to the surgeons' level of a state of ease and satisfaction.</em></td>
<td>4</td>
</tr>
<tr>
<td>Preferred Way to do Surgery&lt;br&gt; <em>The influence refers to the personal favorite way(s) that the surgeon wants to use during the case.</em></td>
<td>10</td>
</tr>
</tbody>
</table>

*Note.* See p.92-98 for detail examples.

**OR guiding maneuvers.** A category of OR guiding maneuvers (Table 4.8) was evolving from the in-depth analysis of the three groups of guidance reported (guidance with the intention to teach, guidance with the intention to direct, and guidance with the intention to assist) based on Moulton's conceptual framework and the newly developed definition of "OR Guidance" used in this study. OR Guidance was reflected in various types of behaviors by which the supervising surgeon performs in the operating room to
teach, to navigate, and to assist the resident to successfully complete the case directly or indirectly. In other words, these various OR guiding behaviors manifest the guidance provided by the supervising surgeon in the operating room.

According to the Merriam-Webster online dictionary, the word "maneuver" refers to “make a series of changes in direction and position for a specific purpose”, or “a movement, procedure, or method performed to achieve a desired result”\(^8\). The three groups of OR guidance, which were classified by their behavior intentions during the early data analysis, well matched the definition of maneuver. Therefore, the three groups of OR guidance were transformed into three types of Intra-Operation Maneuver under the conceptual framework of guiding phenomenon (see Figure 4.2). These OR guiding maneuvers are:

- Teaching- maneuver guidance (OR Guidance with the intention to teach)
- Navigating- maneuver guidance (OR Guidance with the intention to direct)
- Assisting- maneuver guidance (OR Guidance with the intention to assist)

The defining features of these OR guiding maneuvers are the same as those of the OR guidance with intentions (see p.75-84). Since the data analysis indicated that the second type of guiding maneuver contained both direct and indirect guiding behaviors, so it was renamed as “navigating maneuver” instead of “directive maneuver” to better describe this type of guiding maneuver in the OR setting. Table 4.8 provides a brief summary of the Intra-Operation Maneuvers. There are 16 types of guiding behaviors in total across these three types of intra-operative guiding maneuvers. Although intra-operation influences may impact the frequency of OR guidance provided

\(^8\) Source: www.merriam-webster.com
by the supervising surgeon, there must be something that the supervising surgeon has in mind to help him/her to pick up the type of guiding behavior and to decide the extent of guidance provided to the resident. As one surgeon commented:

“I use silence as a teaching strategy. Residents may know if I keep silent, that means they can move on; if I stop them, that means I don't think it is safe (to do that). ... With this PGY5 resident, again, in 9 months, she will not have supervising surgeons with her in most time, so I have to provide her a different (type of) scaffolding. I try to use this whole year to prepare her (to join private practice). ... I will let her do most of the case (which) she is comfortable with, and makes suggestions, or help her at the point she is not quite sure what she gets.”

It is very clear from the above comments that the surgeon's teaching strategy and his preferred way to train residents influenced the guiding behavior he would select. Other supervising surgeons who work with the same PGY5 resident may not use similar types of guiding behaviors, for they may have different personal preferred ways to train residents in the operating room.
Table 4.8

Guiding Maneuvers in the OR.

<table>
<thead>
<tr>
<th>Type of Intra-OR Guiding Maneuvers</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Maneuvers</strong></td>
<td></td>
</tr>
<tr>
<td><em>The intention of these guiding behaviors is to teach the resident through showing how to operate the current case by the surgeon and/or explaining the surgeon’s thought process to shape the resident’s future intra-operative judgments as well as adding new knowledge about instruments for future cases.</em></td>
<td></td>
</tr>
<tr>
<td>• Physically showing how to apply an operative skill and/or a technique to the current case</td>
<td>2</td>
</tr>
<tr>
<td>• Explain the surgeon's thought process or intra-operation decisions on actions and instrument selections to shape the resident's judgments in future cases.</td>
<td>7</td>
</tr>
<tr>
<td>• Allow the resident to learn from under-controlled &quot;not appropriate&quot; decision/action.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Navigating Maneuvers</strong></td>
<td></td>
</tr>
<tr>
<td><em>The intention of these guiding behaviors is to navigate the resident in the operation directly or implicitly towards the successful completion of the case.</em></td>
<td></td>
</tr>
<tr>
<td>• Point out the critical spot or the direction of next step with an instrument or fingers directly or implicitly in open procedure</td>
<td>11</td>
</tr>
<tr>
<td>• Point out the critical spot or direct the resident to the next step through driving the camera in laparoscopic procedures</td>
<td>14</td>
</tr>
<tr>
<td>• Verbal direct or re-direct steps of procedure and/or resident's intra-operative judgment</td>
<td>29</td>
</tr>
<tr>
<td>• Direct resident’s action and intra-operational decision through teaching medical students' knowledge of the procedure and anatomy.</td>
<td>5</td>
</tr>
<tr>
<td>• Question resident's judgment to prompt further thinking</td>
<td>4</td>
</tr>
<tr>
<td>• Direct resident between steps of procedure through providing feedback or clues to resident's questions</td>
<td>7</td>
</tr>
<tr>
<td>• Ask the resident to describe next step</td>
<td>2</td>
</tr>
<tr>
<td>• Direct the resident to the next step through confirming his/her action and/or complimenting</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 4.8 (cont.)

**Assisting Maneuvers**

*The intention of these guiding behaviors is to assist the resident to complete the task through facilitating the OR team to effectively support the resident and/or perform the resident's intra-operative decision by the surgeon.*

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct the OR team without asking the resident</td>
<td>6</td>
</tr>
<tr>
<td>Double check critical points of procedure or resident’s judgment</td>
<td>4</td>
</tr>
<tr>
<td>Remind the resident at cautious points</td>
<td>11</td>
</tr>
<tr>
<td>General comments on the procedure and/or anatomy</td>
<td>5</td>
</tr>
<tr>
<td>Doing part of the procedure as a surgeon or an OR team member while the resident leading the case</td>
<td>9</td>
</tr>
</tbody>
</table>

*Note.* See p.92-98 for detail examples.

**Rule-of-Control in the OR.** As data analysis continued, an emergent theme about supervising surgeons' guiding "styles" was evolving from four surgeons who were supervising surgeons in two or more videotaped cases. A surgeon's main guiding style seems to be consistent across cases and residents unless something deviates from his/her "rule of control" in the OR.

"Rule-of-Control in the OR" is not a pure control strategy of supervising surgeons' guiding behaviors in the OR, but the dynamic of OR guidance provided. As previously discussed, unplanned guidance may occur more frequently than planned guidance does during an operation. Since unplanned guiding events are very difficult to be foreseen accurately, a detailed plan of checking and/or restraining the supervising surgeon's action of guidance in the OR is hard to be set up prior to the case. For a supervising surgeon, guidance provided to the resident is not the only thing he/she needs to control in the OR, because 1) the control issue of OR guidance is a dynamic
balance (equilibrium) between supervising surgeons’ dual responsibilities in the OR --
guarantee the patient safety and provide training for the resident; 2) the supervising
surgeon has to control the case through guiding the medium of a resident. Thus, the
supervising surgeon is required to constantly monitor the case, the resident, and the
guidance provided to the resident throughout the operation. "Rule-of-Control in the OR"
is the primary guiding principle(s) that help supervising surgeons to monitor and to
balance the dynamic of guidance in the operating room, although surgeons used
different names to describe it during stimulated recalls with interviews. From Figure 4.2,
"Rule-of-Control in the OR" includes the supervising surgeon's philosophy of training
residents in the OR and the responsibility as a surgeon in the OR (Table 4.9). These
factors also contribute to setting up the keynote (main tone) of guidance provided by the
supervising surgeon in the operating room. As one surgeon stated:

“When I decide my teaching mode (for the resident in the OR), I will also
decide my primary teaching purpose of the case and the teaching method. For senior residents, usually I will let them learn by doing more; for junior residents, I probably will show them more. ... For junior residents, I usually will teach them step by step; for senior residents, I will teach them (the) ways to identify problems and find solutions.”

In the statement above, the supervising surgeon's "teaching mode" -- personal
philosophy of training residents -- was part of his "Rule-of-Control in the OR". It would
influence the primary way he would use to train and/or guide the resident in the
operating room (e.g. step by step). But his selection of guiding behavior to guide the
junior resident "step by step" (e.g. verbal direction) might be interfered with other factors,
such as resident's PGY level and confidence to perform.

In addition to setting up the keynote of OR guidance, the "Rule-of-Control in the
OR" may have an impact on the extent of OR guidance provided by the supervising
surgeon. Namely the supervising surgeon’s philosophy of training residents in the OR
and the responsibility as a surgeon in the OR may influence the amount or the level of
guiding content delivered to the resident at the guidable moment. As one surgeon
indicated:

“(The PGY5 resident raised another option to do the case) it is doable, but
hard for a patient who has half of her stomach removed already. ... I do
not want to do too many things to damage the patient. ... I am just going
through (the case) with the resident with my logic can be and what
symptoms we would or would not think about. ... I tried to teach the
resident (something she can use) in her future similar cases”.

This surgeon further commented the reason why he did that was that he had a
different guiding intention for the PGY5 resident; if she were a junior resident, he would
give direct orders instead of prompting her analytical thinking. In other words, this
surgeon's "guiding intention for PGY5 resident", as part of his philosophy of training
residents in the OR, may influence not only his guiding way(s) in the case, but also the
level of the guiding contents, such as his discussion about "another option to do the
case" with the resident. Likewise, the patient safety, as part of a surgeon's responsibility,
may have an impact on the amount of guidance provided as well. For example, a
surgeon stated:

"We (the surgeon and the resident) free up the vein, divide it, and swing
(vein) there. The resident did most of the artery, I gave her a little help I
don't normally do due to the patient's condition (was not good). ... Maybe I
am over critical; I have to do something (to help her in this case). I am still
a surgeon."

From all interviews, surgeons' descriptions showed that supervising surgeons
had to control the dynamic of guidance provided to the resident in the operating room
under their dual responsibilities, although they might not be aware of it.
Table 4.9

Emergent Descriptions of Rule-of-Control in the OR.

<table>
<thead>
<tr>
<th>Description of Rule-of-Control</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeon's Philosophy of Training Residents&lt;br/&gt;<em>This factor refers to the surgeon's personal philosophy and/or ways of training residents in the operating room has a direct impact on the type and the level of guidance provided.</em></td>
<td>7</td>
</tr>
<tr>
<td>Responsibility as a Surgeon in the OR&lt;br/&gt;<em>This factor refers to the surgeon is aware of his/her responsibility as a surgeon and provide guidance to the resident to ensure patient safety.</em></td>
<td>4</td>
</tr>
</tbody>
</table>

*Note.* See p.92-98 for detail examples.

Here is an illustrative example to demonstrate the overall decision-making phenomenon of guidance provided to a resident in the operating room. Contributing factors and guiding maneuvers are indicated in *Italic* font.

Surgeon S was one of the surgeons who would draft an initial guiding plan before getting into the OR. He knew the PGY5 resident (*resident's status and trustworthiness*), who would work with him on the Laparoscopic Ventral Hernia Repair case (*case property*), and the patient's health conditions (*patient morbidity*). It was not the first time he worked with this PGY5 resident (*trustworthiness*). But since surgeon S evaluated the case as a difficult Laparoscopic case even for a PGY5 resident (*case property combining with resident's status*), he initially planned to let the resident have some freedom to operate and would not watch as closely as he would do with a junior resident in similar cases. Likewise, he could use the camera /laparoscope to guide the resident during the case. As surgeon S mentioned things might change with the case once it started. So he changed his OR guiding maneuvers under influence along with the case progression, his personal factors, and personal factors from the resident. For example:
during the operation, the resident caused a little bleeding while cauterizing, he then directed the resident to move forward (case progression and surgeon's personal factors, navigating maneuver); when he found the resident's behavior of pulling and dissecting a tissue was a bit more aggressive than he expected, he jumped in and reminded the resident not to pull too hard (personal factors from the resident, assisting maneuver); later he saw the resident do not handle the instrument in the way he wanted and felt hard to explain the instrument handling technique vocally (personal factors from the surgeon), he then took over the instrument and demonstrated how to handle it in front of the resident (teaching maneuver).

Although these Intra-Operation Influences had impacts on the guidance that surgeon S provided to the resident in the OR, his teaching mode helped him to adjust the level of guidance provided in order to take patient safety and training resident into account at the guidable moment. For instance, the resident dissected a tissue and told surgeon S that he thought there was a bowel there; surgeon S said he did not think so and moved to another direction without detailed explanation; surgeon S did not show the resident a whole lot more about "why it was not a bowel" but gave a little statement about a different direction from what the resident was doing right now. Because the surgeon S's teaching mode was to have the PGY5 resident to learn by doing more and to identify problems by himself. At the same time, he believed that the patient was safe even he did not provide substantial guidance to the resident at this point, for the resident was doing a good job on this difficult patient who had many scars. The patient safety and surgeon S's teaching mode (Rule-of-Control in the OR) collectively monitored and influenced surgeon S's guiding behaviors throughout the case. For example, at the moments of little bleeding and the resident's aggressive pulling,
surgeon S provided guidance at those moments without further explaining the reason why.

From the illustrative example above, the contributing factors to the decision of OR guidance investigated in Phase Two indicated that supervising surgeons tend to draft a guiding plan after knowing the resident and the case upon the "Pre-OR Initiators" (case property and resident factors). This initial OR guidance plan may be changed after the case starts, because most guidance events are unplanned; the case progression and personal factors from the surgeon and the resident may influence the supervising surgeon's guiding behaviors, collectively or individually in the OR, especially the frequency. These guiding behaviors including the supervising surgeon intend to teach, to navigate, and to assist the resident to successfully complete the case, represented Teaching Maneuvers, Navigating Maneuvers, and Assisting Maneuvers intra-operationally. The surgeons' dual responsibility for patient safety and training residents served as their "Rule-of-Control in the OR" to balance the dynamic of OR guidance provided to the resident. Although the decision-making phenomenon was deconstructed into four dimensions, these contributing factors, especially the Intra-Operation Influences and Rule-of-Control in the OR, may influence the supervising surgeon's guiding behaviors, including the decision, frequency, and the amount, collectively during the operation. Further studies about each dimension are needed to build up and refine a holistic guidance decision-making phenomenon in the OR. In the next chapter, the findings and possible implications from this study will be summarized and discussed.
CHAPTER 5

Discussions

The research findings from this study in surgical residency training are summarized and discussed in this chapter. In the first section, the overall findings were reviewed. Then the three types of emergent OR guiding maneuvers were discussed under the Conceptual Framework of the Decision-Making Phenomenon about Guidance in the OR (Figure 4.2) along with the contributing factors to decisions of OR guidance. Finally the limitations of this study and suggestions for future research were pointed out at the end of the chapter.

Overview

This study was designed to explore how supervising surgeons provide guidance to residents in the operating room by establishing and developing a typology of OR guiding behaviors, by investigating factors that influence supervising surgeons' decision-making on guidance, and by exploring whether the frequency and the amount of guidance reported by residents are the same as those reported by supervising surgeons. Findings from Phase One and Phase Two are:

1. Sixteen types of supervising surgeons' behaviors from the three OR guiding maneuvers (teaching maneuver, navigating maneuver, and assisting maneuver) were identified as OR guidance, including: physically showing, explain, learn from not appropriate decision, point out with instrument/finger, point out with camera, verbal direct/redirect, direct
through teaching medical student, questioning, give feedback to resident's question, ask next step, confirm and compliment, direct OR team, double check, remind, general comments, and doing part of the procedure.

2. Most of the reported guiding behaviors were identified in both open procedures and laparoscopic procedures; "point-out" and "verbal direct/redirect" were two types of reported behaviors used most commonly; the reported frequency of teaching maneuver guiding behaviors was lower than those of navigating and assisting maneuver guiding behaviors.

3. The difference of OR guidance reported by supervising surgeons and residents were reflected in the overall reported frequency and the reported amount of OR guidance: surgeons and residents reported the same amount of guidance on nearly half cases; but the agreement on the overall frequency of reported OR guidance from surgeons and residents had a great range of variation.

4. Thirteen contributing factors which might influence supervising surgeons' decisions on guidance in the OR were identified. They were demonstrated in three dimensions: 1) Pre-OR initiators (case property, patient morbidity, case scheduling, trusted resident, and resident's foundation), 2) Intra-Operation influences (case progression, resident's confidence to perform, resident's personal traits, surgeon's previous experience, surgeon's comfort level, and surgeon's preferred ways to do surgery), and 3) Rule-
of-Control in the OR (surgeon’s philosophy of training residents and patient safety).

Based on these findings, the phenomenon of guiding in the OR will be discussed in the next section.

**The Guiding Phenomenon in the OR**

Although several researchers have conducted studies to explore teaching in the OR (see p.36-41), some of the key features of supervising surgeon’s guiding behaviors that happened in the OR went unexamined, such as the perception of OR guidance/guiding behavior, the influencing factors, and etc. This study was designed to further explore the OR guidance and add accumulating knowledge to the scaffolding model of training residents in the operating room. Two key themes were emerging from the data analysis: 1) the divergence in the perception of OR guidance between surgeons and residents, and 2) the dynamic equilibrium of guidance provided by the supervising surgeon in the OR.

**Divergence in the perception of OR guidance.** In this section, the OR guiding behaviors will be discussed, and then followed by the divergence in the perception of guidance.

**OR guiding behaviors.** OR Guidance was observed in various types of behaviors that the supervising surgeon performs in the operating room to teach, to navigate, and to assist the resident to successfully complete the case directly or indirectly. The 16 types of OR guiding behaviors were classified into three groups by their behavior intentions (teach, direct, and assist). According to Fitts & Posner’s three-
stage skills acquisition model (see p.18-19), Swanson's system model of performance improvement, and Pratt's general model of teaching, these three groups of OR guiding behaviors might be considered as the outcome of supervising surgeons' intra-operative assessment of residents' skill levels in the OR. No matter which type of guiding behaviors the supervising surgeon performed, the guiding behavior might be an outcome-based maneuver with a specific intention at that point.

In Swanson's system model of performance improvement, he indicated that the 'outcome” was usually generated after the "assessment”. Likewise, the "outcome” might influence the "input” of next step, for the performance improvement progress was determined by the assessment results. For example, a supervising surgeon verbally directed the resident to move the scissors a little bit higher to dissect the tissue when observing the resident's performance, because the surgeon judged the resident's dissection might be off the place. Based on Swanson's performance improvement model and Fitts & Posner's skills acquisition model, the surgeon might determine the resident was in the "associative/Integrative” stage in which the resident practiced skills but still needed external clues to apply the skill. So, the surgeon directed the resident to dissect the tissue a little bit higher by verbal direction, which was one of the guiding behaviors from the group of "guidance with the intention to direct/navigation-based maneuvers”.

The intention of guidance may associate with the resident's level of expertise (competency). If the resident is assessed to have sufficient knowledge, skills, and experience, the supervising surgeon may take an "assistant" role and let the resident lead the case; if the resident is considered to have some knowledge, but have
insufficient skills and experience, the supervising surgeon may teach the resident how
to apply the skill and explain the reason; if the resident is in an intermediate stage, the
supervising surgeon may direct the resident to perform and intervene in the operative
decision-makings. In the above example, if the surgeon determined the resident was in
the "cognitive" level of the skills acquisition model, the surgeon might physically show
how to dissect -- as one type of the guidance with the intention to teach -- instead of
directing vocally, because frequent errors might occur. Driver training is another good
case in point. The trainer needs to teach the learner how to steer properly even after the
learner has passed the written test; when the learner's driving skill has been improved
to another level, the trainer may direct the leaner to drive on the road, such as telling the
learner how to merge into the left lane; when the learner's driving skills are close to
mature, the trainer may sit like a passenger and only intervene in the emergency
situation.

However, in order to support the OR guidance adequately, expertise and skills
acquisition models need be articulated to the case level, not to the surgical training level.
For one thing, supervising surgeons' assessments on residents' performance are case-
based and intra-operationally. For another, residents acquire new surgical skills and
develop their competency through a variety of surgical cases which differ from each other.

_Divergence in the perception of guidance._ During Phase One data analysis,
most surgeons and residents were observed to call OR guidance differently. Lack of
shared perception of OR guidance between surgeons and residents may be a common
phenomenon happened in surgical residency training. This may be caused by: 1)
Residents' way of learning in the OR, 2) surgeons' way to teach in the OR, and 3) the OR context. Residents' way of learning in the OR is set by the cognitive apprenticeship training model and the "one resident-to-multiple supervising surgeons" training relationship. Distinguished from trainees in other professional fields, surgical residents need to learn skills from multiple supervising surgeons in the OR during the same training period, and then re-assemble what they have learned to develop their own ways to perform surgical cases. Thus, the concept of guidance developed by residents in the OR may differ from that reported by supervising surgeons.

Likewise, the cognitive apprenticeship also influences surgeons' way to teach in the OR as well. As Pratt pointed out in the General Model of Cognitive Apprenticeship in the OR (Figure 2.5), the supervising surgeon has the authority to decide educable contents and opportunities in the case, and becomes the center teaching element in the OR. Thus, residents' perception (voice) may become secondary. As a result, surgeons and residents may not share a common perception of the OR guidance. In addition, the OR training context may also have an impact on the teaching/learning interventions happened in the operating room, because 1) teaching in the OR occurs in a high risk domain where the surgeon should assure the patient safety, and 2) usually the OR teaching culture is not in a "command and obedience" military style, for improving residents' ability to lead the case and operate independently is one of the key training goals.

Lack of shared perception of OR guidance between surgeons and residents may also be the reason why surgeons and residents reported OR guidance in different amount and frequency (Table 4.4). For one thing, residents and surgeons may pay
attention on different behaviors; for another, residents may not be able to recognize the impact of supervising surgeon's guiding behavior on his/her operative performance. As a result, the supervising surgeon may report substantial guidance provided to the resident in the OR while the resident may just report moderate amount of guidance received from the supervising surgeon.

However, the surgeon may not be able to assess the resident’s net performance if he/she cannot accurately estimate the amount of OR guidance provided to the resident. Based on Swanson’s Performance Improvement model, the surgeon’s input to improve the resident’s next performance (action) may be too much or too little for the resident. Likewise, the supervising surgeon's dual roles as supervisor and evaluator for the resident may impact the surgeon's assessment on the resident’s operative performance as well. Therefore, building up a taxonomy of OR guidance is needed to scaffold residents’ training in the OR. After that, more detailed issues regarding the OR guidance, such as the impact of guidance and the quality of guidance, can be further investigated in future studies.

As mentioned in the Literature Review, OR guidance should be faded out step by step along with the resident's competency development. Dunphy & Dunphy (2003) outlined the stages of ZPD in surgical education (Table 2.2); the Instructional Scaffolding model (Figure 2.2) also provided conceptual guidelines for the fading mechanism. However, these models were built on the long-term residency training and might not articulate residents' development stages within an individual surgical case. For example, Dunphy & Dunphy’s ZPD model has four stages (see p.32). Based on its descriptions, stage three and stage four may never occur in the OR, because
assistance at the stage three “could be disruptive”, and life-long learning, which usually applies to licensed surgeons, happens in the stage four. However, per as the policy requires, a supervising surgeon needs to work with a resident in the OR under no circumstances. The first two stages of Dunphy & Dunphy’s ZPD model provide limited guidelines for surgeons to assess residents’ intra-operative performance and to decide the intention and the amount of guidance for the next step. Thus, in order to further investigate scaffolding residents in the OR, the guiding behaviors and maneuvers need to be identified first, because the OR guiding behaviors and maneuvers are the fundamental information required to study scaffolding residents in the OR through guiding.

**Dynamic equilibrium of decision to guide residents in the OR.** This study investigated the contributing factors of surgeons’ decision-making on guidance in the OR. And then, during the process of deconstructing the decision-making phenomenon of supervising surgeons’ OR guidance based on Moulton’s conceptual framework (Figure 2.6), an evolving conceptual framework of the decision-making phenomenon about the guidance in the OR was formed (Figure 4.2). Four dimensions (Pre-OR Initiators, Intra-Operation Influences, Intra-Operation Maneuvers, and Rule-of-Control in the OR) were illustrated in the conceptual framework. Three dimensions (Pre-OR Initiators, Intra-Operation Influences, and Rule-of-Control in the OR) were acknowledged to have the potential to influence supervising surgeons’ OR guiding behaviors, which were observed in surgeons' Intra-Operation Maneuvers, collectively or individually.
Contributing factors to the OR guidance decision-making. A total of 13 contributing factors to OR guidance decision-making were identified in this study and sorted into four groups: OR setting-related factors, case-related factors, resident-related factors, and supervising surgeon-related factors.

The result from data analysis indicated most (9/13) contributing factors were related to residents and surgeons. Based on Pratt’s General Model of Teaching (Figure 2.4), this result illustrated that the majority of OR guidance might be provided when the surgeon wanted to engage or give feedback to the resident in the operating room. The relationship between the resident (learner) and the surgeon (teacher) in Pratt's model referred to the learning engagement in the context. The supervising surgeon might use guidance to engage the resident intra-operationally, and/or justify feedbacks after assessing the resident's performance. Likewise, according to Pratt's General Model of Teaching in Cognitive Apprenticeship (Figure 2.5), the surgeon (teacher) and the case (content) merged in the OR setting (context). This might suggest that the teachable contents and/or the guidable moments were all decided by the surgeon. Thus, it was important to further investigate surgeons’ guidance decision-making phenomenon in the OR.

Dynamic equilibrium of guidance decision. To better explore the dynamic equilibrium of guidance decision, this section was organized in accordance with the following sequence: overview, the dynamic equilibrium, and the case-based ZPD and scaffolding.

Overview. This decision-making phenomenon may be unique to the surgical residency training due to its educational process and the training goal. The educational
process of a resident in surgery is a process of developing his/her expertise. A surgical resident obtains operative experience throughout the five post-graduate training years (PGY). The goal of a surgical residency program is to prepare the resident to function as a qualified practitioner of surgery at the advanced level of performance expected by a board-certified specialist. For the resident, the essential learning activity is the interaction with patients under the guidance and supervision of faculty members who give value, context, and meaning to those interactions. For the surgeon, the guidance and supervision in the setting of residency training are responsible for assuring the provision of safe and effective care to the individual patient; assuring each resident’s development of the skills, knowledge, and attitudes required to enter the unsupervised practice of medicine; establishing a foundation for continued professional growth.

Assessment is a necessary step to improve learners’ performance based on Swanson’s Performance Improvement model (Figure 2.1). As discussed in the last section, the intention of OR guidance may depend on the surgeon’s assessment of the resident’s performance. However, unlike athletes, a surgical resident does not have a long-term one-on-one coach in the operating room throughout the five-year training. The on-and-off relationship between a supervising surgeon and a resident and the non-repeatable high-risk surgical case may lead the supervising surgeon to cautiously assess the resident’s intra-operative performance and then make decisions on guidance. To assure the patient safety and to assure the resident’s learning in the OR, surgeons may turn the decision-making on guidance into a gradual process. Supervising surgeons may draft initial guiding plans before entering the OR, and keep testing and adjusting the initial plan based on the case, the resident, and the surgeon’s dual responsibilities till the end of the case.
**Dynamic equilibrium.** When interviewing surgeons about their decision-making experience of OR guidance, an emergent complicated theme about controlling the dynamic equilibrium of decisions to guide residents in the OR came into sight. Dynamic equilibrium refers to "a state of balance between continuing processes"\(^9\) or "a state of balance achieved by two forces in motion"\(^10\). In the OR, the dynamic equilibrium of guidance decision may be formed by surgeons' dual responsibilities and further complicated by two issues: 1) most OR guidance would be situational responses to unplanned intra-OR events, and 2) the on-and-off relationship between supervising surgeons and residents.

Supervising surgeons usually need to keep monitoring the case, the resident, and the patient throughout the procedure due to their dual responsibilities of training residents and assuring patients' safety. However, these two responsibilities are hard to align with each other in the OR. For example, although an old saying said "failure is the mother of success", residents would not be allowed to learn from the case "failure" if the costs were the patient injury. Meanwhile, supervising surgeons are the key decision-makers of residents' OR learning opportunities according to Pratt's General Model of Cognitive Apprenticeship in the OR (Figure 2.5). Thus, given the dual responsibilities and Swanson's performance improvement model (Figure 2.1), supervising surgeons have to monitor and assess not only residents' performance but also patients' safety in order to determine intra-operative learning opportunities as well as OR guidance for residents.

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\(^9\) Source: Oxforddictionaries.com  
\(^10\) Source: Dictionary.com
Another reason why supervising surgeons need to keep monitoring the case, the resident, and the patient in the OR may be that the progress of the operation is difficult to predict. Each surgical case is unique and impossible to be replicated or repeated, because the patient, the disease, and the resident are changing from case to case. Supervising surgeons have to cautiously assess unplanned intra-operative events and make situational decisions for OR guidance.

If the training takes place in other professional domains, such as tennis training, the assessments of unplanned intra-operative events may be relatively simple. For one thing, the relationship between the coach and the tennis trainee is long-term, one-on-one, and constant; for another, the coach and the trainee know each other very well from the long-term relationship, including their personal traits and the progress of performance. However, the one-time, task-based and "on-and-off" relationship between the supervising surgeon and the resident adds uncertainty on some contributing factors to the decision of OR guidance, such as the resident's status, trustworthiness, personal traits, and the surgeon's previous experience with the resident. As one surgeon pointed out in the semi-structured interview, 100% surgical private practice came from referral; supervising surgeons had to make sure they trust that the resident before letting the resident do the operation. Thus, uncertainty on contributing factors to the OR guidance decision furthers the complication of assessing the unplanned events and controlling the dynamic equilibrium of guidance in the operating room. One possible consequence of effective dynamic equilibrium of guidance in the OR may lead to a win-win outcome: assuring the patient safety as well as maximizing the resident's intra-operative learning efficiency and skills acquisition. Although various expertise development models and theories have been explored in the literature and been discussed in Chapter Two, such
as Dreyfus and Dreyfus Model, these models were built on the long-term residency training and might not be able to articulate residents’ performance stages within an individual surgical case. As a result, making OR guidance decisions and controlling the dynamic equilibrium may become challenging. In this case, an intra-operative scaffolding method may be able to compensate the uncertainty on contributing factors to surgeons’ decision-making on OR guidance and helps to achieve effective dynamic equilibrium of guidance provided to the resident in the operating room.

**Case-based ZPD and scaffolding.** As discussed in the Literature Review, the instructional scaffolding model and Vygotsky's Zone of Proximal Development have been well studied and tested on various professional domains. However, they are usually applied to long-term macro-level knowledge learning fields. For example, Morelock and his research team (2003) applied scaffolding to the early childhood development. But training resident in the OR is to help residents to learn technical skills within a given short period of time in a high risk domain. The variety of cases, patients, diseases, and supervising surgeons makes it very hard for the traditional scaffolding model and the stages of ZPD (Table 2.2) to be implemented in the surgical residency and to articulate residents’ intra-operative performance stages. Although Pratt (2009) presented an approximate scaffolding model for teaching in the OR (Figure 2.3), methods of defining the boundary of ZPD and factors that might influence the supervising surgeon’s assessment of the resident’s development stages within the scaffold were not given. Likewise, Nyikos and Hashimoto (1997) pointed out some theoretical concerns about the concept of ZPD, such as the operational definition of "development" under different interpretations of the relationship between ZPD and scaffolding (see p.34). Findings from this study provide a possible way to define the
upper and lower boundaries of a resident's zone of ZPD and suggest that scaffolding residents in the operating room may be built upon the resident's case-based intra-operative Zone of Proximal Development (ZPD), which should be drafted before the operation and then being adjusted along with the case progress and the resident's performance. Case-based scaffolding model is recommended to be zoomed out on a single surgical case instead of the five-year training. Pratt (2009) pointed out that beyond learners' ZPD, learners cannot do the task even with the teacher's help, or can do the task totally by themselves. The situation is similar when guiding residents in the OR. Supervising surgeons may roughly decide how much they would let the resident do in the OR -- namely what the resident can do and cannot do in the case. In the example illustrated in Chapter Four (see p.112-114), although surgeon S evaluated the case as a difficult Laparoscopic case even for a PGY5 resident, surgeon S initially planned to let the resident have some freedom to operate the case and would not watch as closely as he would do with a junior resident in similar cases, because 1) he knew the PGY5 resident's status and the level of trustworthiness, 2) the resident had worked with him on the Laparoscopic Ventral Hernia Repair case before, and 3) the patient's health condition was appropriate for the resident's training level. As one surgeon commented:

"If an intern (PGY1) works with me on this difficult case, I probably will ask the resident to do some scrub things -- I want the (PGY1) resident focus on how to run the camera well, and hand something (to me) or hold something, for the (PGY1) resident doesn't have enough hands-on coordination to perform the case safely."

From the comment above, it is clear that the supervising surgeon would not let a PGY1 resident do a lot because most part of the case was beyond the PGY1 resident's "can do" limit. Another case in point, one supervising surgeon let the resident wipe the incision with gauze without the guidance provided, for this might be some basic action
that the surgeon trusted the resident can do by himself. Thus, the "can do" and "cannot do" section in the supervising surgeon's initial guiding plan may be considered as the initial boundary of the resident's ZPD in the case.

The resident's intra-operative ZPD will be refined together with the surgeon's OR guiding maneuvers once the case starts, because the Intra-Operation Influences (case progression and personal factors from the resident and the surgeon) may change along with the operation. Within the resident's intra-operative ZPD, the supervising surgeon can teach, navigate, and assist the resident to complete the case. For example, in the illustrative example in Chapter Four (see p.112-114), surgeon S was constantly changing his guiding maneuvers based on the resident's refined ZPD during the operation.

Findings from this study (Table 4.8) demonstrated that navigating maneuvers were the intra-operation guiding maneuver which was reported to be used most frequently, especially guiding behaviors of "verbal direction/redirection" and "point-out with finger or instrument or camera". This might be caused by 1) the possible uncertainty on contributing factors to the guidance decision-making, and 2) time pressure. Given the possible uncertainty on contributing factors to the surgeon's decision of OR guidance, the supervising surgeon may give more directive guidance point-by-point, such as verbal direction and point-out with fingers, to ensure the patient safety. Likewise, surgical cases usually are required to be completed within the specific timeframe. Under the time pressure, surgeons may speed up the case by providing directive guidance.
From the scaffolding perspective, this type of directive guidance should be faded out step by step if possible. In the operating room, surgeons are suggested to gradually transform from teaching maneuver guidance to navigating maneuver guidance and then to assisting maneuver guidance through assessing/re-assessing the resident's intra-operation judgments and performance. Surgeons may have experienced this type of guidance transition in the OR, but just not realize it. For example, as one surgeon mentioned:

“Sometimes is hard to explain (the action) to the resident via talking. I will (take over the instrument to) demonstrate it, and then give (the instrument) back to the resident to see whether he can replicate it.”

That means the surgeon may not use the teaching maneuver guidance for next time on the same action if the resident can replicate it successfully. Another example of assessing is that sometimes the supervising surgeon will ask the resident what he/she wants to do next. "Asking next step" is one of navigating maneuver guidance, but not as directive as the verbal direction does. If the resident does not plan to do what the supervising surgeon wants to do, the supervising surgeon then may still provide navigating maneuver guidance, such as verbal redirection, to the resident; if the supervising surgeon is satisfied with the resident's answer -- namely the resident passes the assessment and merges into another performance stage -- then the supervising surgeon may use assisting maneuver guidance (e.g. holding the retractor) and let the resident lead the next step of the case. Findings from this study (Table 4.8) have shown this trend to some extent, though residents' PGY levels might have an impact on the result. Most residents in this study were senior. Based on the ZPD and scaffolding models, if residents are seniors (PGY4 and PGY5), the amount of teaching maneuver guidance should be deceased and the assisting maneuver guidance should
be increased. However, the issues of uncertainty on guidance decision-making and the time pressure stimulated the frequency of navigating maneuver guidance in the operating room. Thus, a study to further investigate the transition of guiding maneuvers in the OR is recommended in future.

In addition to changing the type of guiding maneuver, gradually decreasing the frequency of OR guidance is suggested as another possible way to scaffold residents in the OR. Supervising surgeons may guide residents from proactive point-by-point guiding to passive guiding by request, especially when working with senior residents. No two surgical cases are identical. A senior resident may be assessed as "mid-level" in the case-based intra-operative ZPD at the beginning of the operation, even he/she has worked with the supervising surgeon before. As a result, the supervising surgeon may proactively guide the resident step by step. In pace with assessing and refining the resident's intra-operative ZPD, the surgeon is suggested to give more learning opportunities to the resident. Given the resident's instant performance/competency level, the surgeon may guide the resident passively in order to improve his/her ability to operate independently. In other words, the supervising surgeon is suggested to narrow down the "guidable moments" along with the evolution of the resident's case-based intra-operative ZPD. As one operating resident in Phase Two indicated, she found out that the supervising surgeon, who worked with her in the OR, was just waiting for her guidance request. Otherwise the supervising surgeon either kept silent or talked with someone else. The supervising surgeon also confirmed his guiding behavior in this case, for the resident was in PGY5 and his intention was to train her to operate independently.
Future Study and Limitations

This study was designed to explore how the supervising surgeon provides guidance to residents in the operating room by establishing and developing a typology of OR guidance, investigating factors that can impact supervising surgeons' decision-making of guidance, and assessing whether the amount and the frequency of guidance reported by residents were the same as that reported by supervising surgeons. The findings from this study update the current understanding about supervising surgeons' guiding behaviors in the operating room and the decision-making phenomenon of OR guidance. In the following section, future research and the limitations of current study will be discussed.

Future studies. This study was the second step in a series studies of OR guidance. And more studies will be needed to further explore this area under this topic in near future. Since the forces for changes made in medical education and training today is "largely external (i.e. Involving financing, emerging public health needs, and workforce planning) rather than internal (i.e. the result of critical self-evaluation within academic medicine coupled with the aim of improving quality and effectiveness)" (Conroy & Kirch, 2010, p.1), future studies about OR guidance should be expanded in two directions: 1) further exploring the OR guiding phenomenon, and 2) how to train surgeons to provide guidance in the OR more effectively.

To further explore the guiding phenomenon in the OR, studies about the guiding maneuvers, decision-making conceptual framework, and more feedback from surgeons are recommended. For the OR guiding maneuvers, a future study is needed to investigate the impact of different types of supervising surgeons' guiding behaviors on
residents' intra-operation performance development. Similar study would be needed for the conceptual framework of the decision-making phenomenon about OR guidance as well. In addition, a national wide survey of surgeons is recommended to enrich the contributing factors to the supervising surgeons' decisions of OR guidance.

In addition to the further investigations of OR guidance, studies are suggested to be conducted to explore the feasible and possible way(s) to train surgeons on how to effectively provide guidance to the resident in the operating room. Training residents in the operating room is in a high-risk context. Therefore, it may be challenging surgeons’ willingness to modify their guiding behaviors if they are not certain about the impact of their modified guiding behaviors on the (patient's) cost, the (surgical case) time consumed, and the patient safety.

**Limitations.** Current study has three limitations. Firstly, data source was limited. There were only 14 surgeons and one surgical faculty participated in this study, and all of them were from mid-Illinois region. Although this may not directly impact the research findings, it limits the scope of representativeness of the findings. Secondly, the time of the review/observation for this study was limited. Due to surgeons' extremely busy OR schedules, no case can be fully reviewed throughout Phase One and Phase Two. Likewise, only limited surgeons (six surgeons in Phase Two) were able to review their own performance due to the data collection restrictions. But the data collected are still sufficient to answer the research questions in this study. Finally, the study was conducted in the surgical settings; the frequency uses of surgical terms may limit the direct applications of the research findings presented here to other non-procedure based education programs outside medical fields.
References


Appendix A Semi-Structured Interview Guide

Individual Interview

Phase _____  Surgeon : FT [ ]  PT [ ]  Date:
Resident: PGY [     ]

Study Purpose:
• The primary purpose of this thesis is to explore how the supervising surgeon provides guidance to residents in the Operating Room.

Self-introduction
"Good morning/afternoon. I am __________. Nice to meet you. "
"This interview is conducted to get your opinions for the OR guidance provided by the supervising surgeon, and then enhance the training outcome of the residency training".
"I assure you that all your comments will remain confidential."
"I'm now going to ask you to review some video segments, and answer some questions. If you have any questions in the middle, please ask me."

Key Interview Questions

• During reviewing the video, please tell your observation about the supervising surgeon’s/your guiding behaviors;
• From your prospect, why the supervising surgeon/you provided OR guidance at this point?
• As a supervising surgeon, what are the major factors that will trigger you decide to provide guidance for the resident?
• At the end of the interview, tell any other type(s) of guidance you provide or experienced in the OR if it/they beyond the types you just described while watching the video records.

Closure

Thank you for your answers. And please provide the estimation for the amount of guidance with the OPRS rating scale given to you.
Appendix B OPRS Evaluation Form Sample

Laparoscopic Appendectomy Rating Form

Evaluator:          Subject:

Status:             

Program:            

Please rate this resident’s performance during this operative procedure. The caption above each item provides descriptive anchors for 3 of the 5 points on the rating scale. "N/A" (Not applicable) should only be selected when the resident did not perform that part of the procedure.

Patient Location

<table>
<thead>
<tr>
<th>MMC Inpatient</th>
<th>MMC Outpatient (23 hour )</th>
<th>St. John’s Inpatient</th>
<th>St John’s Outpatient (23 hour )</th>
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<td>O</td>
<td>O</td>
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</table>

Hospital Medical Record Number

Date of Procedure

MM/DD/YY

OPRS Case Difficulty

1. Straightforward anatomy, no related prior surgeries or treatment
   - O

2. Intermediate difficulty
   - O

3. Abnormal anatomy, extensive pathology, related prior surgeries or treatment (for example radiation), or obesity
   - O

Degree of Prompting or Direction
Substantial direction by attending. Resident performs all steps but the attending provides constant direction to the resident and surgical team.

Some direction by attending. Resident performs all steps but the attending provides occasional direction to the resident and/or to the surgical team.

Minimal direction by attending. Resident performs all steps and directs the surgical team independently with minimum or no direction from the attending, to either the resident or to the surgical team.

### Procedure Specific Criteria

#### Incision / Port Placement

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<th>5 Excellent</th>
<th>4 Very Good</th>
<th>3 Good</th>
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<th>1 Poor</th>
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<tr>
<td></td>
<td>Safe, efficient and optimal positioning of ports for procedure, &amp; anatomy</td>
<td>Functional but awkward port positioning, generally safe technique, some difficulty inserting ports.</td>
<td>Poor choice of port position, unsafe technique insertion/removal.</td>
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#### Exposure

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<tr>
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<td>Optimizes exposure, efficiently directs retraction and camera to maintain exposure and pneumoperitoneum</td>
<td>Adequate establishment and maintenance of pneumoperitoneum, camera angle and retraction but with occasional loss of exposure.</td>
<td>Poor / Inadequate pneumoperitoneum, camera angle and retraction with frequent loss of exposure</td>
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#### Appendix Dissection
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### Expedient and Efficient Location of Appendix and Creation of Mesoappendix Window Close to Cecum

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### Appendix Division

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### Appendix Removal

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### General Criteria
### Instrument Handling

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<td>NA</td>
<td>Tentative or awkward movements often did not visualize tips of instrument, or clips poorly placed.</td>
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- Fluid movements with instruments consistently using appropriate force, keeping tips in view, and placing clips placed securely.

### Respect for Tissue

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<td>NA</td>
<td>Frequently unnecessary tissue force or damage by inappropriate instrument use.</td>
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- Consistently handled tissue carefully (appropriately), minimal tissue damage
- Careful tissue handling, occasional inadvertent damage

### Time and Motion

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- Clear
- Efficient time
- Many
economy of motion, and maximum efficiency & motion, some unnecessary moves unnecessary moves

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### Operation Flow

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Obviously planned course of operation and anticipation of next steps. Some forward planning, reasonable procedure progression. Frequent lack of forward progression; frequently stopped operating and seemed unsure of next move.

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### Overall Performance

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Please indicate the weaknesses in this resident's performance:

Please indicate the strengths in this resident's performance:
Appendix C Transcripts

Phase One and Phase Two Transcripts

Phase One

A=Supervising Surgeon, R=Resident, F=Reviewing Faculties

Laparoscopic Cholecystectomy 1 - S

One comment on guidance is how he (surgeon) retracts; this is one way you (surgeon) can control what happens. The supervising surgeon both assisted the case and controlled. The surgeon is very quiet, in terms of I will probably be saying/asking the resident what they want to do. From my experience, surgeon is very comfortable with resident to ask to reposition. It is the resident asked for direction; surgeon can assist, but a little contaminate the teacher. At this point, if I were the supervising surgeon I would feel very uncomfortable and ask the resident to stop; I probably will provide verbal or physical guidance and even block the resident. The supervising surgeon stepped away due to two reasons, one is the radiation, second is too close to the screen to see. It is interesting so much sort of cooperation in doing this case; this resident is very profession with this procedure, practically no input from the supervising surgeon, they work together as partner like already work for a long time; my case will never like that, for not familiar with the resident. This a little bit talking, I would say just conversation. Right now the supervising surgeon is giving couple of direct instructions to the people (OR staff) -- which is interesting. He uses alternative way to tell the resident he had trouble to see what he wants to do instead of letting him to do, maybe he knows the resident well and think he can do, but also maybe the resident indeed doesn’t know
how to do; the supervising surgeon should ask resident what he wants to do. The screen is on the surgeon's side. I can tell the resident is sort of struggle, and the supervising surgeon is quite patient in terms of not jumping in and providing more active guidance; he stands in an assistance mode.

**Laparoscopic Cholecystectomy 1 - F**

The supervising surgeon is talking and holding the camera for the resident, pointing out the right place without asking (the resident); the supervising surgeon shifts the camera there without asking, -- I would call it "assistance" not "guidance", (because) who is assisting may not be educated, from teaching point, whether the resident knows when to ask a person to move the camera. The supervising surgeon did not provide guidance because it is the medical student (in fact, she is the resident) driven the camera. It is not a lot happening at this point; the supervising surgeon is injecting the dye and taking the picture; in fact he is doing this part of the procedure. X-ray instruction comes from the supervising surgeon, but whether order or not depends on the resident and the surgeon's preference, and the decision is based on what the supervising surgeon wants to do. From guidance point, the supervising surgeon is doing all of this, that is the supervising surgeon is doing that part of the operation -- this is really guidance, for he is doing it (for the resident). It is difficult: the surgeon is directing the camera, but the resident knows where she wants to go. Because the surgeon knows how to do, so he drives the camera without her asking for it. It is not really cueing, just doing, assisting. The supervising surgeon is giving orders to somebody (resident). The surgeon (gave direction to) reposition the grasper. It is assistance rather than guidance.
Laparoscopic Cholecystectomy 1 - R1

He is telling R to turn round. He is not really doing, just watching. The resident is actually telling the surgeon to do that. The resident is struggling a little bit, but the surgeon says nothing just let her figure out...OK, and then she got it. He told her not to clip too high. He tried it by himself. Whether use x-ray depends on whether they want to see more or not. The resident is the person who performs the x-ray. Some surgeon does x-ray for all cases, some are not; usually x-ray needs to be ordered before the procedure, but you still can order it during the case - though it will take longer to get it. The resident told the x-ray person to backup; this is not the surgeon directing, it is the resident says "yes, this is what I want it". He is looking at the image. He just made the call and said "that's good"...but the resident said nothing after this though she can say "OK, x-ray is good". She is testing, and clip off .. gallbladder... cut next... He is still in a too early stage to do anything in terms of the technical procedure. He actually wants her to close it. The resident is telling the surgeon what she wants to do. He just told her what to do exactly was to pull it up. The surgeon is getting out smoke for her; he just did that. She is telling him ready to come back. The resident is telling the surgeon what to do. They are running low of gas. She was doing by herself and decided on her own. He was telling her how to put the gallbladder into the bag. He was not really help. He said "do it".

Laparoscopic Cholecystectomy 1 - R2

The surgery is almost done, so his (surgeon) directing is too late. He (surgeon) is providing a little guidance here on clip off; he is telling the resident to turn round; but
most part the resident is done by herself. The resident is actually telling the surgeon to do there; she is struggling a little bit, but the surgeon says nothing just let her figure out...OK, and then she got it. Surgeon is serving more like an assistance; he is moving the along by directing the OR staff, but most part still serves as an assistance. I think his role is appropriate. Surgeon is serving more like an assistance; he is moving the along by directing the OR staff, but most part still serves as an assistance. I think his role is appropriate. The surgeon is directing the OR staff because they address the question to him, so I think that is no matter of him or not to let the resident perform independently; this surgeon in fact is one of the strong teaching faculties who will allow you to perform independently. Resident should be the person give command of on and off for the (x-ray) machine; surgeon told the x-ray tech to take a picture, and then take a picture again; she (resident) said "looks good" and he (surgeon) is confirming. In most part, the surgeon is serving as a teaching faculties and allows the resident to do everything she should be doing; the surgeon is calling for his own instrument. That is him (surgeon) positioned the patient -- the surgeon asked the anesthetist to put the patient head up - I don't see any wrong of that, scrub tech cannot help with this, how things can be easy for operation; technically the resident should know what is best for her; he (surgeon) is not really directing the case. Resident gave an order for herself. The surgeon provided some guidance here on her (resident) hand placement; he serves again as assistance because he is not directing the trocar.

**Open Inguinal Hernia Repair 1 - S**

The supervising surgeon is speaking right now, he is showing them - it is clearly teaching (medical student). The supervising surgeon is helping with his figures, so it is
not explicitly saying anything but by doing the dissection is clearly guiding the operation. You can argue that as he put the retractor without the resident telling him where to put it - that is guiding, too; if you have a medical student (to do that), you need to tell the student where to put it, now the supervising surgeon is on his own without checking with the resident. If the surgeon does that (exposure) without asking resident where or how to put it, it is guidance. The supervising surgeon is pointing out some vessels that if approach too close could cause bleeding, that is clearly guidance a well. He (surgeon) is pointing out something right now, he (surgeon) also points out the anatomy to the student which could argue would be guidance, because if it is the first time the resident work with the supervising surgeon, (it is guidance), but since this is the chief (now), so it probably is not guidance (if happens now). It seems the supervising surgeon is just exploring; if he has done this 500 times, he may do it much better than a medical student, and knows how to pull exactly the way he knows the resident needs to pull. The surgeon is teaching the medical student and again it could argue it is in-direct guiding, because he (surgeon) wants to make sure the resident be aware what is he doing. The surgeon said "stop" -- this is guidance. He (surgeon) is teaching the medical student, but it is not guidance, for it is pretty basic stuff. The surgeon is trying to find it (bleeder); again there is a little bit guidance there; he (surgeon) should let the resident find it; The surgeon is making decision how to repair this -- this is also considered as guidance, because they are talking about the suturing materials. The resident is just asking a question to the surgeon, again this is always guidance, for the resident should make a decision on what to do next on the sac -- he (resident) may know what to do, but
may just want the approval from the surgeon. Although the supervising surgeon was
talking to the medical student, he was guiding the resident.

**Open Inguinal Hernia Repair 1 - F**

The supervising surgeon is more watchful in this case with a junior resident, the
supervising surgeon is checking. The supervising surgeon is putting the retractor -- that
is guidance. The surgeon has the sac on one hand and needs to be dissected -- that is
assistance. Now the supervising surgeon is holding the retractor. The surgeon is talking
with the medical student. It is the medical student's talking; again it is guidance -- maybe
unconscious guidance. It is guidance. The supervising surgeon is talking with the
medical student. The supervising surgeon is double checking -- that is kind of
supervision, not guidance -- the supervising surgeon supervises the resident by double
checking. The surgeon is teaching the medical student -- that is probably guidance. He
explained something technically to the medical student that would help the resident --
that is probably guidance.

**Open Inguinal Hernia Repair 1- R1**

He is retracting for me while I am operating. I am calling for all instruments. The nurse is
asking the surgeon questions; he is answering. It is not my first time to work with him. In
most part he is just watching and letting me to operate. He is answering questions from
the medical student; otherwise he is not directing the case so far. He is confirming that I
have what I want -- he is asking me and (I said) "yep, I got it". The patient seems
"lactose" allergy, so we do not use the typical type. The surgeon has discussion with
other people, and I talk with the scrub tech and continue the operation -- which is good.
I can hear their conversation, but I focus on my operation, and now I am showing the medical student the difference of vascular there -- I am also showing to the surgeon as well. He is feeling and confirming that I got it. There is a pause there which is the way he used to teach the medical student. He is catching the bleeding (point) for me so I can cauterize it; this is kind of two person job, again he is acting as an assistant as he should -- he did a good job. There seems a little bit directing here a while ago -- kind of confirming where I want to dissect the hernia sac. Since the medical student here, so there is a conversation between he and the student; otherwise he is still assisting. He is retracting (for me); he is filling in and use his fingers to stretching the sac for me. I identify the sac, he just cauterize. He is looking up the "T-holes" and holding up for me while I dissecting. What I am doing is (with my hands) to un-spread for him and cauterize what him wants to. He is allowing me to do the operation. Here I open the sac per as the his preference -- this is also my preference, too. He is directing himself to tie. No, I did the tight by myself. I am operating by myself. He is teaching the medical student. He is teaching the medical student, but it is not guidance -- it is just a teaching point he catches for the medical student -- he should know I know how to do.

Open Inguinal Hernia Repair 1 - R2

That is the medical student has a question (to ask the surgeon); the surgeon is trying to tell him (resident) to go down the "shelving edge", he (surgeon) points to him (resident) - - that's good. The surgeon is pulling the retractor. I don't think the surgeon is really doing much, he just watch and see whether he (resident) knows next step - I guest; the resident just ask someone (surgeon) to retract there; resident is leading the case right now; he (resident) is doing what he (surgeon) told him to do earlier, he (resident) is
isolating the cord. Resident was talking loud, asked for a "pan-rose"; surgeon told him (resident) not to (do), interrupt the performance, and the resident is going back to pull (the sac). The surgeon looks around and showed him (resident) with putting a "bovie" on it; he (surgeon) is telling resident he wants a little bit clear up. The surgeon is re-directing the resident with guidance with this – the surgeon is putting the clamp by the sac. The surgeon is searching with boive; the resident picked up something. The surgeon talked through the resident (how) to do that; the resident directly asked the surgeon how to do that. The resident is asking for an instrument (pick-up).

**Thyroidectomy 1 - S**

This is a Thyroid procedure. The supervising surgeon is instructing the resident to cut the suture short; the surgeon is requesting suture scissors, and the resident tightens the knot. The resident is tightening. The supervising surgeon now is directing the resident how to proceed with this dissection; the supervising surgeon is instructing the resident how to proceed. The resident now appeals to be directing the dissection, with the supervising surgeon's assisting by pulling one muscle. The supervising surgeon now is instructing the resident how to get exposure and retracting on the thyroid (to have it got exposure). The supervising surgeon is now asking the resident where the parathyroid locates, and also indicating where he believes the direct-thyroid and parathyroid, so he is providing specific guidance. He (surgeon) opens it now and points out where it is, and implicit in his (surgeon) direction, the resident is easy to identify the landmark of the recurrent laryngeal nerve; now they are dissecting out the middle thyroid. Right now the resident is proceeding to dissect one muscle opposite the thyroid gland independently; the surgeon is crossing bipolar (forceps) and now to cauterize the muscle. The
supervising surgeon is asking the resident to pause, so he can exam and help via inserting his figure to orientate himself in the dissection. The surgeon is now taking over -- no actually he is inserting a retractor, and (this) indirectly influencing the direction of how the dissection proceeds - by word, by exploring, and by indirectly cuing. The surgeon also points out where he believes the "recurring nerve" should be presented, and this cause the resident’s attention; the surgeon instructs the resident that the place where he wants to be dissected. The surgeon is providing guidance on how to deliver thyroid gland to the resident to excuse the dissection. Right now the supervising surgeon is giving some instruction as far as the direction and location where he should do dissecting in order to identify the nerve.

**Thyroidectomy 1 - F**

I cannot hear what they are talking; the supervising surgeon gave the resident instruction occasionally. I cannot hear what they are talking; the supervising surgeon gave the resident instruction occasionally. The supervising surgeon is doing a little retraction here; I cannot hear clearly; the supervising surgeon gave quiet a lot of verbal direction, but did not interfering physically with the resident. The supervising surgeon seems continue giving instruction, but I cannot decide what it was (due to the noise). Sometimes the supervising surgeon gave direct instruction, sometimes he was just saying or re-enforcing what the resident was doing. Now the supervising surgeon was doing exposure, so he was assisting by exposing.

**Thyroidectomy 1 - R**
Surgeon is allowing resident to do a lot of work, but he is also suggesting (resident) to tight this off, don't tight that off -- that is good, because on thyroid cases dissecting thyroid free from surrounding tissue with kitter, with clamps, and forceps. Sometime the surgeon will have the resident to do, when they do the case, they will use bovie or bipolar the instruments to do a lot of retracting in the dissection that way, but it requires less thought about where the procedure going. He (surgeon) does a lot directning of suction or tight that off -- of cause, he (surgeon) is doing a little bit just talking about the case and to himself about the thyroid. The resident has the clamp, so he is directing the surgery to go; this part of the procedure is very simple, doesn't require a lot of cognitive though as that of the dissection with the clamp. He (surgeon) is directing the resident (by) saying "dissect from the wall of thyroid". The scrub tech is dropping something; the surgeon is grabbing the kitner (clamp) now -- just retracting, not dissecting. Now it looks like the surgeon is identifying the parathyroid which is a usual case. Now (the surgeon) supposes just retracting happens, but there is kind of vital point, too -- because this is the portion which the resident needs to find the nerve, -- that's why they are very careful.

**Open Inguinal Hernia Repair 2-S**

The supervising surgeon is giving a combination: information about future case when the resident becomes surgeon need to think about, and also some guidance about what he wants to happen in this case for the patient via teaching the medical student; he is not explicit on "I want this done" but he is giving guidance I believe he wants the resident to do some thinking interpretation for the specific patient. He is explaining exactly what is she doing; he and the resident are discussing something intro-operative for this case, and try to identify the anatomy. The supervising surgeon is giving
guidance on what he believes on anatomy, so the resident can feel it and determines whether he can agree. He points it out the anatomy to the resident. He (surgeon) tries to teach the resident to think about things in future cases. Though the surgeon in his phraseology doesn't say "open the sac", but he tries to let the resident take some part of the decision making in and phrase it as "maybe beneficial to open the sac" instead of "open the sac", it is not directly (guiding the resident, namely indirect guidance). The surgeon asks the resident what she wants to do to stimulate her to think about what they (resident and surgeon) want to do, and the resident answers; this is an open option, I am sure the surgeon could correct the resident if he doesn't agree (with her). The supervising surgeon is giving the resident more autonomous and help on how would like to divide, not saying "you have to do this, do that", in surgery, offers several options, he wants the resident to make decision for themselves; I said (this may) not (be) guidance, ... I don't know how to phrase it...well, it is not only suggesting -- he did not suggest "you could do this, you could do that", he just said "what do you want to do?", and gave the resident opportunities to think for themselves. Different from some guidance the supervising surgeon said, "you don't want to do anymore dissection, just delete if you want to" - if it was guidance, the supervising surgeon would say "we do not want to dissect any further". That is different guidance - "I don't want to go down below there if you want to go above"; the supervising surgeon was telling the resident what the anatomy was. Clearly here, the supervising surgeon wants the resident to open the sac further; he explains the reason to do this. This is an open-ended question to make sure the resident understand. The supervising surgeon gave the resident more autonomous here. The supervising surgeon wasn't explicit about exactly how to do it, he just gave
general terms what needed to be done in this portion of the operation). This is encouragement. The supervising surgeon gave general comments about anatomy, he did not play a significant role in managing this case, but does come up with future case again; he gave comments about what he thinks about anatomy is -- I think he reinforce what the resident is thinking. The supervising surgeon gave the resident opportunity to operate as independently as you can with senior staff; he did not correct resident on suture choice -- choices what she wants to do, but I am sure if he would, he could concern the patient safety; the supervising surgeon make a general phrase about reducing the contents to safety reason, but also a lesson teaching the resident something in person. The surgeon is assisting. Resident made the decision about the size of the patch, and the surgeon wants to check by himself -- that's exactly what I could, too. I think he agrees (with resident' judgment). Once again, the supervising surgeon is teaching with open ended question; he has special way to measure, I guess, this one I haven't used; the resident is using the same method, so the supervising surgeon is explaining his method "compares" the one he utilizes.

**Open Inguinal Hernia Repair 2 - F**

That's guidance, the supervising surgeon is really telling what she (the resident) needs to do to the student; he is talking with the medical student, some of the conversation is just teaching, when he told what would need to do next, is sort of guidance. This is guidance. All teaching is future guidance. The supervising surgeon is retracting for the resident, so that is assisting. Now the supervising surgeon is prompting - "what would you like to do, what's your next step". The supervising surgeon is talking to the medical student the resident should do this, should do that -- that would be interpreted as
guidance, because he is saying the next step; (whether the resident changes behavior) doesn't change guidance, because she can refuse to do but won't affect the supervising surgeon telling her (to do), but (this telling) is guidance; if the intention is to guidance the performance, I think (the behavior) is guidance; if the resident perceives differently and refuse to change, I will still call guidance; I can give you advice, but you can ignore, right? But it is still advice. The supervising surgeon gave guidance again by saying "don't do anymore dissection". The supervising surgeon may be anticipating the resident needs to be given guidance, checking do I need to tell her what to do. The resident is asking the supervising surgeon for guidance again. This is interesting, because she (resident) is asking (question), gets whole guidance question becomes complicated. There is guidance. This is guidance. The surgeon said "beautiful" - that is complement, not guidance. Now the supervising surgeon is giving guidance, because he is telling with his instrument; but again, she is asking, and he gives opinion, again, that is guidance, because he is saying what she is trying to do, though she knows what she trying to do.

**Open Inguinal Hernia Repair 2 - R**

He (the surgeon) is teaching, explaining reasons to her (medical student) why open the sac. He (surgeon) is teaching (again) of the critical things about the inguinal hernia sac, and the resident is dissecting the hernia sac -- a whole lot of things she needs to do is identifying the sac and dissecting down. He (surgeon) is mentioning this is hernia sac. He (surgeon) asked the resident to open it (sac). For senior level resident, the technical thing (the surgeon could do) is to question the resident and test the resident's knowledge to see what step you will take; in this case, the surgeon asked (the resident)
"hey, what you gonna do now?" (Since) the surgeon knows how to do, he is just testing the resident what's step she wants to do. It is testing resident’s knowledge about things want to do. It is guidance, and testing your knowledge (about what will you dissect next). They want to come round the sac. The resident is asking the surgeon "what about this way?" some surgeon is quite demanded, but he (surgeon in this case) isn't. The surgeon is asking "what you want to do?", and indicating his preference -- there is a lot of ways to close the hernia sac, and the surgeon twists it around and then suture it, or hold it up and run the suture back and forward, and he holds it up, so he indicates to resident of his preference. The surgeon asks what size of patch she (resident) wants to use, and she said she want a large one; the surgeon is not sure how big is the hole, and put two fingers in (to check); this conversation happened before the resident puts the patch in, but (after that) the resident said "hey, it (the hole) is kind of big", and then the surgeon put his fingers in (and checked), said "OK, it is big" – he (surgeon) is kind of agree her judgment.

**Laparoscopic Cholecystectomy 2 - S**

It seems the supervising surgeon allows the resident to do the entire case, he is very comfortable with things, and there is not a lot of guidance actually -- which is surprising; it seems the supervising surgeon is focusing on teaching the medical student. He (surgeon) is just watching; this is guidance right there. That was guidance right there -- that was my first time to see he do any intro-operative teaching; but he clearly broke his (resident) concentration -- because he (resident) is doing something the supervising surgeon doesn't like; that was an interesting comment. The surgeon is assisting at this point -- as you know OR guidance is letting the resident do vast majority. I don't know
how much that piece (camera) actually doing is to guide the resident -- it seems the resident is fairly confident and ready, so in fact you can "jog" around and keep the camera on place with the resident, probably know exactly what are they doing. The resident seems very confident; he (the surgeon) is telling him (resident) where to go. I don't think the surgeon is giving guidance (at this point), he is just helping to let the R become a little more efficient. He (resident) is talking with the surgeon at this point. The supervising surgeon now actually engages the resident what do you doing.

Laparoscopic Cholecystectomy 2 - F

The supervising surgeon is teaching (med student) -- I think he is talking to the med student. He (surgeon) is sort of making suggestion. This one is little different because the supervising surgeon is doing a lot of talking to the medical student; ... the supervising surgeon is doing something; it is the supervising surgeon correction of the (resident's) behaviors, it is going to change the resident's behaviors -- it is guidance. That is kind of encouragement. That is a direct order -- the supervising surgeon is talking.

Laparoscopic Cholecystectomy 2 - R

He (resident) is doing on his own, but if he makes a mistake, or if he is doing something he (surgeon) doesn't agree with, he (surgeon) says "I will do it differently" guiding him (resident) differently. (It is kind of guidance) even the supervising surgeon is telling the med student 'I will do it differently' it is still guidance (for the resident). The surgeon is telling the resident to do (dissection). It is the resident who is doing all ... on this one. He (resident) is even talking to the camera holder to come closer to look.
The supervising surgeon is trying to determine the mid-point of the hernia, and the size of hernia, and determine the size of the mesh. Now the supervising surgeon is leaving for the mesh he ordered (for the resident). They open the mesh right now, and the resident is putting the stitch on it – hernia mesh; they ordered two sutures the surgeon needs. The resident is still putting sutures, the supervising surgeon is just watching; something wrong with the suture that the resident put, I guess; I don’t know why, they had asked for another stitch, they always ask two, they put it to "porch". The supervising surgeon is instructing her (student); the resident is doing with her team with her thing. The supervising surgeon is instructing her (medical student) to hold the camera right. The supervising surgeon is doing suture fastening -- determine the place in this stage, and the resident does not participate in how he determines the place of the suture; maybe I will explain such thing, or maybe he trusts her (resident) ; the supervising surgeon is fastening the suture; the resident should do this after graduate from residency, but one of them has to do this, because it is a two-people job, either he gives the suture off, or passes the suture around, determines of where you want to pass the suture, I think the resident should participate. The resident is telling the medical student to pull the camera back, and the supervising surgeon wants to help him (medical student) to accomplish the task. The resident is holding the mesh up, and the supervising surgeon is determining where he want to put the camera; he pushes the camera closer (from the medical student), medical student doesn't know where he should look actually. I will do the same thing (push the camera) I guess. (if I were the supervising surgeon in this case) I would have the resident to determine the place of
mesh; oh, wrong stitch, the resident gave the wrong one -- that's belongs to her side, she was taking it out. The supervising surgeon is instructing the resident.

**Laparoscopic Ventral Hernia 1 - F**

This is lap ventral hernia. He is giving direction to the nurse on what he wants. That is sort of guidance -- letting resident know what she needs to do; none would say that is not guidance because you want her to it. This is stitching ... a simple case may be complex. The supervising surgeon used some instruction of technique on laparoscope. The supervising surgeon is kind of "authoring" (the resident to do what he wants her to do, he is not physically doing that).

**Laparoscopic Ventral Hernia 1 - R**

The surgeon is helping the resident, but she (resident) is the person making primary decision -- so that's why the surgeon is helping her right now. The student was holding the camera; resident was inserting an instrument to the trocars. He (surgeon) is still assisting her (resident); so she is handling that suture for him to clamp. The supervising surgeon began to determine the place (of inserting the needle holder). Medical student now drives the camera. He (surgeon) is controlling student's hand to move the camera -- this is his job to make sure the student don't "hold" the camera. She (resident) is supposed to hand him (surgeon) all the sutures, and has to be in a specific order, so she (resident) gave him the wrong suture, so they have to start over the stitch -- the resident gave the surgeon wrong suture, so they have to do it again. The surgeon is telling resident to make the mesh is flat, because there is a "falling" mesh there, and telling her to make sure.
I think the supervising surgeon at this point is directing the resident with the camera -- directing him where to go by moving the camera; not verbally saying that, but focusing the camera so that's the part he (resident) can see, and the resident is cueing on that part and moving along. Moving the camera is one of ways to direct the resident to work - it is kind of telling them here is what I want you to be. There is a little bit direction here, the supervising surgeon is telling the resident to keep on working. The supervising surgeon is alerting the resident to be aware of the bowl; I don't think he say how exactly to do, just alerting that he doesn't get to the bowl. Surgeon is alerting the resident to be aware of the bowl. (They) suture there, the supervising surgeon just comment, no direct teaching (what's) going on right now. The supervising surgeon at this point tries to work with the resident to "free" up the bowl -- that's what he wanted him to do, so he suggested; the supervising surgeon does not tell explicitly, he just say "the bowl is going there", he may comment the bowl has attached to the mesh, and he (the resident) should follow that. The supervising surgeon moved the camera again, because he was going to see what happen on that side. This point the supervising surgeon is generally directing the resident there was a mesh there, but I don't think he is actively doing anything as far as directing (him) on what to do and how to do. He was not really telling him (the resident) how to roll and how to pull off everything, more like a cautious note. Basically, the supervising surgeon just tries to tell the resident to be careful to have respect to the tissues, when handling the tissue, there should be no tearing. Again, the supervising surgeon is re-directing him by pulling the camera actually it telling the resident come from the back; the resident is doing pretty well, but came to the bowl; the
supervising surgeon is a little bit more cautious, and there is frequent re-direction and
reminder to be "gentle" to pull in a specific way. They made good progress, moving
along, but the resident gets around the bowl, he is a little bit more aggressive, that's
why the supervising surgeon jumps in and says "this bowl there, don't pull too hard".
When the resident graduates from residency program, they should be able to operate
independently; this point, resident asked surgeon for guidance as where he should cut,
and surgeon said "yes, up there". (surgeon) Asking or just like "I am doing good" -- more
re-assurance the actual (judgment/step). He (surgeon) is working there, driving the
camera, and in-directly telling the resident this is where I want you to work (in this area);
it is very common in laparoscopic cases, surgeon is driving the camera and telling
resident this is where I want you to work.

**Laparoscopic Ventral Hernia 2 - F**

I cannot hear (clearly) what are they saying; the supervising surgeon is speaking but I
cannot tell he say what; the supervising surgeon is handed an instrument -- he prepares
to do something. So the supervising surgeon is giving some instruction for that. The
supervising surgeon is telling the resident the hernia is a little bit higher. Again, he is
giving some instruction to the resident -- guidance is anything facilitates the case or
gives direction to the case. The supervising surgeon was just talking, but he again gave
some instruction about how to do; it is the surgeon who drives the camera because the
instrument is in his hand. This considers the resident is asking for guidance at this point.
They are talking but I cannot identify the words; the supervising surgeon is pointing
something (on the screen). This is exactly -- he said "be careful" - that's guidance, again
all these conversations are guidance, he gave direct instruction on how to do. Surgeon
is talking; resident is asking question (to surgeon) -- asking for validation. The supervising surgeon is saying "be careful". The supervising surgeon gave direction on approach. The supervising surgeon wanted the resident to change direction -- it is instruction and guidance. The supervising surgeon is providing guidance; I think anytime he gives instruction is guidance; the instruction may be confront, or be reinforce or getting change. I think even confirming - saying "that's good" -- is considered as guidance. Again, surgeon told (resident) what he wanted to be -- it is guidance. They are talking about maneuver; you can see something the surgeon is verifying, reinforcing, or validating. Again the resident is asking for confirmation.

**Laparoscopic Ventral Hernia 2 - R**

The screen is right here, they are both watching (it); the supervising surgeon is holding the camera. They are discussing what to do this and the relationship to the bowl here; they both converse back and forward. They just talked about gone through this (dissection) slowly, and gave the resident direction (by) saying (something like) “this is the bowl, slow down”. The supervising surgeon talked about this bowl and tried to get this bowl off (by telling the resident how to do). (The supervising surgeon used camera to tell the resident where to perform) it is kind of pushing the resident (to follow this movement), sometimes the supervising surgeon will move the camera and (then) point (to certain spot) which is a good technique. (This stage) is just trying to get into the procedure; you can see they are taking down the hernia; they are just talking about what they think about this right here -- this may be a piece of mesh. The surgeon is still in early to do anything in terms of the technical procedure. You can see hernia right there, they are talking about this "properly" suture and the old mesh. The surgeon gave
some guidance here. See, this is all suture here, this is hernia, so what they doing is turning it off around here, it like repairs the hole here. There is a "patch" here. It is still the surgeon driving the camera; this is the cut-off right now.

**Thyroidectomy 2 - S**

This one used cautery is the supervising surgeon. What I can tell you right now is he may be an ENT surgeon because they don't know how to go through this (identifying parathyroid). (The surgeon did a lot in this case) well this is the usual thing the supervising surgeon would do. The resident has trouble to get in it (thyroid), they should tie that thing (tissue). The supervising surgeon put up the clamp there, but they should look up the tissue first;... it is hard to direct the resident when you get the blood vessels from the thyroid right there. I don't see guidance here. He (surgeon) just did suction. They are not retracting on the thyroid gland. They pull up, see, this is thyroid. They are just cutting muscles. They just need to put pressure on it (tissue).

**Thyroidectomy 2 - F**

This point the supervising surgeon is just assisting, you know, it's kind of talking out loud, but I won't really call it guidance. That's guidance -- verbal, the supervising surgeon is telling the resident what to do. (The surgeon is talking) en, but lot of these is talking out loud, you know. That is assisting. You can argue that is guidance because he is exposing it or assist it. You can argue that is guidance because he is exposing it or assisting it – not really guidance. That's guidance; the supervising surgeon is "jumping" by pulling (the retractor). More guidance there - the supervising surgeon wants the resident to open a little bit more; all the time he is doing that with his instrument
"theoretically" is guidance, showing the resident where to cut, so each time he shows the resident with that is guidance; but that's why things he just "taught" may be argued he is assisting; it is more like the supervising surgeon is retracting, so they expose where they need to cut - like in lap chole (the supervising surgeon) driving the camera. This is teaching more than guidance. That is guidance.

**Thyroidectomy 2 - R**

This is a conversation between the surgeon and the resident. This is not one of our residents. (This surgeon is quite talkative) he is (a talkative person). That is how he is. That is a good communication; he (surgeon) is watching the resident's doing, commenting on anatomy, let the resident make a decision where to go. I think he (surgeon) discuss the plan (with resident) when to get this open and what is going to do, instead of not saying anything. Rather than showing him (resident) what to do he (surgeon) is directing him to do it -- which I think is helpful. The surgeon is directing the resident right now where to go. I feel the surgeon is talking to the resident, giving guidance the resident needs. I think in this situation the surgeon probably feels he need to provide guidance to this resident -- because he (resident) is inexperienced, so I think he (surgeon) is doing more. Surgeon position the patient very well, just ask the resident to perform; some people may count that is doing a case, because you physically doing the case, but really the case is making the decision to cut there than that; the surgeon already made a decision where should cut, and ask the resident to do that. (The surgeon told the resident) cut here, bovid there, do that; the resident should be the one saying "OK, next I want to separate the muscle; that's the surgeon (who is) doing that (action now). The surgeon gave an order to the nurse/scrub tech.
Phase Two

A=Surgeon, R=Resident, I=Investigator

Open Inguinal Hernia 1 - A

I: Why did you check with your fingers? A: I want to make sure R is on the right spot. I will nearly do it for almost every resident.

I: Why did you ask the medical student questions? A: At this point I am just telling the medical student what R is doing, and R is doing dissection now. I: Did you intend to teach R some information via talking with the medical student? A: No, at this point, R is doing the case all by himself, I am not doing anything (for R). I am just telling the medical student what I am doing.

I: Do you think this case is appropriate for R’s PGY level? A: Yes. I: How do you decide whether the case is appropriate for R’s PGY level? A: Before we start the case, I know what I am gonna to do with the case. I: If you think the case is too difficult for R’s PGY, will you do more? A: Yes, and also it depends on the resident. I don’t care which level he is, I want to know the resident first before we doing that. So I need to know the resident before I decide how much to let him do. I: Is it kind of trust on the resident? A: Yes. Private practice 100% comes from referral. So I need to make sure I trust the resident before I let him do it. I have to see what they can do. I usually make them watch me do a case, and how I do it, and I have to watch them operate some. R is doing this 100% by himself. By the time I let R do this much, I know he knows how to do the case because I led him do the case before. I would do a lot more and ask a lot more (at that moment than he was PGY5 now). If R is doing something I am not normally do, I
will stop him. But at this point, I won’t let him do the whole case without knowing he can do it. If there is something dangerous, I will stop him. I: Will you ask R what is his next step? A: No. I let R do the case till he does something wrong or I know he is not doing the right stuff excellent. I won’t let R do so much until I know he knows how to do this step. I won’t let him get to this point until I know he can do it. If the attending cannot see the R as much as we do, that attending may keep asking “what is your next step?” during the case.

I: You discussed the current case with the medical student. Is it something about what R needs to do next? A: This is not anything to prompt R. I just tried to get the medical student involved. Because he is not involved.

I: Did you work with R on dissecting? A: Yes. I am using the boive and R was showing me. He is showing it (where need to be dissected) to me, and I dissect. I: So, it is kind of he told you to dissect here? A: Yes. He is doing the case; anyone can hold the boive and turn it on as he does. Is it dissecting with bovie a two-people job? A: Yes, even two residents can do that. In the future, either the first assistant or another resident can help he when he joins the private practice. I: Is your finger? A: No, it is R’s finger. He is showing me where to dissect with his finger. By this point I let R do the case, he knows I want to get him experience. Because the hardest part is doing on your own without somebody showing you. He will never get to this spot without me knowing him.

I: You were teaching the medical student about the plug which R needed to use next, right?” A: I just want to teach the medical student -- I know R can do it. If I worry about R knowing something I don’t usually prefer, I will directly tell him. I don’t assume R would
pay attention on what I telling the medical student. Some people may like to use this way indirectly tell the R, but I don't like it. I just tell R directly. I: Telling the R directly is your personal style? A: Yes. Some people use indirect teaching methods, but I am not so favorite. I just want to involve the medical student more.

I: You seem have a discussion with R, right? A: R is gonna put the stitch the way I don't want, that's why we had that discussion. I tried to explain to him why I put the mesh and stitch the way I do. I: Something like suturing has multiple ways, do you allow R to try and see different ways? A: No, I want him to see my way. For chief year, I probably will be comfortable at the moment they try different ways. I: That means for junior residents you may not feel comfortable? A: Yes. I: When you explained to R, do you think you were teaching him? A: Yes. But I try to get him to answer. So I asked him a question why I did this, because the mesh was on the top.

I: Why you check with fingers at this point? A: I want to make sure the mesh is on the right spot. Since this is the (hernia) repair. I: Why do you want to make sure at this point? Do you want to see whether R can do things correct? A: Because I want to make sure everything is right, and everything is on its spot. I: So you just want to double check and confirm R's previous action? A: Yes. I: Why do you think it is very important to double check? A: Well, this is sewing the mesh, this is the repair, this is the whole reason we came here to fix the hernia. I: So it is a very vital step? A: Yes.

I: Do you think R knows your behaviors? A: Oh, yes, residents know their attending, and know what their attending try to say. I: Even you did not open your mouth? A: Yes.
I: Will your previous residency training experience remind you something important about the procedure or the case R is doing, then you give guidance to R? Or you will only provide guidance based on the real-time case progression? A: I do it most on real-time case situation. I: In this case, do you think you are more directing than teaching the R? A: Yes. I: if R is not so experience, will you give him more direction and guidance? A: Yes, and also depends on who is and how they act. Even it is a chief resident work with me for the first time, I won't let them do the entire case, but will let them do a little bit more than junior, but I still want to do what they can do. I: so once you know what they can do, you can decide whether you will teach R or direct R at this point? A: Yes, that's right.

I: Do you think your role in this case is just assisting R and serve a gate-keeper to double check on vital spots? A: Yes.

I: For the whole case, how much guidance did you provide to R was for teaching purpose, directing, and just assisting him? A: R is doing the case, I just lead him (through the case). 15-20% is directing him.

I: So, did you allow R to make decisions when you assist him? A: R did most of the decision making, there were couple points there I changed him, but that was very few. I: Did you teach him during the case? A: Probably 15-20% of the case I teach him how to do it. I: If R has a different way to do suturing, will R discuss with you? A: R has to discuss with me otherwise I won't let him do it. If R is a chief, I may let him do it; but if he is a junior, in most cases, I probably won't let him do it.
I: Will the case OR schedule influence your way to provide guidance? A: Yes, in morning cases, I will be more casual, unless we are really busy then I will speed things up; but for afternoon case, probably I will speed up and won’t let the resident do much.

I: So, what is the overall amount of guidance you gave to R in this case? A: For his PGY level (PGY3), I think he is doing a good job, I would say minimal (to some); for a PGY5, it is too much guidance; for a PGY1, I would say it is lack of guidance.

**AV Fistula Revision B**

I: Did you explain what will you do to R? A: Yes. I: Why? Do you always do that? A: It is a very difficult case for R because the patient has a lot of scars. I: Do you mean this case is very difficult for R’s PGY level? A: Not only her PGY level, but her previous experience. She might do some AV fistula cases with other attending, but I guest most of them might be creation, which is much easier than this one (unless the patient condition is not good). I: so, the case is not appropriate for R? A: hard to say, I am not sure about her previous experience. But I felt guilty not to let her do a lot in this case. I: Why? A: Because I am a surgeon. A good surgeon should ensure his patient safety and make the case perfect.

I: In this case, you did the majority job and R just assists you, correct? A: Yes. Because this is a case I don’t feel comfortable to give away. I: Due to the case difficulty level? A: Yes. I: What’s the overall amount of guidance you provided to R in this case? A: A lot. Because the case is too difficult. I: Will you let R do more if she were PGY5 not PGY2 in this case? A: Maybe let her do a little bit more and less directive. But I still want her to do what I want her to do. I: So when you receive the case and know which resident will
work with you, will you make a decision on the primary teaching purpose, the way and the amount of guidance provided? A: Maybe. I define my role as a teacher in the OR no matter which resident works with me. At the same time, I am a surgeon as well. I need to ensure my patient safety. My goal is perfect case for each case. I: What factors will influence or trigger your decision on “I need to give guidance at this point”? A: Well, when they drive me nuts…I always teach residents what I want, and I always feel I do every case. I: Is it your personal style? A: Yes.

I: Did you give R some direction at this point? A: Maybe. I usually talk while operating -- it may give some directions to the resident, if they pay attention; sometimes it just helps me to release my tension. I: Did you order a new instrument for R? A: yes, I don’t like the one she ordered. I: You thought for her PGY level, she might not able to choose the right instrument for herself and then you order for her? A: I don’t care, I just want her to do what I want. I: That’s why you ordered your preferred instrument for her? A: Yes.

She can pick her own instrument, but I am sure that will be a wrong one. She used cautery. I: Is it not a good one? A: No, cautery is fine, but just I am not a big fan of cautery. I: Will you feel uncomfortable if she uses a cautery? A: Well, I never feel uncomfortable. I just want her to do what I want. I: You explained to R the reason why you did not like cautery -- is it kind of teaching her? A: I just encourage her to dissect there, pull the vein out ….I want her to identify these things, I do not want to go back.

I: Did R just tell you what she think and what she see? A: Yes. The patient arm’s condition is not good. I: Does R need to do it all by herself in the future after graduation? A: Yes. Now R can do some section (of the case). I like to do things. I can sit there and
do nothing, but the operation will take twice longer. And I think it will not be necessary to take advantage of patient safety.

I: Did you ask R to identify the vein? A: I ask her to look through this thing, this vein here, and asked her what did she think what this was. I: It likes to test her whether she can identify the vein? A: Well, I just want to make sure she can see through. I am not sure whether we have a vein to work there. So this is useful.

**AV Fistula Creation B**

I: Why do you adjust the head light? A: I adjust the light to make myself see well.

I: Why do you point out the vein to R? A: Because we (need to) get down through the incision and find the vein. I: Why do you decide you need to help her find the vein? A: Because her time is going slowly. I: Do you think her speed is slow? A: No, her speed is not slow, but her dissection doesn't move along as expeditiously as I thought. I: So, she is not skillful? A: No, she is just not sure. It is safer to slow down if you are not sure. Residents working with me know if they slow down and not work efficiently, I will join them. We free up the vein, divide it, and swing there. R did most of the artery; I gave her a little help I don’t normally do due to the patient’s condition. We opened it – she did part of it – and began suturing. Maybe I am over critical, I have to do something. I am still a surgeon. I: So you let her make decision or you make decision for her? A: At this point, I made decision and she performed. I: If in 2 years, R works with you again on AV Fistula as a PGY4, will you let her make decisions? A: Maybe. I will be always actively involved, because it is how I work.
I: In this case, do you think R serve as an assistance and learner to learn AV Fistula? A: Yes, she learns how to perform AV fistula. I: She learns how to do it by observing you to perform? A: Actually she did 80% or 90% of the case, the only thing (I did) was actively directing what I want to be done. I: You mean usually you actively direct most part of the cases? A: Yes. I: In the AV Fistula Revision case, R was more like an assistant to you due to the case difficulty and the complication of the patient, so in this case, did she do a lot more? A: Yes, in fact I think she did most of the case -- I really do. She did the whole anastomosis, and she did most of the dissection, I am sure I did some, but not over amount. I: But the anastomosis and dissection were done under your direction, right? A: Yes. I am a surgeon. There is a difference between knowing how to do and actually doing that. Sometimes R cannot take the bite I want just because her hands cannot coordinate well. Like the more video games you play, the more hands coordination you have. R knows exactly what she wants to do, and just a matter to make her hands do it. To let her do the way I want her to do can improve. I: So R just lack of hands-on experience? A: Yes.

I: Do you think this case is appropriate for R to operate? A: Yes, this one is much easier than the revision one. I let her do most of the case.

I: You kept telling R what to do? A: Yes, I told R this was too big, this was too little. I: Will you use your instrument to point it out for her? A: No, I am usually just verbally talking about what I want. I: If there was a medical student in your case, would you direct R via teaching the medical student? A: No, I just will tell R straight out what I want. I don't waste time on doing that.
I: Regardless PGY levels, in your cases, you think you are a teacher and teach residents, correct? A: Yes, that is the way what I do it. I am a surgeon, but I am not foolish enough to think I am absolutely true. One way it works, they need to think about it. I: It seems you do not double check on some critical points in this case? A: I don’t need it. From the beginning, I double check each step -- even no resident there, I will do it for myself. I want my case can be excellent.

**Laparoscopic Jejunostomy B**

I: Is your style to debrief the case at the beginning before the operation? A: Yes, usually I will go over it with the resident if we have discussed the case before, like we saw the patient in the clinic together, or inpatient we talked about the case around couple days, I may not do as much as that; but otherwise, I usually debrief the scrub things and say "this is the thing I usually do, and what may you think you will do? Tell me the sequence." I: Why do you do that (debriefing)? A: Before we start the case together, I think it is helpful to have the attending and the resident to have a mental model similar with what you want to do, and that will resolve that sort of saying the scrub things and interrupt the resident in the operating room if I don’t agree with something, or they don’t understand my logic for something in front of the nurse or anesthetics depends on how I do it. But if they know where I want to go and why I do things in certain way, that would be easier for them to work with that. For senior residents, I may let them do with their ways, because by then usually they have a pretty good mental model from procedures they have done numerous times; I may comment if they do something different from me; but if I think it is important, I may say "I rather you do it in that way, here is what I want
you to do”; if I don’t think it is important, I may let them do, I may say ”that’s fine with what you are doing”. That’s how I will approach that.

I: You discuss with R regarding a possible new way to do the case? A: Yes, R raised the question ”should we do this with total endoscopy?” I did this before, it is doable, but hard for a patient has half of her stomach removed already, so it is harder to do ... and for this patient's case is a little bit challenge, we did that is for the patient safety. I do not want to do too much things to damage her (patient). With the endoscopy approach, you cannot stitch and do things to compensate something wrong. So it is not a reasonable approach. I: So you tell R what you think about it and teach her for the future similar case? A: Right. I am just going through with her with my logic can be and what symptoms we would or would not think about. R raised another option other than the one we planned and scheduled, which we could not done at this time because we did not consent with the patient and planned for that. So (this discussion) literally it is a discussion from teaching perspective in this setting ... she may use it in future similar cases.

I: You have a small discussion with R. Did you let her make the decision? A: Yes, I let her make the decision. And again there is several ways to do in terms of the trocars, there is a number of options we have, so I want R to think through how she would do it and it is an appropriate suggestion that put both on her side so she can work with both hands and do not need to cross. So I think her suggestion makes a lot of sense, and that’s why I like to do again (with reasoning), especially for chief residents. I want her to think those things through. I: You do it for their future cases? A: Yes. They can learn if I say go here and cut there, but they just technically perform a ”cut’ function; but if I say
"where would you like to cut them and why OK that work", and there is bunch more analytical activities on their (resident) part, and I think the intension is different.

I: Will you give junior residents more direction than senior residents on similar case? And for chief, will you just guide them for their future cases? A: I think for PGY 2 or 3, I would be more likely to tell them what to do; but for the chief, I want to give them more opportunities. Ideally I would like to do it to any level residents, but the resident may not have enough experience with that case; they throw out ideas, you can teach them by saying "that's a good idea" or "that's not a good idea because XYZ"; sometimes residents make stuff up but just don't have the foundation, and usually lead to waste of time. I: Do you refer the "foundation" as residents' knowledge and experience? A: Yes. Like in the phase that they develop anatomy, I almost keep silent and see how well they can do that. And then, I can redirect if they are wrong, or I think they do something really well and reinforce their right choice. I: What factors do you think contribute to residents' foundation? PGY level or number of cases they performed? A: Some of both.

I: In laparoscopic procedure like this case, if you find R miss some point, how do you remind her? A: I am just showing (with grasper) her where I saw the colon, and where she supposed the colon (she thought) to be, to help her with exposure.

I: Will you keep silent when R ask you questions? A: I use silence as a teaching strategy. Residents may know if I keep silent, that means they can move on; if I stop (R), that means I don't think it is safe. If R asks me a question directly, I generally will respond. With this R, again, in 9 months, she will not have attending with her in most times, so I have provide her a different scaffolding. I sort of try to use this whole year to
prepare her (to the attending may not being there). I: When you knew the case and this resident would work with you, did you make a brief decision on how much overall guidance you would provide to this resident? A: For this case, sine she is a chief, I will let her do most of the case she is comfortable with, and make suggestions, or help her at the point she is not quite sure what she gets. Sometimes, the resident just forgets the step, I will make suggestions. I: If this case was done by an intern, would you think this case is not appropriate for R's PGY level, and then take over? A: Yes, if an intern works with on this difficult case, I probably will ask R to do some scrub things -- I want the R focus on how to run the camera well, and hand something or hold something, for R doesn't have enough hands- on coordination to perform (the case) safely.

I: Will you use 'that's good" to confirm R's action? A: Yes. Surgery is a very emotional thing, people's emotion is important for the procedure. If I see something good, I will say that. I: So, you are giving kind of positive reinforcement on their behaviors for the future? A: Yes.

I: Do you try to direct R via explaining the procedure to the medical student? A: I am just teaching the medical student. From teaching perspective, it is no good to let the student stand here and do nothing.

I: Do you think R is asking for guidance at this point? A: I asked R to put the tube between the abdominal wall, she just asked me which way I wanted to put the stitch on. So, the answer is yes. I: Do you think R is asking for direction or confirmation? A: I think she is asking for direction - whether it is worth efforts to do one more. I: So you mean R is asking for suggestion on the decision whether it is worth efforts to do more? A: Yes.
I: Why do you remind R to check whether it is a good position after inserting back the camera? A: I think I was saying (at that moment) let's confirm the better view. It is small hole incision ... my logic there was if you got the opportunity to do (remind) it, it adds insurance that would happen (to see better). I: You remind R about this is based on your experience? A: No, I even cannot say it is my experience. I never have one this tube leak, but a lot of cases I did in surgery (tell) it is no trouble to take a look. I: So you just remind her a better way to do "double check" in her future cases? A: Correct, also assist her to better perform the case using every mean she has to ensure she has done the best job.

I: Why did you replace that part on the instrument? A: The instrument has an adapter, the adapter allows you to flush it or plug in. So I switch the plug with the adapter. I: In the future, R should do it by herself or her scrub tech will do it for her? A: She needs to know because her scrub tech may not know. This is R's first time to see this particular tube -- that's another big discussion with her (regarding the tube's function and usage). That's probably why I did not say "R, tells the nurse you need the tube". Because we need to flush the tube and she never see it before. I did describe to her how I did this. I: You are teaching her about this new tool, right? A: Right. She may never choose to use it, and I did tell her why I choose it in this setting. Explaining how to use is to give R more options for her future cases.

I: Before the case, what factors may impact your decision on how much guidance provided and the primary purpose you would like to provide guidance to R? A: It does depend on the level of the resident. I sometimes use the BID model, ask residents what they want to learn from this case, and ask them “Did you learn something at the end of
this case?” after the case. I: What factors will trigger you to make intra-operational
decision on guidance during the case? A: If R is doing something unsafe, or using a
wrong or unproductive way to operate, I will give guidance at that point.

**Laparoscopic Cholecystectomy with Intraoperative Cholangiography B**

I: Did you give residents direction in order to help them set up the case? A: That I did it
with R4. I don’t really tell her much about -- she knows how to put it in. We were doing
some stitch teaching now. I: Will you tell R setting up the case is what they need to do in
the future after graduation? A: I may tell senior before they join private practice. I: Will
you tell junior residents? A: No, because juniors do not have the foundation to
understand (case setup). I: Do you think this case difficulty level is appropriate for R4 or
R2 ‘s PGY level? A: You never know until you get in there; this one is outpatient, so I
agree with R4 to let R2 do most of the case. I: Outpatient case is easier than the
inpatient one? A: For most part, yes.

I: When you received this case and knew which resident would work with you, did you
decide how much the R can do or the overall guidance you would provide? A: I am kind
of let the senior take the lead as how much they are going to do and how much to hand
off. I: How do you define your role in this case? Teacher, monitor or something else? A:
With having a 4th year resident, I don’t need to do much direction, and I will let them do
more actual direction unless something I want them to be done in my specific way or I
think it is unsafe. I: You mean with a PGY4 resident, you will let her do more? A: Yes, I
will let a PGY4 resident do more and lead the case than a junior resident. I: What you
mean by junior residents? Does it refer to PGY1 and 2? A: Most are PGY2, some are
PGY1. I: How about PGY3? A: That depends on how many cases they did as PGY2. I: Does the R’s personality will impact the way you provide guidance? A: Yes, some may take some kind of guidance better than others. Even the R is aggressive, I may not want to control more, but may give more vocal about how I do it and what I want to do.

I: Will you use this way to physically help R in both open and laparoscopic procedures? A: Procedure does make difference. If something is inside the belly, and my hands on it, I can directly control; but with a scope, I can point them the direction and physically tell them how to do more than able to direct something in open.

I: So you want to ensure the patient safety, right? A: Right. It is still kind of teaching that let them watch and do that correctly and safely. It is not a teaching point in formal. R4 is half teaching and half making suggestions for R2. I: Why do you keep watching the screen? Do you want to make sure them do it correctly? A: That is because this is a laparoscopic procedure. You don’t really look that much on the actual patient, the focus about what we doing is on the screen. I: So you let R4 make decision when to hand off to R2? A: Yes, but if I think it is unsafe, I will stop them.

I: Will you kept silent in most part of the case until you see something dangerous happen? A: Also for something I think can be done easier and better. See, at this point, I gave comments. R2 definitely learned something. Even I only work with her on this case, I probably will let her do most, but may take much longer. In lap procedures, the more residents do, the better. I: Will procedure and PGY impact your guidance in the OR? A: I think both of them. In lap case, (for a PGY2) you may need to take more direction to make her things done. I will do a lot of directing (for R2 case) because I
won’t assume she knows how to do it. For PGY4(R4) I know what she can do, I know she knows the cystic duct, so I let her to pull out and dissect. I will give R2 more direction if she was the only resident in this case. I don’t make any assumption until I work with this resident for a while. If I know she cannot do something well, I will give more guidance on this part (in next case). For residents I know (them) I likely give less guidance and direction unless things did not go the way we plan to go.

I: If you want to teach R2 something very important in this case, what will you do? A: I probably will walk her through step by step. I: Vocally or physically? A: Both. For laparoscopic (procedures), usually (guide) verbally because you cannot touch things inside.

I: Overall, how much guidance did you provide to R4 and R2 in this case? A: For R4, it was some guidance – I gave her quite a lot confirmation. If I only do this case with R2 along, there would be a lot of guidance compared with R4, especially in laparoscopic procedure. Because you cannot physically hold up something and tell the resident “cut here”; you only can use your camera to point out where you want them to cut, but not show them how to cut. I: Is the guidance you provided built up on your expectation for the resident? A: Sort of. Guidance is built on residents’ individual experience and their PGY level. I: What issues may impact your expectation of their performance as well as the amount of guidance provided before time out? A: Several things. Their pre-experience with this type of case, resident’s personality, and whether this is a routine case or not. If it is a rare case, I probably will give more guidance. I: Any other factors will trigger you to provide intra-operation guidance at some point? A: How they are progressing, whether there is something unsafe, and I find an easy way to do. I: So,
your guiding and teaching style may be changed if you work with a resident in open procedures? A: Maybe, part of it depends on who I operate with. If I work with junior residents, it is very easy for me to open direct traffic; for senior residents, I want them to do more, but I can still direct them. I: Will your teaching and guiding style change along with residents’ PGY? A: Yes, because the teaching focus are different for junior and senior residents. I: What’s the difference? A: For junior residents, my focus is to walk them through the case and know the operative and surgical things, I will directly tell them “try this way”; for senior residents, my focus is to improve their techniques and decision-making, such as finding out solutions, I may ask them “how about this way?”.

Laparoscopic Ventral Hernia A

I: You are driving the camera and watching the screen, so do you just assist the R at this point? A: Yes, since R is a senior resident and knows how to do, so I am comfortable to let him do a little bit more. He certainly knows the step and the procedure fairly well. If I have a question, I definitely will guidance him along, but at this point, he is OK. He did a good job. If he has questions, he certainly can ask me. If I feel uncomfortable about what he is doing, I will stop him.

I: Do you try to teach him new things? A: Right now, I talked with him about cautery -- not using cautery, and the reason to use cautery. He is a good resident; I just gave him more options he might use in other cases.

I: Did you make decisions for R or let him make decisions? A: I let him do most, but at this point, for the little bleeding I just ask him to ignore and move on. When cauterizing, if you stop too many times, it will totally stop. I: Does your purpose is to help R walk
through the case? A: Yes, but if he is a junior resident, I probably will help him a little bit more by showing him how to do.

I: When you receive the case and know who will work with you, will you decide the amount of guidance you will provide to him? A: Yes, this is a huge part (that I will decide the amount of guidance provided to R after confirming the case and who will work with me). I have a pretty good idea what is going into the case. From a teaching stand point, I will let a senior resident have some freedom and will not watch as closely as I would do with junior type of resident. If this is a junior resident, I probably will guide him a lot more than what I did in this case with R. I: Which issue will impact your decision on guidance, residents -- PGY level or your confidence level on the resident? A: I think both. PGY level is one thing, but if a PGY2 or 3 who did a lot of cases with me may make me feel more comfortable than PGY 4 and 5 (resident) I haven’t worked with them a lot.

I: You told him a little higher? A: Yes, I think he may be off the place where I would be, just kind of guide him a little bit. I: You mean you give him direction? A: Yes, I gave him direction without showing him a whole lot, and a little statement about a different direction from what he was doing right now. But at this point, he is doing a great job – because this is not an easy case. I: Why? A: See, a lot of scar tissues here…this is a more senior level type of case. If he were a junior resident, I won’t let he do a whole lot.

I: Did you give R some suggestions on how to operate? A: Yes, because we are getting to the point where I think I should let him pack some questions about what should he do
next. Step back and look back the area whether we could go with a little bit different direction.

I: When you adjusted the camera, did you want to remind R something? A: Yes. In fact, I like to control the camera in laparoscopic cases because I can use the camera to guide the resident during the case. It is very helpful, I can tell them where they need to be. I run the camera as an instructor and try to engage them.

I: Did you ask R a question? A: Yes, because he is the one who is doing the surgery, and to see what he said, and see whether he sees the same as what I see. As a senior resident, I trust his input. I: Will you keep silent when R asks you a question? A: Usually when R asks you a question, that means they are not sure and you need to send out some clue. He may feel a little bit uncomfortable if I keep silent. If I don’t reply “OK, you can do that” or “no”, I may need to spend more time in directing them. If the resident asks me to approve, I will feel a little bit uncomfortable not say anything.

I: Why you tell R that? A: He is a little bit more aggressive than I expected, so I told him to use more sharp dissection – this is a method he has used many times. I: You told him that is for the patient safety? A: Yes, that’s right.

I: Did you ask him to dissect from another direction? A: Yes, he is on the spot (where I think need some direction), and I pull the camera back – I direct him with the camera as a tool and tell him we maybe go from different direction. I: Did he do it in a wrong way? A: Well, he is in the spot where I think he can improve the position a little bit. So I am kind of re-directing him and see whether it should work. And then, I let him work – I feel comfortable with it. I: Why you let him work? Because his PGY level? A: Usually
laparoscopic ventral hernia is for PGY4 and PGY5, sometime also for talented PGY3. But it depends on the case. So you have to engage in the case, when you get into there, you may change mind. But if the case is not as complicate and difficult as this, I may be more comfortable to let a PGY3 try it. Again, it also engages with my confidence level with the resident. You know, once the complicate case starts, things may change with the case.

I: Why you tell him to be careful? A: To remind him to step back and make sure he is on the right spot. I: So you just prompt him by saying that? A: Yes. I want to help him to move the case on without troubles. I just confirm he that he is on the right spot and re-encourage him. R just made a statement that the bowel fell away -- he just made kind of statement about what we saw. During the case we converse with statements about what we see, and see whether we are on the same page.

I: Why did you ask R to switch? A: Because R has some trouble with the angle and handles the instrument in the way I don't want; I just paused him and interrupted at that point, and showed him (how to use) the instrument; it is not about how to do a good job in surgery, it is just more with technical skills. I: Is it common to teach a resident how to use an instrument in the OR? A: It is not uncommon, especially for junior level residents. If I feel them do not do the way I want them to, and I feel something I can teach them, then I will stop them and demo it. Sometimes it is hard to explain to them with just talking, I will demonstrate it, and (then) give back to them to see whether they can replicate it. That’s the way what I will do.
I: In this case, what issues trigger you to provide guidance during the operation? A: I observe them and watch them, if I feel them cannot do it within the time I given (in mind), I will stop them and show them the way I want them to do. And then I give back to them. It is also kind of depending on my comfortable level. I: Before the case, what will influence your overall decision on guidance? A: PGY and case difficulty level. But their experience also impacts my teaching mode. When I decide my teaching mode, I will also decide my primary teaching purpose of the case and teaching method. For senior, usually I will let them learn by doing more; for junior, I probably will show them more. I: What is your teaching mode? A: For junior, I will teach them step by step; for senior, I will teach them ways to identify problems and find solutions.

Open Hernia Repair A

I: Did you guide the resident via teaching the medical student? A: Yes, I am really directing the resident through teaching medical students. I do it all the time. If this is what the R needs to do next, I will talk with the medical student about “what yet is R to do now?” It is no question the R pays attention (to this conversation). I: So you suppose the R is listening to your conversation with the medical student? A: I think they probably understand, especially when they don’t know next step or lack of forward planning.

I: At this point, why do you pick up these contents to teach the medical student? A: Because this part is so visual. This is a fuzzy concept they learn from med school, but it suddenly become so clearly defined at this point. It is a perfect time to help them understand. I: Who do you mean “them”? A: Residents go first. But for the student, I am doing two things at one: pointing out something is really critical in anatomy, and at the
same time I use it to tell the resident if you don’t know what to do next, this is your next step.

I: When you receive the case and know who will work with you, will you make a brief decision on how much case you would like to let R do? A: Right. I sort of divide residents into three groups: naïve, medium, and chief. Naïve may have done the procedure 1 or 2 times, but it - the case - is a new procedure for them; so I need to provide guidance in almost every step, including between steps. The medium are people who have done a few (cases), their confidence is higher, most of the time they may guess what the next step is, or maybe they can do quite well on one step, but they may stunk when moving to next step, so I provide guidance on between-steps to help them proceed to next step. Chief are the group that really get the big picture, usually they are chief residents. I try to stand back, not even guide between steps, I am helping them to go ahead. My only contribution is if there are some fine points that I think they miss or I want to reinforce. So I have different focus on each resident (group). I: For the 2nd group, you give more directions to point out where they should go, correct? A: Yes. Sometimes if you don’t give direction, things will stuck in the OR.

I: Before you getting into the OR, what issues may impact your decision on how much guidance provided to the resident in the OR? PGY level? Or others? A: It is not only PGY level, but my personal experience with them, the case frequency, and the resident’s experience on similar cases. I need to know where they are on the learning curve, and then I can decide how much guidance I should provide. For example, if I found out a resident did not perform as well as I thought during the first 10-15 minutes, I will step in and provide guidance. So it is a combination of pre-operation needs
assessment and intra-operation assessment. I: During the operation, is there any other issues trigger you to give more guidance on some points? A: If I detect them lack of confidence to perform the case, I will give guidance. Another thing that I will change guidance is I want R to slow down to recognize something, like “is it really a sac?”. Asking R to slow down is kind of guidance. I: So you want them slow down first, and then think about it, correct? A: Yes.

I: Are you kind of testing R’s knowledge? A: I just make sure she knows her next step and her forward planning. Sometimes, they know what the next step is, but just don’t know attending’s preference. In this case, the R (chief resident) did not do a lot of this type of cases during PGY4. Since she will go to private practice soon, she may suddenly wonder whether she can do a hernia repair. At this point for R’s case, I am just making sure she is making the right judgment.

I: Did you want to give her direction by asking this question? A: This is a leading question to help R to walk through the case. For chief residents, I am kind of letting them decide how to do the case. But I won’t let PGY2 do that. For a chief, if I really think there is a safety issue, I will stop her and provide my reasons --- this is my concern, not my preference. I need to explain why if I don’t agree with her.

I: Why do you take over R’s work? A: I usually do it on junior residents. The reason I took over: 1) to avoid injury, for I find R is lack of confidence, and 2) I think R can beneficial from watching me to perform. I: Do you think R can learn from watching? A: Every resident can learn from watching a case. Sometimes you try to explain several
times, but they may learn better from watching you. However, some residents hate being taken over.

I: You asked R to show you how to do -- is it guidance? A: I think it is guidance in my way – it like I am saying “this is important, how you do it technically? I need her to think about what she is doing.

I: Saying “good” to resident is kind of reinforcement? A: Yes, it is reinforcement. Reinforcing good performance is as important as feedback. Because it will lead her to do it again on recent cases. I would also say “that’s perfect!” so the resident will know “ha, I need to do it again”. So they may do it again on similar cases in the future. I: You mean you teach them for future cases? A: Yes.